6caud

SIXTH International Conference on Architecture and Urban Design

[UN]EQUAL SPACES

# PROCEEDINGS BOOK

NOVEMBER 13-15, Tirana 2025

Department of Architecture, Faculty of Architecture and Engineering, EPOKA University

EPOKA UNIVERSITY

6th International Conference on Architecture and Urban Design

**6-ICAUD**

# PROCEEDINGS

**Proceedings Book of the**
**SIXTH INTERNATIONAL CONFERENCE ON ARCHITECTURE AND URBAN DESIGN**
6-ICAUD
November 13-15, 2025

**ISBN: 9789928135476**

**Edited by:** Edmond Manahasa
Valerio Perna
Anisa Cenaj

**Cover Design:** Eugert Skura

**Published by:**
Department of Architecture
Epoka University
Tirana, Albania

*All rights reserved.*
*No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law. For permission requests, write to the publisher, addressed "Attention: Permissions Coordinator," at the address below.*

**Assoc. Prof. Dr. Edmond Manahasa / Assoc. Prof. Dr. Valerio Perna / MSc. Anisa Cenaj**
Department of Architecture
EPOKA University
Tirana, Albania
emanahasa@epoka.edu.al / vperna@epoka.edu.al / acenaj@epoka.edu.al

## Welcome Speech

Dear participants,

It is our great pleasure to have you in the SIXTH International Conference of Architecture and Urban Design that will be held on November 13-15, 2025, organized by the Department of Architecture at EPOKA University.

We look forward to endure our academic practice and provide an excellent forum for scientists, researchers, and practitioners, not only from Europe, but from all over the world. Thereby, new ideas, latest developments, and potential directions in the fields of Architecture and Urban Design shall be presented and discussed under any of its specialized themes. The main focus of the conference will be on exploring [UN]euqla Spaces in terms of social, economic and cultural aspects.

# Committees

## Organizing Committee

(Department of Architecture, EPOKA University, Tirana, Albania)

Assoc. Prof. Dr. Edmond Manahasa – Chair /Epoka University
Assoc. Prof. Dr. Valerio Perna – Vice-Chair /Epoka University
Dr. Egin Zeka /Epoka University
M.Sc. Kreshnik Merxhani /Epoka University
Prof. Dr. Sokol Dervishi /Epoka University
Dr. Artan Hysa /Epoka University
Assoc. Prof. Dr. Odeta Manahasa /Epoka University
Dr. Desantila Hysa /Epoka University
Dr. Ina Dervishi /Epoka University
M.Sc. Nerina Baçi /Epoka University
M.Sc. Manjola Logli /Epoka University
M.Sc. Anisa Cenaj /Epoka University
M.Sc. Katjana Boriçi /Epoka University

Conference Secretariat:
M.Sc. Anisa Cenaj

Technical support:
M.Sc. Nikolin Majmari
M.Sc. Eugert Skura

## International Scientific Committee

Andrea Maliqari, Polytechnic University of Tirana
Anisa Cenaj, Epoka University, Albania
Antonio Acierno, University of Naples Federico II | UNINA
Armand Vokshi, Polytechnic University of Tirana
Artan Hysa, Epoka University, Albania
Cinzia Bellone, G. Marconi University, Italy
Denada Veizaj, Polytechnic University of Tirana
Desantila Hysa, Epoka University, Albania
Edmond Manahasa, Epoka University, Albania
Egin Zeka, Epoka University, Albania
Enis Jakupi, State University of Tetovo, Macedonia
Enrico Pietrogrande, University of Padua
Federica Pompejano, UNIGE - University of Genoa, Italy
Fereniki Vatavali, National Centre for Social Research, Athens
Florian Nepravishta, Polytechnic University of Tirana
Francesco Calabrò, Universita Mediterranea di Regio Calabria
Francesco Defilippis, Polytechnic University of Bari, Italy
Giorgio Rocco, Polytechnic University of Bari, Italy
Gjergji Islami, Polytechnic University of Tirana
Ivan Cabrera i Fausto, Polytechnic University of Valencia
Ina Dervishi, Epoka University, Albania
Katjana Boriçi, Epoka University
Kreshnik Merxhani, Epoka University, Albania
Manjola Logli, Epoka University, Albania
Kujtim Elezi, State University of Tetovo, Macedonia
Mariateresa Giammetti, University of Naples Federico II
Marsela Plyku Demaj, POLIS University, Albania
Marta Casanova, UNIGE - University of Genoa, Italy
Nerina Baçi, Epoka University, Albania
Nuran Saliu, State University of Tetovo, Macedonia
Odeta Manahasa, Epoka University, Albania
Sokol Dervishi, Epoka University, Albania
Valerio Perna, Epoka University, Albania

## ORAZIO CARPENZANO

Full Professor of Architectural Design at the Faculty of Architecture, Sapienza University of Rome. Dean of the Faculty of Architecture, Director of the Doctoral School in Architectural Sciences, and Coordinator of the Ph.D. in Architecture—Theory and Design. Formerly Director of the Department of Architecture and Design (2016–2020).He has participated in architectural competitions, earning various awards and honorable mentions. His projects and writings have been featured in both national and international publications and journals. Among his most recent works are the new Corso Trento e Trieste in Lanciano, the Piazza delle Pietre d'Italia in Redipuglia, and the Federico Fellini Museum in Rimini, currently under construction.In addition to his research in urban design, primarily focused on contemporary urban conditions, he has pursued more complex and original explorations at the intersection of architecture, art, and emerging technologies. He is the author of over a hundred essays on theories and techniques of architectural and urban design. Besides maintaining a prolific editorial role in publications by Public Entities and Institutions, he also curates national and international architecture exhibitions and conferences.
international journals and book series on urban safety, green infrastructure, urban regeneration, urban and landscape planning. His last books published by the FedOA (Federico II University Open Access) Press: Acierno A., Coppola E. eds. (2022), Green Blue Infrastructure methodologies and design proposals; Acierno A. (2019), Chromatic city. Applying s-RGB Design to contemporary space.

## ANTONINO SAGGIO

Antonino Saggio (Rome 1955) is an Architect and Full Professor of Architecture and Urban Design at "Sapienza" Università di Roma. He has been for several years coordinator of the Ph.D. School in "Theory and Design" and director of the International book series "The It Revolution In Architecture"' He has written several books among which one of the most important ones – 'Architecture and Modernity: from Bauhaus to the IT Revolution' – has also been edited in Albanian by POLIS University. Three main guidelines distinguish his work: first, the confidence in the concrete possibility of teaching architectural design through making its methods evident and transmissible. This approach has been tested with many students and graduands, with the members of nITro (New Information Technology Research Office), and with many assistants and collaborators that are currently teaching in foreign institutions such as POLIS University.

The second fundamental aspect of Saggio's work is the continuous interrelation between the critical historian moment and the design phase. Particularly, this research path permeated his intense critical activity and led to the birth of books regarding Giuseppe Terragni (published by Laterza), Giuseppe Pagano (published by Dedalo), Louis Sauer (published by Officina Edizioni), Peter Eisenman and Frank O. Gehry (published by Testo&Immagine). The third peculiarity of his work concern the belief of today's catalyzing role of Information Technology in the definition of a proper 'IT Revolution in Architecture.' This topic has been part of his early teaching years at Carnegie Mellon-Pittsburgh and has continued at ETH Zürich and is currently part of his commitment at the Faculty of Architecture at "Sapienza.' The book series 'The IT Revolution In Architecture,' founded by Saggio in 1998 and also edited in English by Birkhäuser, has been a focal point for the deepening of this topic and contributed to influence a whole generation of architects that are currently at the forefront of the international debate.

## MONIKA ARCZYŃSKA

Dr. Eng. Arch. Monika Arczyńska studied at Gdańsk University of Technology and TU Delft. In her doctoral dissertation, which she defended with distinction, she examined the relationship between consumer society and sustainable housing.From 2006 to 2017, she worked for Heneghan Peng Architects, based in Dublin, where she designed public buildings around the world, including the Grand Egyptian Museum, the Palestinian Museum, the National Centre for Contemporary Arts in Moscow, and the award-winning Giant's Causeway Visitor Centre in Northern Ireland. She is a regular contributor to the monthly magazine Architektura-Murator and the Czech magazine INTRO, runs the urban-architectural blog Six Letter City, and organizes a series of lectures on architectural topics. In 2015, she founded the consulting and design office A2P2 architecture&planning, where she focuses on consulting, design, and participatory processes operating between the architectural and urban scales.
She lectures at the University of Gdańsk and teaches design courses at Gdańsk University of Technology in the format of an urban laboratory, with an emphasis on team management.

# Contents

**CONFERENCE CALL** ..... **1**

**KEYNOTE SPEECHES** ..... **5**

The Unequal Space: Architecture, Urgency and Possibility ..... 6

Art, Architecture and Infrastructures of a New Generation in UnLost Territories (unequal spaces) ..... 17

**HUMAN-CENTERED DESIGN** ..... **31**

A QUALITY ASSESSMENT OF PUBLIC SPACES FOR INCLUSIVE AND DYNAMIC COMMUNITIES: CASE OF "LIRIA" SQUARE, DURRËS ..... 32

USER EXPERIENCE DESIGN (UXD) IN HIGHER EDUCATION: A MULTI-SCALE HUMAN-CENTRIC DESIGN STRATEGY OPTIMIZING UNEQUAL SPATIAL DESIGN FOR QUALITY OF LIFE ..... 50

DANCER'S SPATIAL NEEDS THROUGH THE LENS OF BALLET MOVEMENT ANALYSIS; CASE OF THE BALLET "GISELLE" ..... 68

**URBAN & LANDSCAPE** ..... **80**

NATURE AS A CURE FOR REPAIRING THE RELATIONSHIP BETWEEN HUMANS AND SPACE: THE PHOENIX-SEE CASE IN DORTMUND ..... 81

"URBAN HYDROSYSTEMS: THE INTERPLAY OF WATER AND DESIGN IN UAE CITY DEVELOPMENT" ..... 94

UNLOCKING ROAD SPACE: DESEALING AS A STRATEGY FOR URBAN SUSTAINABILITY ..... 109

URBAN TRANSFORMATION OF A SOCIALIST SILICA BRICK MULTIFAMILY HOUSING NEIGHBOURHOOD IN POST-SOCIALIST TIRANA ..... 118

VIA APPIA AS ARIADNE'S THREAD: LINKING LANDSCAPE, COMMUNITY, MEMORY, AND DESIGN ..... 130

A PROPOSAL FOR RURAL DEVELOPMENT: THE CASE OF LLËNGË VILLAGE IN POGRADEC ..... 138

**HISTORY & HERITAGE** ..... **158**

THE REPRESENTATION OF STRUCTURE IN FRANK LLOYD WRIGHT AND MARION MAHONY'S WASMUTH PORTFOLIO ..... 159

MATERIAL PERSISTENCE, URBAN DISRUPTION: READING THE "DINE HOXHA" VILLA IN TIRANA ACROSS REGIMES ..... 171

"PROCESSUAL LEGACY" ARCHITECTURE AND HISTORY IN THE ROMAN SCHOOL OF URBAN MORPHOLOGY ..... 184

URBAN EQUILIBRIUM ..... 194

**BUILT ENVIRONMENT & PERFORMANCE ..... 197**

EFFECTS OF EARTHQUAKE DEPTH IN A FRAME STRUCTURE CONSIDERING SOIL STRUCTURE INTERACTION DURING 2016 SEPTEMBER SKOPJE EARTHQUAKE ..... 198

EVALUATING THE THERMAL PERFORMANCE AND ENERGY EFFICIENCY OF A VERNACULAR DWELLING IN TIRANA, ALBANIA ..... 204

EVALUATING ACCESSIBILITY IN EDUCATIONAL ARCHITECTURE: A CASE STUDY OF PLM SCHOOL IN DURRËS, ALBANIA ..... 213

**DIGITAL & TECHNOLOGY ..... 223**

INTEGRATING BIM AND IMMERSIVE VR FOR VERNACULAR HERITAGE DOCUMENTATION AND CONSERVATION IN ALBANIA ..... 224

MAR AS A BRIDGE BETWEEN HISTORICAL NARRATIVES AND ARCHITECTURAL SPACES ..... 237

BEYOND AUTOMATION: HUMAN-CENTERED APPROACHES TO NEURAL NETWORK INTEGRATION IN ARCHITECTURAL DESIGN ..... 260

CATALYZING ARCHITECTURAL INVENTION: AI MIMESIS AND CRITICAL RECOMPOSITION IN DESIGN EDUCATION ..... 277

# CONFERENCE CALL

# CONFERENCE CALL

The Department of Architecture at EPOKA University, welcomes participants to the SIXTH International Conference on Architecture and Urban Design (ICAUD), to be held on 13-15 November 2025 in Tirana, Albania. Building upon the success of the previous five editions of ICAUD, the conference promises a wide range of topics on architecture and urban design and an international audience of academics and practitioners from around the world. The 5th ICAUD provided an international forum for knowledge exchange where 57 scientific papers and posters were presented by academics from 12 different countries. All contributions were reviewed by a scientific committee consisting of internationally acclaimed scholars. The keynote speakers comprised internationally renowned academics and local policymakers.

Social justice, housing affordability, and land management issues represent some of the most urgent challenges for both countries in rapid development and more consolidated ones. Established theoretical and practical tools such as planning theories, market strategies, ownership models, environmental and conservation regulations, etc. have shown their limits and inefficiencies in dealing with contemporary rapid transformation and fast-growing settlements. Furthermore, while in the global economy and society, cities and metropolitan areas are vital, the global processes of urbanization, and metropolisation in particular, are speeding up socioeconomic gaps, tensions, and inequality that either directly or indirectly impact the residents of these cities. Those ongoing changes also stress the importance of a rising trans-disciplinary interaction among diverse fields of knowledge, having affected the whole peoples real-life realm at the global scale, and a critical reflection on the efficient implementation of the innovative and intelligent tools that emerged during the last decade. The 6th International Conference on Architecture and Urban Design (6ICAUD2025) aims to animate a deep urban "think-tank" moment and invites academics and professionals to join us in exploring the intricate relationships between housing, law, economics, and spatial justice intertwining in a (UN)equal world constellated of (UN)equal Spaces.

6-ICAUD Organizing Committee
Department of Architecture, EPOKA University

## CONFERENCE TOPICS

1 UNEQUAL SPACES

- Historical Legacies of Spatial Segregation
- Invisible Borders: Economic and Social Divides
- Gentrification as Displacement and Homogenization
- Surveillance and Policing of Marginalized Spaces
- Climate Vulnerability as Inequality
- Social Justice in Urban Environment
- The Design of Inequality

2 EQUAL SPACES

- Participatory Design and Co-Creation
- Reparative and Acupunctural Urbanism
- Digital Tools towards Equality
- Open-source architecture and bottom-up city-making
- Bioclimatic Design for Marginalized Climates
- Feminist Movements and Architecture
- De-colonized Aesthetics

3 THEORIES AND PRACTICES

- Present Discourses on Design Theory
- AI integration and Challenges in Design
- Trajectories in Design Education
- Updating the concept of sustainable design and SDGs
- Learning from urban resilience and self-designing
- Permanencies and temporariness in design styles

4 AI&ADVANCED TECHNOLOGIES

- AI for Equitable Urban Futures
- Digital Twins and Participatory Simulation
- Robotics and Affordable Construction
- Computational-based Design Strategies
- Augmented Reality for Cultural Preservation

5 HISTORICAL AND FUTURE PERSPECTIVES

- Materiality Across Time
- Sacred Spaces and Urban Morphology
- Urban Models: Continuity and Disruption
- Temporality and Resilience
- Resistance and Hybridity
- Utopias and Uniformity

# KEYNOTE SPEECHES

# The Unequal Space: Architecture, Urgency and Possibility

Orazio Carpenzano
Sapienza - Unversity of Rome
Via Flaminia, 359, 00196 Roma RM, Italy
*orazio.carpenzano@uniroma1.it*

## INTRODUCTION

The theme that this academic community puts before us today — The Unequal Space — is not an abstract argument confined to urban theory, but a tangible reality that insinuates itself into the life of every city, every street, every inhabitant. The unequal space manifests as an open wound on the skin of our coexistence, a condition that is first and foremost social and cultural, and then, consequently, spatial. Architecture and the city have never, as they do today, had to come to terms with a profound dilemma: territory is not merely a passive backdrop but an active theatre of the inequalities that cross our contemporary societies. This spatial inequality, as Manfredo Tafuri argued, is inseparable from the structures of power that in the abstract seem invisible, yet in the built environment become strongly tangible and divisive (Tafuri, 1969). In our time, in which Covid-19 has returned the intermediate space between home and city to centre stage, the value of residential space has revealed itself with new clarity — not as a mere shell, but as a "place of resistance and of relation" (Carpenzano, 2020). The interstitial space, the balcony, the courtyard — these spaces became new theatres of life and sociality, constituent elements of the possible city, capable of responding to inequality not with walls or separation but with connection and dialogue.

But take heed: the challenge is not only to design new spaces; it is to learn to read and understand the meaning of space in a fragmented city, one often afflicted by a spatial illiteracy that obstructs participation and collective awareness (Carpenzano, 2021). Unequal places are also born of scarce spatial literacy, which generates indifference and reproduces segregations that are not only physical but also cultural and social. Let us think of this as an education in place — a necessary practice requiring an interdisciplinary and pluralist effort, weaving together architecture, urban planning, philosophy and politics. Every project that engages with the city must seek a fragile and dynamic equilibrium between continuity and innovation, history and future, protection and openness. In this perspective, the city reveals itself as an organism in becoming, in which form is moulded by the deep needs of social life and by the demand for spatial justice (Lynch, 1960).

In my project experience — as in the Masterplan for the historic centre of Viterbo — I sought to put heritage and contemporaneity into dialogue, promoting public space as an instrument of inclusion and social cohesion. The project is never neutral; it is always political action, the possibility of stitching together torn urban fabrics and restoring dignity to those who inhabit the city but are often excluded from it (Carpenzano, 2016).

Similarly, the Fellini Museum in Rimini is configured not merely as a cultural container but as a new active pole within urban space, where collective memory and daily life interact, generating new geographies of participation in and appropriation of public space.

These examples are microcosms of possibilities that must be situated within a broader discourse — one that looks to sustainable urban policies and to sensitive forms of design capable of placing dwelling at its centre as a living, complex and profoundly social experience.

Such practices find resonance in the United Nations Sustainable Development Goals, and in particular in the objective of reducing spatial and social inequalities (SDG 10) — a challenge to which architecture must contribute not as a spectator but as a protagonist. Only an architecture that knows how to think of space as a generator of equity can imagine cities in which inequality is not a condition destined to repeat itself, but a problem to be confronted and overcome with design courage and civic intelligence.

In conclusion, the unequal space is a dramatic condition but also an extraordinary occasion for rethinking and renewal. Architecture, if it knows how to position itself as an inclusive and anticipatory discipline, can propose new models of spatial relation capable of combining protection and innovation, individuality and community, fragility and strength.

I leave you with this open challenge, with the awareness that every place is a story, every space a gesture towards justice and the poetry of coexistence.

## THE INTERMEDIATE SPACE AND THE CARE OF LIVING: ARCHITECTURE AS AN ACT OF SPATIAL JUSTICE

Today, there are places that are not measured in square metres but in human metres: they are those spaces suspended between the intimacy of home and the openness of the city, between domestic silence and collective noise. It is there, in that intermediate space, that one of the most urgent matches in contemporary architecture is played out today. I am not speaking only of a physical threshold: I am speaking of a relational territory, an "elastic dwelling shell" that expands, adapts, takes care. The pandemic, like a pitiless spotlight, illuminated the fragility of our dwelling models and reawakened the consciousness of space. Balconies, courtyards, terraces — once marginal — became vital centres of a new urban rituality, spaces of affective and mental resistance. Here, a quotidian quality of dwelling was refounded that asks today to be understood, protected and, above all, designed. This intermediate space is a symbolic and real threshold; it is a place of mediation between the individual and the collective, between form and lived experience. In it is reflected my idea of the city: not a system of functional enclosures, but a sensitive organism in which each fragment contributes to a grammar of dwelling that is inclusive, plural and poetic. But there is an obstacle that precedes and inhibits us: it is what I call spatial illiteracy — a widespread condition in which the population does not possess, or has forgotten, the tools for reading, interpreting and demanding quality in the built space. This lack of awareness weakens citizenship, reduces participation and — like a silent fog — allows forms of normalised segregation to consolidate, where the city is no longer a place of possibility but of separation.

Spatial literacy is not a cultural luxury; it is a political necessity, a precondition for being able to exercise the right to the city. We must teach the reading of space as one learns a language: with attention to details, to nuances, to silences. Because even the voids speak — and often they cry out the inequalities we do not wish to see. Space, then, is never neutral. It is a mirror of power relations, of privileges, of exclusions. But it can also become an instrument of care, repair and redemption. I see this in the projects to which I have had the privilege of giving form: in the Masterplan of Viterbo, where the historic centre becomes a laboratory of urban inclusion through participatory regeneration; in the Fellini Museum of Rimini, where urban narrative opens to collective memory and public fruition as a cultural and social act. In all these works the principle is the same: to reduce the distance between dwelling and living, between the built and the humanly shared. This means rethinking space as shared time, as plural narration, as a place traversable not only with one's feet but with memory, bonds and possibilities.

Architecture is therefore political act, but also poetic gesture. It does not design only buildings, but horizons of coexistence. It does not plan only spaces, but relations and possibilities. If we accept this responsibility, we can truly speak of spatial justice, in which the city is not a machine for dwelling but a home for living together, in difference and in dignity.

In conclusion, the intermediate space, as I understand it, is a metaphor and a project: it is the attempt to give form to the invisible, to make the fragile inhabitable, to construct a proximity that cares. It is there that the potential of the future city lies: not in the spectacularity of great works, but in the delicacy of details, in the recognition of the other, in the possibility of a shared gaze.

Today, more than ever, it is the moment to return to designing — and to living — the city not as a sum of spaces, but as a constellation of possibilities.

## 1. THE CRISIS OF PUBLIC SPACE: ANATOMY OF A VOID

We live in a time in which public space — once the beating heart of the polis — has become space in flight. Not through physical absence, but through an erosion of meaning. The piazza, which was once an agora, then a political stage, then a theatre of urban civilisation, today risks transforming into a non-place of transit, emptied of collective function and shared significance. The crisis of public space is not only urban: it is a crisis of relation, of recognition, of legitimacy. It is the portrait of collective solitude, where encounter is suspect and lingering is surveilled. The city breaks into functional islands, into zones impermeable to the different — and the threshold between centre and margin becomes an invisible but inexorable frontier.

Yet urban design can still be an art of stitching together. My vision of the intermediate space — between home and city — finds here its natural extension: what happens in the threshold can refound the city as a space of protected encounter, of meaningful proximity, of shared access.

Because true regeneration is measured not only in square metres, but in square relations: how much space is there, in a place, for the other? How much recognition does it produce, how much citizenship does it generate? To recover meaning in public space means rethinking its grammar, so that it returns to being inhabitable space, narratable space, democratic scene. And this implies a political and design act together: drawing the void not as absence, but as a promise of relation.

## 2. THE CITY AS DYNAMIC ORGANISM: A TOPOLOGY OF LIVING

The city is never complete. It is not a static object, but an organism in becoming — a porous structure that breathes, that adapts, that changes in form and meaning. Like the body, it carries the scars of its fractures, the stratifications of time, the unfulfilled promises and the still-living dreams. Every urban form is a geography of relations, a fragile equilibrium between permanence and transformation, between memory and future. The city lives because it changes. But not every change is progress: the task of architecture is to distinguish the mutation that emancipates from that which excludes.

In this perspective, urban form is not a dogma, but a structure open to time, capable of welcoming the flow of social practices, the hybridisation of cultures, the discontinuity of lived experience. A mode of thinking is needed that is not afraid of complexity, but that knows how to translate it into design: a design that listens before it draws, that observes before it delimits. Rethinking the city as a dynamic organism means accepting its instability as a resource, its disorder as an opportunity, its differences as design material. Architecture, in this sense, is a long exercise in listening, a form of care for the living through space.

And in this organism, every detail — a bench, a portico, a threshold — can become an urban heartbeat, a place of ordinary life that constructs, day by day, the extraordinariness of coexistence.

## 3. DESIGN AS A FORM OF RESISTANCE: ARCHITECTURE AND CIVIC RESPONSIBILITY

In an era in which urban space risks becoming commodity or enclosure, designing becomes an act of resistance. Not only resistance to oblivion or to speculation, but resistance to indifference. To resist means to take care; it means affirming — through design — that everybody has the right to a dignified space, that every community deserves visibility, that every margin can become a centre if recognised and valued.

Architecture is no longer (only) construction: it is critical action, the writing of possibilities, the mediation between conflict and cohabitation. It is no longer enough to design for the city; one must design with the city, recognising in its inhabitants — all of them, not only some — the co-authors of future space.

In my work, this idea takes shape in every project that seeks to deconstruct the distance between those who draw and those who dwell, between technical language and lived language. I think of Viterbo, Rimini, Rome — where each intervention has sought to interrogate the context, to generate listening before form. And then there are the experiments, like MAAM — a mixed city, inhabited museum, resistant utopia — that teach us that space can still be collective invention, a living expression of unguaranteed rights, a forge of new citizenships.

To resist today means not yielding to the inertia of the already known; not surrendering to the trivialisation of dwelling, but seeking with every project a way to give voice back to silent places, to re-signify the ordinary, to transform space into narrative and into right.

In summary, the city we want is not perfect, but inhabitable. Not symmetrical, but just. Not abstract, but alive. If architecture still has a task — and I believe it does — it is to imagine and build places where

the other is not an obstacle, but a beginning. Where space does not divide, but welcomes. Where form does not close, but opens onto the possible. In a fragile time, to design is to resist. And to resist is, in the end, an act of love for the future.

## PUBLIC SPACE, THE DYNAMIC CITY, DESIGN AS RESISTANCE

### 1. THE CRISIS OF PUBLIC SPACE: THE EROSION OF THE AGORA

Today public space is traversed by a profound crisis: not only in its physical arrangement, but in its symbolic and democratic function. It is the visible symptom of a process of privatisation of living, where collectivity dissolves, retreating into spaces regulated by consumption and surveillance.

Henri Lefebvre, already in the 1970s, warned us:

"Space is a social product. And its organisation is always the expression of power relations." (The Production of Space, 1974)

Public space, then, is not a void to be filled but a field of forces, where rights, identities and conflicts are negotiated. When this space empties of common meanings — when it ceases to be an agora and becomes a showcase, a passage, a theatre of surveillance — democracy retreats together with space.

And here the thought of Hannah Arendt interweaves, reminding us that:

"To be seen and heard by others derives from presence in public space. Without this visibility, humanity dissolves into the private sphere." (The Human Condition, 1958)

Our task, as designers, is then to reconstruct visibility. To give form to spaces that return to being shared scenes, spaces of speech, civic theatres.

It is not enough to fill piazzas: it is necessary to reactivate relations. To give depth to the threshold, dignity to waiting, beauty to lingering. Because public space is what allows the city to be a moral subject.

Cinema tells this well. I think of Alfonso Cuarón's "Roma" (2018), where the shared courtyard is simultaneously a place of domesticity and of social hierarchy; or of Bong Joon Ho's "Parasite" (2019), where the staircase between basement and penthouse becomes an architectural map of inequality. Both remind us that space narrates, separates, conditions.

### 2. THE CITY AS DYNAMIC ORGANISM: THE LIVING AS FORM

The city is a body in transformation. It is never neutral or complete. It is, as Michel de Certeau would say,

"an invisible web of everyday practices, a spontaneous choreography made by those who inhabit it." (The Practice of Everyday Life, 1980)

If urbanism often draws from above, urban living acts from below, carving out paths, inventing uses, generating an affective and resistant geography. Between map and territory, the inhabitant is the true

cartographer of the city. And architecture must recognise in these "minor uses" an inexhaustible design source.

Designing the city as a dynamic organism means recognising the temporality of space, its capacity to mutate, evolve and adapt. It means designing for what we do not yet know, but that will come to pass: the transformation of working models, the new coexistences, the irregular rhythms of new urban families.

Here too, cinema offers a precious lens. In Chloé Zhao's "Nomadland" (2020), the city disappears and disperses: it becomes a car park, a container, a caravan. A mobile, wounded, but resistant humanity. Sean Baker's "The Florida Project" (2017) shows the suburb as a threshold-place, where the city is degraded but alive, fragile but full of desire. Marginal spaces, yes, but intensely lived.

These are images that remind us that the city happens even where there is no design, and that architecture cannot escape the task of listening to those margins, designing with the wounds, giving form to the dignity of the invisible.

## 3. DESIGN AS A FORM OF RESISTANCE: THE POLITICS OF SPACE

In this scenario, the project is not a technical gesture, but an ethical and political act. To design means to take a position, to choose, to expose oneself.

It is, as I said at the outset, a gesture of resistance. Resistance to indifference, to anonymity, to the commodification of space. It means proposing an alternative to the world as it is. It is not only a question of building: it is a question of imagining possibilities.

As in Lefebvre, the right to the city is not a right of access but a right of production: the right to transform urban space according to plural needs, desires and visions.

This is why in my projects I seek to practise this resistance through listening:

in the Masterplan of Viterbo, public space is not decoration, but an instrument of identity restitution;

in the Fellini Museum of Rimini, architecture celebrates memory not as a relic, but as a machine of collective relation;

in Rome 20–25 Quadrant XI, dwelling is not a function, but a relational and civic experience — a project about time and quality.

Finally, MAAM. There, in that inhabited and unclassifiable museum, art is an instrument of survival, space is an act of protection, coexistence is design. A living example of what Arendt called vita activa:

"To act is to begin. And to begin is to set something new in motion." (The Human Condition, 1958)

Here, then: to design is to begin the new. It is to believe that space can still generate relation, possibility, justice.

## CONCLUSION: SPACE AS PROMISE

If the city is a text to be written collectively, the project is its critical alphabet. If public space is in crisis, our task is to make of this crisis a threshold, not an end. If architecture wishes to remain relevant, it must inhabit complexity with intelligence, but also with poetry.

Let us work, therefore, not to close forms, but to open possibilities. Because in the end every space — if listened to, if traversed, if shared — can still become a place of justice and of beauty. And this, ultimately, is the most political and the most poetic act that architecture can perform.

## A CASE STUDY: PERFECT DAYS — EVERYDAY SPACE AND PERCEPTION

### ROUTINE, CARE, MINIMAL SPACE

The protagonist, Hirayama, lives a simple life, marked by rituals and care — of public toilets, of his plants, of nature, of the light filtering through the trees. The space of the public toilets, normally marginal, becomes for him — and for the viewer — a place of meaning, meditation and aesthetics. It is not mere function, but sensory and emotional relation.

The film, directed by Wim Wenders (2023), uses the Tokyo Toilet project, which commissioned toilets in 17 different locations in Shibuya, Tokyo. They are signed by famous architects (Tadao Ando, Toyo Ito, Shigeru Ban, Fumihiko Maki, etc.). The aim: to improve hygiene, accessibility, safety and aesthetics as part of the urban experience. The toilets are conceived as "usable by anyone, regardless of gender, age, ability or disability". Additional functions (baby-changing areas, disabled access, signage, safety) also play an important role. There are technological and spatial innovations: walls that become opaque, transparent glass when unoccupied, so as to guarantee cleanliness, visibility before entry, and reduced anxieties related to safety.

There is an interesting contrast between urban visibility and invisibility: Hirayama works in "hidden" spaces of the urban fabric (public toilets), but these spaces — thanks to architecture — become visible, notable. Often in cities certain spaces are invisible: spaces for those with fewer resources, less power — like public toilets, surrounded by stigma and neglect. The film "saves" these spaces, places them at the centre through a poetic gaze. This reversal is already a form of spatial critique.

### FORMS OF SPATIAL INEQUALITY IN PERFECT DAYS AND THE TOKYO TOILET PROJECT

#### 1. Accessibility (Physical, Disability, Elderly)

In the previous urban context, many spaces — particularly public toilets — were inadequate: unsafe, difficult to use for people with reduced mobility, and lacking essential provisions. The Tokyo Toilet project intervenes by building "universal" toilets, accessible to all. The design attends to level changes, clear signage, diversified functionality and devices to increase safety (such as transparent glass or strategic mirrors). Particular attention is paid to usability by all, without exclusions.

#### 2. Social Stigma

The film highlights how cleaning work in public toilets is often considered humble or degrading. The toilets themselves are avoided places, perceived as dirty or uncomfortable. Through the character of Hirayama, who performs his work with care and dignity, the film restores human and poetic value to everyday

gestures. Equally, the Tokyo Toilet project transforms a minimal public service into an architectural work, contributing to changing the social and cultural perception of these places and of those who care for them.

### 3. Territorial Distribution of Services

In cities, not all areas have equal access to quality public services: often the peripheries remain excluded from regeneration interventions. The Tokyo Toilet project intervenes in the Shibuya district at various strategic points — parks, stations, transit zones — without limiting itself to central or tourist areas. This contributes to reducing spatial inequalities within the neighbourhood.

### 4. Space and Urban Dignity

Degraded or neglected public spaces influence citizens' perception of their right to live in a well-tended and welcoming city. In the film, the space of the public toilet becomes a place of quality, order and beauty. Constant care becomes part of the citizen's right. The protagonist finds a sense of identity and fulfilment precisely in the maintenance of these spaces, underscoring the link between personal dignity and urban quality.

## LIMITS OF THE PROJECT

Notwithstanding many positive aspects, both the film and the Tokyo Toilet project present important limitations:

Limited scope: The project remains confined to the Shibuya neighbourhood of Tokyo. There is no guarantee that a similar model could be replicated elsewhere with the same effectiveness. The gap between well-designed central areas and peripheral ones still lacking adequate services remains strong.

Long-term maintenance: Designing and building is only the first step. The real challenge is to guarantee ongoing management, care and safety over time. The film shows the protagonist's dedication, and the project includes a maintenance plan, but the question remains open: will quality be maintained everywhere and over time?

Broader inequalities: The film does not directly address themes such as housing shortage, mobility, income, urban density or land use. However, it allows a crucial point to emerge: public space is never neutral. It is the product — and at the same time the reflection — of complex economic, political and cultural conditions.

## IMPLICATIONS FOR CONTEMPORARY ARCHITECTURE AND URBAN PLANNING

### Designing for the Invisible

Designers must look at aspects that are often taken for granted or made invisible (public toilets, accessibility, perception of safety, hygiene) as central, not marginal, elements.

### Public Space Policies as Policies of Spatial Justice

Access to dignified spaces is a matter of equity: those who live in less well-endowed, poor or marginal neighbourhoods have worse spatial conditions — and therefore a worse quality of life. The film suggests that even the manner in which we clean, maintain and govern public space matters.

### Symbolic Value of Everyday Architecture

Not only museums and skyscrapers: "minimal" architectures can be powerful vehicles for cultural change — they shift perception, reinforce the sense of belonging, and restore dignity.

### Inclusive Horizons

Contemporary architecture — especially in common spaces — must integrate diversity: gender, age, mobility, cultural needs. "Universal" spaces not merely as an aesthetic operation, but as an ethical commitment.

### The Importance of Maintenance, Management and Urban Context

Even beautiful architectures can decay if abandoned; the need is to think long-term, considering those who inhabit space every day — not only the spectacular effect.

## DESIGNING FOR THE INVISIBLE: AN ETHICS OF THE COMMON SPACE

In the heart of our cities, amid the noise of traffic and the indifference of facades, there exist spaces that do not ask to be looked at, but to be lived. They are the spaces of the invisible — those that do not appear in glossy magazines, those that do not make the news, but that every day safeguard the dignity of those who pass through them.

To design today means training the gaze upon what escapes. It means recognising that a bench in the shade, an accessible public toilet, a safe pavement, are not technical details: they are political gestures, they are acts of care. Often, it is precisely what is invisible that constructs the deep meaning of dwelling.

We have long celebrated the exceptional, the icon, the monumental work. But true architecture — the kind that changes people's lives — is also made of minimal things: a shelter from the rain, a place to sit without consuming, a light that welcomes rather than repels. It is there that spatial justice is played out: not in the equality of forms, but in the equity of possibilities.

Every public space is a promise. And that promise must be kept not only at the moment of inauguration, but every day, in the slow time of maintenance, in the silent care, in the shared responsibility. A beautiful place that decays is a wound. A humble but well-tended place can become a symbol of renewal.

It is necessary to imagine an architecture that is not only scenography, but infrastructure of coexistence. That speaks not only to tourists, but to inhabitants. That does not represent an idea of perfection, but welcomes the complexity of the real: its fragilities, differences, shifting needs. Spaces that do not exclude, but include. Spaces where every body, every voice, every step can feel legitimate.

In this sense, designing is not an aesthetic act, but an ethical one. It is interrogating our way of being in the world, the relations we wish to cultivate, the future we wish to build. It is understanding that even the most modest of architectures can carry within it a powerful symbolic value: it can generate belonging, reawaken dignity, weave community. The urbanism of the future will not be made only of new buildings, but

of new gazes. It will be made of attention, of proximity, of listening. It will be a poetic practice of the everyday, capable of seeing potential where today we see only waste.

And then, perhaps, we will be able to say that we have designed not only for the eye, but for the soul. Not only for the present, but for a promise of a shared future.

## DESIGNING FOR THE INVISIBLE: ETHICS AND POETICS OF CONTEMPORARY PUBLIC SPACE

In the contemporary debate on architecture and urban planning, the urgency emerges forcefully of shifting the gaze beyond the formal and symbolic exceptionality of the iconic work, in order to interrogate what often remains at the margins of design discourse: the spaces of the invisible, of the ordinary, of the everyday. Spaces that are not celebrated, but are fundamental to the quality of urban life.

Public toilets, accessible benches, safe routes, respectful lighting, spaces for the free resting of the body and of thought: these are the elements that structure a true experience of public space. Yet too often these devices are relegated to mere technical infrastructure, ignoring their centrality in the construction of a just and inclusive urban environment.

Designing for the invisible thus means recovering an ethics of space, one that does not limit itself to the production of image or the pursuit of spectacularity, but that assumes the responsibility of guaranteeing conditions of access, dignity and belonging for all. The urban project becomes, in this perspective, a political practice operating on the terrain of spatial justice: an equitable distribution of the opportunities offered by space, especially in peripheral, vulnerable or neglected contexts.

This implies a change of paradigm. Architecture is not only the construction of places, but the construction of meanings. Even minimal architectures — bus shelters, thresholds, stairs, fountains, resting surfaces — take on a significant symbolic value. They are places where the sense of belonging is formed, where the right to be visible is recognised, where one can live the city without necessarily having to consume it.

In this sense, the design of public space cannot prescind from a radically inclusive horizon. Differences of gender, age, ability, culture and status must be considered as original conditions of the project, not as subsequent additions. To speak of the "universality" of space means recognising the plurality of the bodies that inhabit it and the multiplicity of uses that can emerge from it. Inclusivity, therefore, is not only a matter of formal language, but an ethical and political question that calls into question the social responsibilities of the discipline.

Similarly, maintenance, management and care can no longer be thought of as secondary domains in relation to design. A work that is also architecturally valuable risks failing in its public function if abandoned, if unlived, if not tended over time. The project must then extend beyond the building site, embracing the entire life cycle of urban space, and involving those who traverse, inhabit and modify it on a daily basis.

To rethink architecture and urban planning in these terms means, in the end, to restore depth to the discipline: to recognise that every space is also a text, a narration, a cultural construction. That public space

is not given once and for all, but is the result of practices, conflicts, memories and aspirations. And that every project is an act of taking a position on the world.

In designing for the invisible, then, a fertile field of research opens up, interweaving critical theory, social practices and design experimentation. A space where the academy can play a decisive role, not only in analysis but in the production of new spatial imaginaries. Because designing the city of the future does not mean only building its form, but rewriting its meaning — starting from what has for too long been ignored.

## REFERENCES

Arendt, H. (1958). The Human Condition. University of Chicago Press.

Carpenzano, O. (2016). O., Rigenerazione urbana e spazio pubblico a Viterbo.

Carpenzano, O. (2020). O., Il valore dello spazio intermedio tra casa e città, Conference

Carpenzano, O. (2021). O., Analfabetismo spaziale e partecipazione, conferenza e pubblicazione.

de Certeau, M. (1984). The Practice of Everyday Life. University of California Press. (Original work published 1980)

Lefebvre, H. (1974). The Production of Space. Blackwell.

Lynch, K. (1960). The Image of the City. MIT Press.

Tafuri, M. (1969). Toward a Critique of Architectural Ideology. Einaudi.

United Nations. (2015). Sustainable Development Goals: Goal 10 — Reduce Inequalities.

# Art, Architecture and Infrastructures of a New Generation in UnLost Territories (unequal spaces)

Antonino Saggio
Sapienza - Unversity of Rome
Via Flaminia, 359, 00196 Roma RM, Italy
*antonino.saggio@uniroma1.it*

To address the theme of UnequalSpaces, I believe it may be useful to discuss the work carried out at my chair at Sapienza in the deeply marginalized peripheral eastern sector of the city of Rome. This territory lies just inside the Grande Raccordo Anulare — the city's ring road — and is enclosed in a wedge between the Aniene river and Via Casilina to the north, extending along the bisector of this territory: Via Prenestina.

Our approach to the theme of unequalSpaces began with the presence of art, or more precisely with a very particular museum: the MAAM (Museo dell'Altro e dell'Altrove — Museum of the Other and the Elsewhere). This museum was born in an abandoned factory occupied by residents of diverse ethnicities, and it inspired a way of approaching urban regeneration — a method that combines art, architecture, and new-generation infrastructures. The project took the name UnLost Territories. It involved five doctoral assistants, approximately two hundred students from my design courses, and produced nine graduate theses. The entire work is presented in the book UnLost Territories, edited by the author together with Gaetano De Francesco, published by Vita Nostra Edizioni and available online.

Figure 1: MAAM (Museo dell'Altro e dell'Altrove) – photo: Antonino Saggio

Let us proceed in order. First of all, the first time I heard about the MAAM was at the American Academy in Rome: some Academy fellows were developing a project in one of the outdoor areas of the large occupied factory. Shortly thereafter — or almost simultaneously — an artist I hold in high regard, Giovanna De Sanctis Ricciardone, told me that the most vital experience in Rome in the field of art was to be found out there, in the extreme periphery of the city on Via Prenestina.

I was therefore aware of the significance of the invitation extended to the nITro group (nitrosaggio.altervista.org) to create an architectural work inside the MAAM. nITro is the acronym for New Information Technology Research Office, a group I founded with architects trained under me. Since 2003 it has been dedicated to the impact of computing on architecture through editorial, research, installation, and exhibition activities. It is based in Rome and Gioiosa Marea, and publishes its own webzine, "On/Off" (onnoffmagazine.com).

The invitation was prompted by the friendship between Michela Pierlorenzi of the MAAM and Valerio Galeone of nITro. The group conceived "tree.it" — a platform, unfolded in space, that was an aesthetic object in its own right but also a ramp for play, a seating structure, and a catalyst for events. It was used for several months and became a focal point for concerts, performances, and for residents' skating and cycling. The conceptualization and construction of tree.it owe much to the energy of Valerio and the firm determination of Michela, as well as many other nITro members who contributed. I wrote: "If Milan presents the gold of Fondazione Prada, in Rome, in the former Fiorucci salami factory occupied by diverse ethnicities, the extraordinary mix of Metropoliz has come alive — a clear example of mixité. Little by little, derelict spaces have been transformed into decent housing and communal areas, and hundreds of artists have donated often extraordinary works through voluntary and enthusiastic labor. Books, catalogues, articles, television programs, a detailed documentary interview have accompanied this reality over the years, and now there is also tree.it. The installation is among the first to work inside the MAAM on spatial — not merely aesthetic — relationships; it intervenes in space and its connections with use through the tools of architecture. The tree.it ramp zigzags between the pillars of a large warehouse, yet seems to have always been there. The children have claimed it: a multitasking object, a small catalyst."

Figure 2: Tree.it, nITrogroup

## New Thoughts

The experience of building tree.it, participation in gatherings, and the enthusiasm of the nITro group members gradually unsettled me. I began to think about how the entire experience of Metropoliz — of which the MAAM was the catalytic component — could actively nourish a new design thinking.

In February 2016 I made the leap and named the new urban project "UnLost Territories" — meaning territories that are "not" lost: territories to be restored to centrality and from which we must, in some measure, also learn. Of course, this was only the first embryo of an idea that we shall progressively elaborate in the following pages.

The consequences have been numerous, in organizational, methodological, and content terms.

## Organization

First of all, it was a matter of shifting the entire work of my chair in Architectural and Urban Design at Sapienza University of Rome, Faculty of Architecture, Department of Architecture and Design, from the part of the city along the Tiber in the northern area of the capital to the opposite side. This was not simply a matter of location; it was also, as I jokingly said, "leaving the Parioli neighborhood to go to the ring road."

The UnLost Territories project involved the convergence of several doctoral research fellows as university teaching assistants, around ten graduating students, and hundreds of student-architects nearing the end of their studies at the Faculty of Architecture of Rome Sapienza. Together, these protagonists converge on a collective urban design project for the city, producing many concrete proposals. Over the past fifteen years, using this system, we have produced four major projects for Rome and a myriad of web pages, individual and collective blogs, maps, and websites. We hope to do the same for UnLost Territories, but to get a sense of this now one can only refer to the previous projects, which were compiled into books (links to the PDFs are included). These are: "Roma a-venire: progetti per una nuova città dell'informazione e della storia viva," "Urban Voids: strategie e nuove partnership per progetti sostenibili nella città di Roma," "Urban Green Line: progetti sistemici per una infrastruttura ecologica a Roma," and the most recent, "Tevere cavo: una infrastruttura di nuova generazione per Roma tra passato e futuro." A defining feature of these long-term chair projects is that "each does their part": the professor teaches, the assistants assist, the doctoral candidates research, the student-architects — who are the true combatants and main protagonists — design, and the graduating students focus on complex and articulated thesis projects that, in each iteration, deepen and in a certain sense redefine the very nature of the collective project. We make only marginal use of public funds, and publications are on demand. But because each person does what they are called to do in their respective role, they do so with passion, "converging" on a theme, on philosophies, principles, and methods. And it is this methodological aspect that we now discuss.

## The Method: Inside Metropoliz

How did we proceed? First, we mapped Metropoliz — or rather, its internal and external areas susceptible to new ideas and actions. This map, created in consultation with Giorgio and Michela and through the painstaking pioneering work of the two graduating students Michele Spano and Manuela Seu, involving repeated visits and photographic surveys, identified 22 "red" spots inside Metropoliz. What are these spots for? They indicate areas for possible interventions, in a sense comparable to tree.it: places where architecture can intervene through micro spatial actions that "transform crisis into value," as Bruno Zevi would say. The context in which these actions are conceived and developed is primarily the ITCaad course in the fifth year, and in July 2016 we publicly presented some outcomes to Giorgio De Finis, the anthropologist who directed the MAAM, and to other experts. In this context we cannot delve too deeply into this sector, but we are convinced that an intelligent use of new means and digital technologies can be fundamental, especially in addressing difficult and crisis situations. In this spirit, for example, we can imagine that eventually we will have the capacity to realize with the nITro group "Reciprocal 3.0." This is a lightweight parametric structure built from several hundred one-meter PVC rods. The result is an organically shaped pavilion that is grafted into different locations, accentuating certain underexploited characteristics of each. Valerio Perna was instrumental in this project.

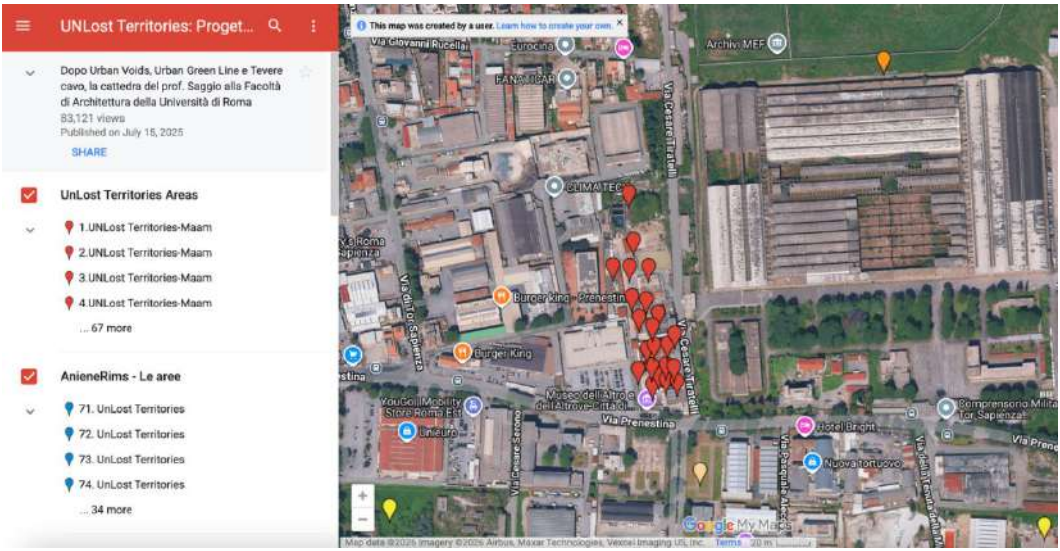



Figure 3: The Inside Metropoliz map

Digital technology intervenes not only by making the structure “site-specific” through a different design each time, guiding the construction process with precise mapping of individual rods, and statically optimizing the specific forces between rods, but also by layering other simple interactive systems that allow transformation of the entire environment into a large musical and performative instrument (in addition to naturally implementing some targeted interactive input-output elements using now economical and widespread technologies). It is also very cost-effective in terms of materials, though careful assembly is required. We have already realized it twice with fine results: in 2016 in Gioiosa Marea, Sicily, and at the Cubo Festival in Ronciglione, Lazio.

Figure 4: Reciprocal 3.0. Image: Valerio Perna

## The Method: Outside Metropoliz

The second step was to extend the mapping process outside Metropoliz. Thanks to the meticulous work coordinated by graduating student Silvia Primavera and other graduating students, we began by mapping 44 areas located within an irregular ring approximately four kilometers in diameter, covering roughly 400 hectares. Metropoliz is obviously within this ring, toward the eastern boundary, not far from the ring road. This mapping work is not carried out solely by identifying 44 abandoned, underused, and derelict areas belonging to the broad categories of relics or urban voids; it also entails an initial photographic survey. The fundamental methodological aspect is that the Google map (accessible at goo.gl/znt2L6) is linked to a blog (unlostterritories.blogspot.it) whose individual posts, in addition to containing a small photographic and planimetric selection, will contain the projects that over the years will converge on that particular area.

Finally, those who wish to look at the map will notice an infrastructural ring formed by a series of segments constituting the outer perimeter and other segments running along the diameter of the ring — roughly a figure-eight configuration. The ring, whose realization is planned in two phases (first the northern section, then the southern), is designed to host a multitasking infrastructure (tram, ecological canal, cycling and pedestrian path), much as we did in Urban Green Line. The ring intersects existing stations and nodes, creates a couple of new ones, and will serve as the great infrastructural flywheel to concretely motivate (socially and economically) projects in the individual areas and revitalize UnLost Territories. Let it be clear:

we are not joking, we are not utopian, we are not “without a place” — this project is for this sector, for this city, for this time: it is here that it must be realized, as many other cities around the world have done (see examples in the books cited above).

Within these maps, the student-architects operate: for each area they define a distinct program, directly manage a specific negotiation with a client identified within the community, and develop a project that is as credible and realistic as it is innovative. Forty-four areas, 44 projects, 44 programs, each different — but how? By following general principles: we have finally arrived at them, and we lay them out below.

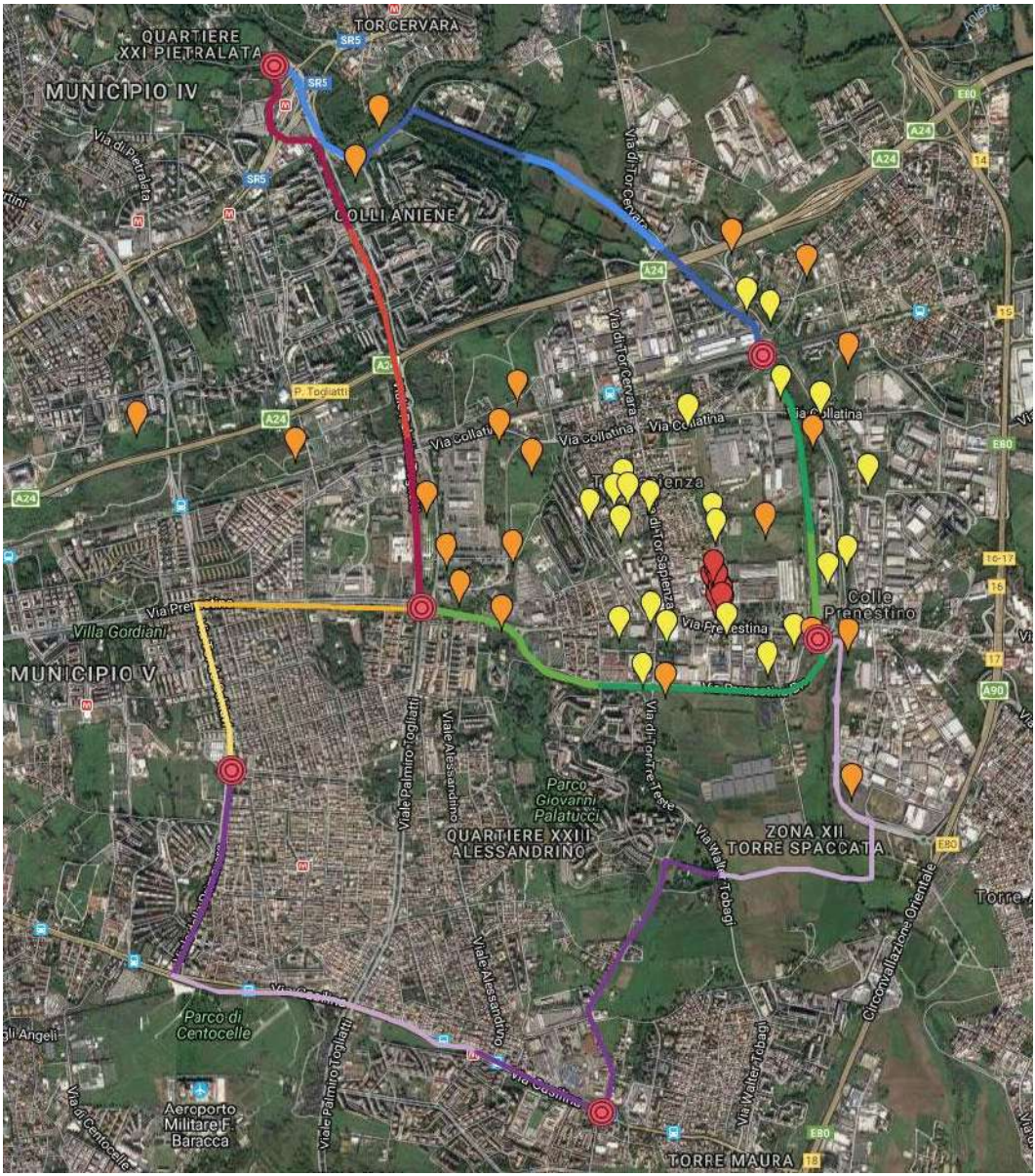



Figure 5: Outside Metropoliz map.

## THE PRINCIPLES OF UNLOST TERRITORIES

Over the years we have developed ten principles that guide all our projects. Five apply at the scale of the architectural project (mixité, driving force, rebuilding nature, infrastructuring, magic crisis), and five at the scale of infrastructural systems (multitasking, green systems, information technology foam, slowscape, and galvanizing). I trust you will appreciate that I shall not illustrate them again here: I refer to the most recent book among those cited — "Tevere cavo" — where they are analyzed in detail and put into action across all projects.

But now let us return to the MAAM and Metropoliz and some characteristics of this experience from our perspective. The core idea of UnLost Territories is that we will "not" concentrate on Metropoliz itself, aside from the small operations described, but rather that we want to "Learn from Metropoliz." The idea is to apply the ten principles outlined above to the specific conditions of this sector, illuminating them with what Metropoliz has already achieved. This means attributing to Metropoliz a propagating and propulsive effect for the revitalization of the surrounding urban territory.

What are these propulsive factors of Metropoliz? Naturally, all readers of this book know the story and there is no need to retrace it here, but these are the points we focus on, which seem to us the key aspects:

- The reuse of an abandoned structure and, progressively, of its external areas.
- The occupation by residents from diverse ethnic backgrounds and various situations of marginality.
- A situation of social equilibrium, dynamic and self-regulating.
- The presence of art as a great "defender" of the occupation.
- The presence of art as a "re-centralization" of the periphery.
- The presence of the artistic gaze on phenomena of marginalization that reopens to a new aesthetic that is also new substance.

Each of these points deserves a lengthy analysis, but our idea is to make the Metropoliz case function as if the designers had a kind of mirror neuron in action. It is a matter of deeply analyzing in order to both emulate and personalize simultaneously — using the behaviors currently in place, "modifying and adapting" them to the other identified areas while naturally contributing much of our own.

For example, we have always worked with the concept of Mixité. In the case of Metropoliz, this concept is expressed in a particular way, because it is certainly a museum (with a quite distinctive philosophy and content) but it is also a social support center, an open laboratory, small educational units, many dwellings — and all of this is catalyzed around art. Perhaps other projects in the UnLost Territories area can propose different mixtures of these uses, or can focus on particular aspects of certain ethnic communities (in the culinary field, craftsmanship, music, language, literature, art itself). Or perhaps the social or educational component becomes prevalent, or that of temporary accommodation, or one might work on the theme of economic sustainability by developing aspects of agricultural self-production. The first thesis project is called "Cerismit: Centro di Ricerca e Sperimentazione 'Michele Testa' per BIA (Building Integrated Agriculture)" by Jiul Kim. Why does the project take the name of Michele Testa? It is precisely the historical story connected to the great former anti-fascist railway worker who founded the agricultural district of Tor

Sapienza that led to the decision to design an agricultural research center: the project is sited in an underused area facing Metropoliz on the other side of Via Prenestina. The new project offers housing, gardens, and work to several family groups from Metropoliz. Three functions characterize the project: a weekly farmers' market for the sale of vegetables produced within the center and in neighboring areas; a research center for agriculture characterized by the possibility of practicing organic farming; and houses and gardens to enable social integration and an active connection with Metropoliz. It seems to us that the original agricultural vocation envisioned by Testa is thus relaunched within the current situation. That the project was realized by an Asian student strikes me as wonderful. "It took a comrade from North Korea to make us discover Michele Testa!" I once said to the students, half-jokingly, I must admit.

UnLost 2030: A Journey Through a Transformed City

But let us proceed in order. We begin by visiting UnLost Territories from its symbolic center of emanation: the MAAM. Here we find the installations Tree.It and Reciprocal 3.0, both works that seek to draw on the great artistic experience of the MAAM to also work with genuine architectural spatiality. These structures are built and come alive through a collective process with residents. Among the various installations for the MAAM is Babel Tower — a tower, also self-built, that creates customizable spaces on its various levels.

Leaving the MAAM, one immediately encounters on the eastern side the large Cerimant Military Block Redevelopment project, transforming it into an arts center. The urban perimeter, once closed and forbidding, becomes a permeable landscape with a system of flows connecting the city to the interior, through routes dedicated to natural environments, sport, health, education, and art. This project makes partial use of the existing rail tracks within the military structure for the creation of the UnLost Line — the infrastructure marking a double loop through the neighborhood and connecting the various metro stops and the Rome–Tivoli rail line, completely transforming this urban sector.

Near the former Cerimant stands Tecnopolo Phoenix: a technology park for the rebirth of the medical hub on Via Emilio Longoni. A series of urban voids and abandoned healthcare structures are brought into a system with a technology park, composed of equipped public green space and new buildings for medical research.

Moving further along, several projects illustrate how the UnLost Line functions as a truly new-generation infrastructure:

Smart Education: an adaptive and permeable infrastructure for interactive learning and education; a system of communal spaces that serves as pathway, park, canopy, and play area.

Ping Pollution Tree: creates monitoring points that capture environmental data and information and, like the trees whose form they evoke, absorb fine particulate matter. The new artificial trees offer Wi-Fi services and USB electric charging; they produce energy and provide a sharing service for Segways or scooters, highly useful given the proximity of the technology park.

Spread The Wave: creates pedestrian crossings of the Line that become elements of information and communication, while simultaneously assisting people with disabilities and the elderly.

Sport Tech: a research center for technologies applied to sport, identifying innovation as a viable programmatic proposition in a neighborhood with a previous industrial vocation.

Moving into the northern section of the Line, projects emerge that address various social issues:

LESSbarre: a low-security prison facility for mothers with minor children — a bar-free, dynamic, and inclusive structure.

Needles: social housing for single mothers, in which an urban void is transformed into a refuge with a permeable public space, housing, and a training center.

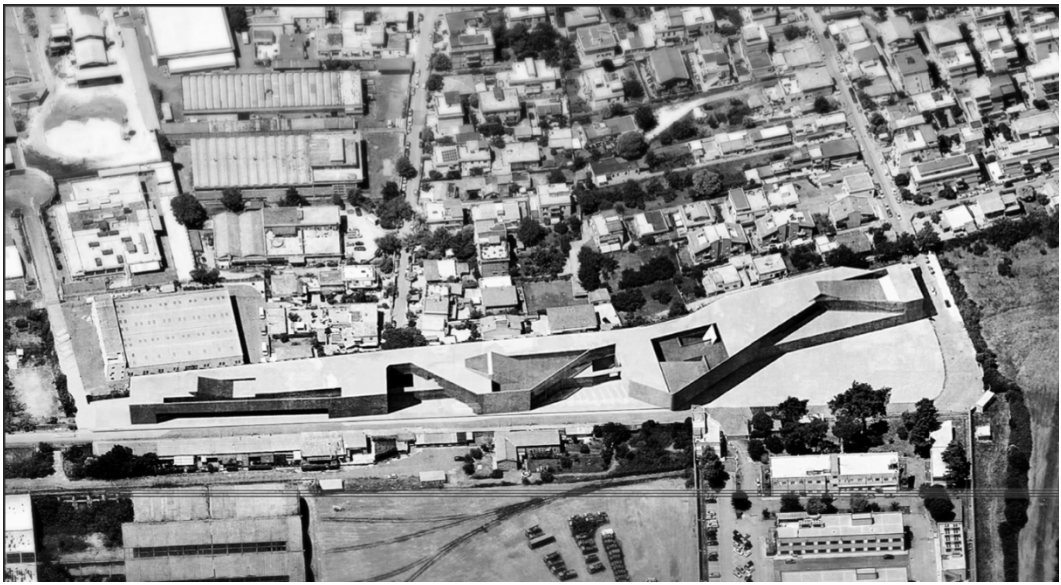


Figure 6: Sport Tech: Research center for technologies applied to sport. Project: Savina Leggieri

CAM – Complesso Artisti Metropolitani (Metropolitan Artists Complex): a museum, laboratory, and residency articulated in a series of excavations to accommodate existing trees and offer workspaces and exhibition areas on the lower floors, and studio-apartments on the upper floors.

In the northern part of the Line, close to the Aniene river, Save IT – Print IT: Reduce, Reuse, Recycle — a project helping the Colli Aniene population cope with issues related to the Eastern Rome water treatment plant. Moving southward, a new entrance to the large Morandi public housing complex is created through the Odin Teatret: a multipurpose center for theatrical arts research featuring a walkable roof (which serves as a ramp to overcome the difference in levels) and a hypogeal condition for the theatrical spaces.

Approaching the major axis of Via Prenestina, one encounters Nodeon: a bridge reconnecting the northern and southern parts of the neighborhood through a circular cycle-pedestrian loop suspended on cables. Just beyond stands Sinapsi: interactivity and open source, which generates a slow exchange through triangular sub-units associated with green spaces; and Pixel Multitasking, an organic multifunctional structure at Prenestino-Centocelle suitable for multiple purposes, such as housing books or facilitating solidarity exchanges among citizens.

Further south, on Viale Primavera, stands Electro Colour Gram: eight stations for multicultural integration that make the sounds of the city visible through color and develop social connections between

eight digitally interconnected Line stations. Still further south is Flowing Lines, which integrates water and smart applications to counter urban flooding, and Joining Patches, an experiment in collaborative design that lifts the Line and frees ground-level space for structures autonomously managed by the community.

Deeper into the neighborhood one finds Meltings Pot: a protection and reception system for asylum seekers (SPRAR building) in a previously degraded area. Along Via Prenestina Bis, the most important station of the Line is created: Art/Station, a station integrated with art and a center for artistic teaching and production.

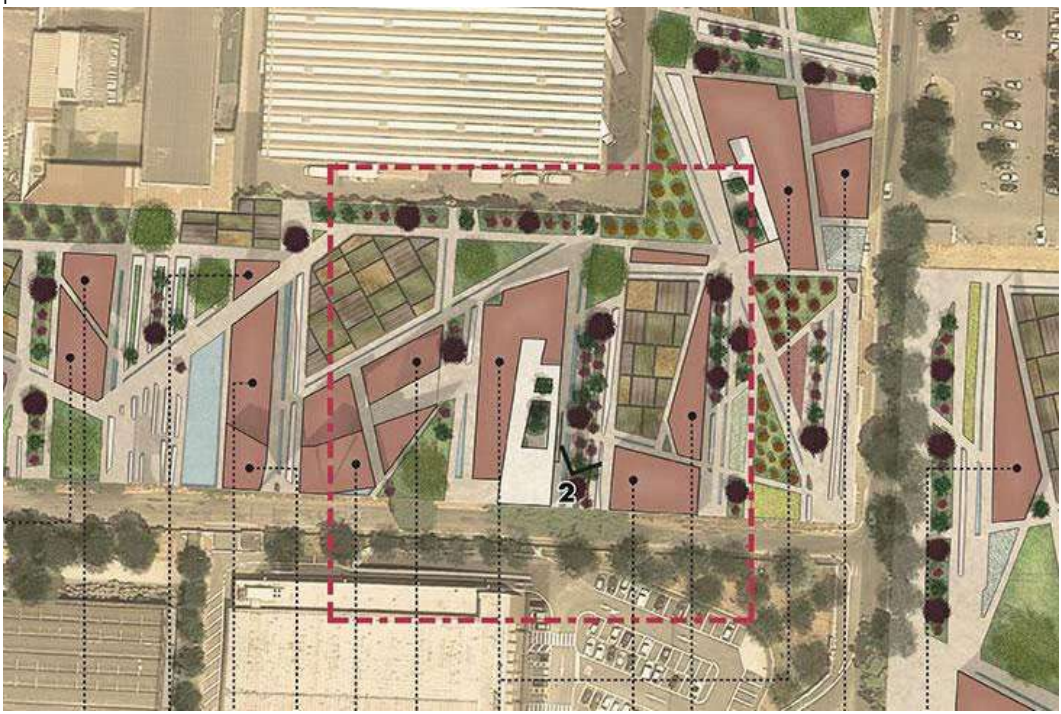



Figure 7: Meltin.g Pot - System for the protection, reception, and socio-cultural integration of asylum seekers. Project: Manuela Seu

Finally, connected to the station, two further projects emerge:

Lighthouse: an experimental center for the autonomy of the visually impaired — an inclusive park accessible through visual, auditory, and tactile sensory channels.

Hostel COM: temporary and permanent residences, a time bank, a cultural center, and co-working space — creating an organic complex of forms and functions in a neighborhood that has now become a vital hub of the entire city.

Figure 8: Hostel COM: temporary and permanent residences, time bank, cultural center and co-working space, access to the Mistica Park. Project: Tiziano Tamburri

Throughout the projects, the relationship with art and the works of the MAAM has always been a strong source of reflection. Our projects have worked with the residual, with the presence of aesthetic force that also arises from low, unfinished, partially assembled situations, from the long tradition of Arte Povera of Rotella and Burri, from the expressionist wing of Pop Art of Rauschenberg that naturally flows into the early cheapscape of Gehry and propagates through to Samuel Mockbee and the Rural Studio. These principles have allowed us to look with new eyes at the extreme periphery of Rome, already present in dozens of MAAM works. The projects in some cases also follow principles of self-construction, growth, phased building, and the generation of spatial and planimetric configurations, naturally opening onto the great theme of self-sufficiency. Hundertwasser — so little understood, even censored, by architects — helped us in certain cases.

This, in summary, is how Metropoliz could propagate its effects across the surrounding territory — a territory that will indeed become "UnLost": no longer lost and dispersed from life, culture, and the city, but reactivated with the same enzymes that already gave life to the MAAM. "Learning from Metropoliz" is a formula easy to understand, even if it stands in direct opposition to the easy capitalist hedonism of Las Vegas, but the denser thought is: "the center is where the action is." The beating heart of Rome now lies at the extreme periphery; it is here, at Metropoliz, that the center of a new city action is to be found. We trust that through the account of this urban project, the theme of the UnEqual Spaces conference has been enriched with an experience of common interest. The data and projects cited are accessible in the book

(also available on Kindle): UnLost Territories: Reconstructing the Periphery in Rome — Architecture and Society in Abandoned Territories, edited by Antonino Saggio and Gaetano De Francesco, which also contains the essay by Valerio Perna — to whom I owe this invitation — and who contributed to the editing of this essay.

# HUMAN-CENTERED DESIGN

# A QUALITY ASSESSMENT OF PUBLIC SPACES FOR INCLUSIVE AND DYNAMIC COMMUNITIES: CASE OF "LIRIA" SQUARE, DURRËS

**Odeta Manahasa, Adriana Lipo**
EPOKA University, Department of Architecture
Rr. Tirane-Rinas, Km. 12 1032 Vore Tirana, Albania
*odurmishi@epoka.edu.al; alipo19@epoka.edu.al*

## ABSTRACT

Public spaces are vital to urban life and are deeply rooted in the human scale. Their relevance has grown over time, highlighting how crucial it is to ensure inclusion and ease of use. Social dynamics strongly depend on the way people interact with their surroundings. Understanding how people see and use public places is critical to creating inclusive and dynamic communities as urban environments change.

This study explores the complex interaction between people who use public places with a specific focus on the "Liria" Square, in Durrës, Albania. The square has undergone several changes over time, reflecting the social and cultural dynamics and the need for equal spaces.

With the aim to analyze its usage and the perception of citizens, the research uses both qualitative and quantitative methods such as observational studies, spatial mapping tools, satellite imagery and user surveys to better understand citizen's perception. We also used GIS kernel density tool to analyse user concentration. In this way, through the analysis of elements such as social interactions, the physical structure and cultural importance, the study aims to identify the fundamental aspects that influence user involvement with "Liria" Square.

The results highlighted obvious problems related to the absence of cycle paths, the limited availability of parking, the lack of greenery and activities that could attract the presence of more people. The well-defined, spacious geometry and perceived safety were key strengths.

This research contributes a human-scale framework for evaluating public spaces, derived from lessons learned in a specific context.

**KEYWORDS:** Open public spaces, user perception, human scale, social interaction, wellbeing.

## 1. INTRODUCTION

The increasing urbanization and the evolution of cities require particular attention to public spaces, which are essential for social cohesion and the quality of urban life. City centers are among the most transformable public spaces that are always in a changing mode. Political, economical, social and cultural changes of a city are directly influencing the city centers. It is the citizens who are directly affected, yet despite the continuous changes, there remains a lack of comprehensive understanding of how specific spatial and cultural elements influence user engagement.

Public spaces have a function in planning and architecture acting as the stage for community life. They are planned spaces within the built environment that promote inclusivity, accessibility and social interaction. The idea of space has far reached effects on social networks, cultural identity and general community welfare. To reveal the true meaning of public space we should analyze its dimensions that together define the landscape. In essence, public space reflects values of inclusiveness and accessibility through the creation of a common environment for people from backgrounds or socioeconomic strata. These areas act as equalizers, where every individual has the right to participate and enjoy and should be available to everyone without social discrimination and limitation (Goltsman et al., 1993). Primarily public spaces are those that do not have a defined or established norm (Churchman,2014).

In addition to their design, the public space extends beyod and become spaces with dynamic character because they act as platforms for social gatherings and cultural activities. These areas are not static, rather they transform according to the evolving demands and tastes of their targeted community (Bigdeli et al., 2013). For instance, a city square could be used as a reading spot during the day and change into an evening market or cultural event venue. This flexibility demonstrates the dynamic nature of spaces. These places are not just environments but stages that develop, change and thrive as human beings interact with their social groups through the process of cultural practices (Turley, 2015). This perspective highlights the impact that public spaces can have on liveliness, identity and overall well-being of its users.

"Liria" Square in Durrës represents an emblematic case study for understanding the interaction between people and urban space. This square, historically and culturally, serves as a manifestation of social dynamics and urban changes, so it shapes the daily lives and well-being of the urban residents. However, with the rapid urbanisation Durres city is going through, the human dimension, how people actually experience and interact with this square is missing. To create more livable and vibrant urban environments, it is of primary importance to understand how city centres foster community engagement and social connections. This research addresses this gap by investigating the key factors of effective square utilization directly from the user's perspective.

Thus, by focusing on “Liria” square this research provides practical ideas for future urban planning interventions that are based on a human scale and to understand how to transform a square into a vibrant city center.

It will answer the following two research questions:

1. What are the key factors that contribute to the effective utilization of a public square from the user's perspective?

2. What measures can be taken to transform the city centre into a vibrant square?

## 2. SCIENTIFIC BACKGROUND AND RESEARCH PROBLEM

Spaces are not only physical entities, humans perceive them and see them as part of a larger concept called the public sphere (Madanipour, 2003). This concept of public spaces encompasses the interplay between people, places and activities that collectively shape interactions within a community. By adopting this perspective architects are challenged to consider not the physical attributes but also the societal and cultural implications of their designs. This expanded viewpoint highlights how design choices are interconnected with people's lived experiences and their sense of identity when engaging with these spaces.

The contemporary architectural discourse on public open space underscores its pivotal role in the social and economic life of communities (Bigdeli et al., 2013). The focus is on creating spaces and gathering spots that serve as valuable social resources, for fostering social interaction, cultural expression and community well-being. This viewpoint is in line with the perspective of Zamanifard, Alizadeh and Bosman (2018) who advocate for an understanding of spaces that considers factors such as their quality, accessibility to the public and the diverse interests of different stakeholders during the architectural design phase. City centers in the public realm act as the cultural and social hub of an area. This area of the city contains a cluster of government and cultural establishments which make it an energetic center for business, administration and amusement (Ryberg Webster & Kinahan, 2013). The city center has a role to play in the sense of representing an area, with its skyline, architecture and cultural sites serving to define its character and identity. The vibrancy and maintenance of this place also significantly promote the sense of pride to be developed as well as perception that is related with the city (Gehl, J., 2010).

In a historical city center, the architecture and structural landscape is an actual living witness to the evolution of their community. The conservation of such buildings and landmarks not only preserves their historical importance but also contributes to the ambience that is associated with the urban setting (Hmood, 2022). The intentional provision of such spaces in the city centers encourages both local residents and visitors to interact with cultural history that are deeply rooted from these locations, promoting a sense of common heritage and community identity (Ryberg-Webster & Kinahan, 2013). Furthermore, historical city centers are viewed as guardians of a community's memory and cultural heritage. Such areas usually include landmarks, monuments and buildings that have historical significance. They further contribute to the storyline of the city (Turley, 2015).

The location of a public space is pivotal considerations in urban planning, ensuring that these spaces are inclusive, well-utilized, and integrated seamlessly into the fabric of a city (Quigley, 1998). As stated by PPS (Project for Public Spaces) and Tibbalds (1992) it is crucial to place spaces in such a way that they are easily accessible visible from a far and open to all. This method seeks to develop spaces that are attractive and welcoming so as to make people form groups upon which they can use them. Gehl (2010) highlights the importance of locating spaces to places where crowds are held for it creates a vibrant urban setting in which people can move easily between different space or activities. Similarly, having public space located in the centers that are well connected to public transport makes them more accessible for many people,

which further promotes social inclusiveness and equal participation. Such spaces contribute to the vibrancy and liveliness of urban environments, fostering the sense of belonging in terms of identity. On the other hand, if these spaces are located in remote areas, then some segments of the population will be left out and as a result social discrepancies would arise with minimal community participation (Carmona et al., 2010).

## 2.1. EVALUATION CRITERIA FOR SUCCESSFUL PUBLIC SPACE

To assess the effectiveness of public space design and determine if it meets user needs, architects and urban planners rely on specific values. Public spaces, which include streets, squares, and markets, vary in character based on their social context, making it essential to evaluate their role in urban life. Several authors have classified effective elements of public spaces in various ways, offering a spectrum of what constitutes a good, long-lasting public area for its users, while considering the current situation and unique characteristics of each city.

Moving on, Christopher Alexander gives us a vocabulary for planning and creating in his book "A Pattern Language," in which he presents 253 patterns that address urban planning challenges, focusing on human elements and spatial connections. These patterns help analyze the design and functionality of public areas on both macro and micro scales. So, the network analysis helps in determining the relative importance of each pattern and statistically analyzing the links between the patterns.

According to Gehl (2011), the main features for evaluating public spaces are human scale, comfort, and social interaction. These principles highlight the necessity of arranging spaces that are open, comfortable and stimulate social interaction. His extensive research over six decades culminates in Twelve Quality Standards divided into protection, comfort, and delight, as detailed in “New City Life”.

Moreover, the nonprofit organization Project for Public Spaces offers a methodology for assessing public spaces using "The Place Diagram," by analyzing hundreds of public areas and discovering that successful venues typically have four things in common: activities, comfort, sociability, and accessibility. This diagram helps measure both tangible features and abstract qualities like community involvement.

While traditional criteria are widely accepted for evaluating public spaces, it's essential to consider the unique social, cultural, and environmental context of each city. Relying solely on traditional principles without adapting them to the local context may not yield optimal results. For example, a study by Kengyel (2016) involving urban planning students highlighted the importance of balancing functionality with community enjoyment, suggesting improvements to existing design criteria by incorporating accessibility. So, it’s important to consider specific factors that contribute to successful community engagement in public space. Understanding the barriers and facilitators of community involvement can inform strategies to enhance the social impact in the creation and improvement of such spaces.

## 3. METHODOLOGY

### 3.1. THE RESEARCH AREA

The center square known as "Liria" is one of Durrës' most distinctive urban characteristics. It marks the intersection of two major roads: “Aleksander Goga” Street in the West and “Grigor Durrsaku” Street in the East. These roads connect to Porto Romano in the northwest, the outside bazaar in the north, and the hills of Arapaj in the east. Representing the city's heart, “Liria” Square is one of the most significant areas. The positioning of the most significant contemporary, modern, and ancient buildings is also a contributing factor. Explicitly, the Mosque (erected in 1931 and rebuilt in 1993), the Municipality, the Palace of Culture, and the Prefecture (erected following the fall of the communist dictatorship) combine to form the large space that is known as the square (Rovigatti et al, 2010). The plaza continues with the Amphitheatre, which is accessible from the southwest via broad steps that up to the hill; the Clock Tower, which was constructed in 1929, is still next to the Municipality; and the Byzantine Forum, which dates back to the sixth century is located behind the Palace of Culture, which was constructed in 1963. Commercial Street continues on the opposite side of the square and terminates with the Old Hamam, Venetian Tower, and the ancient city walls (figure1).

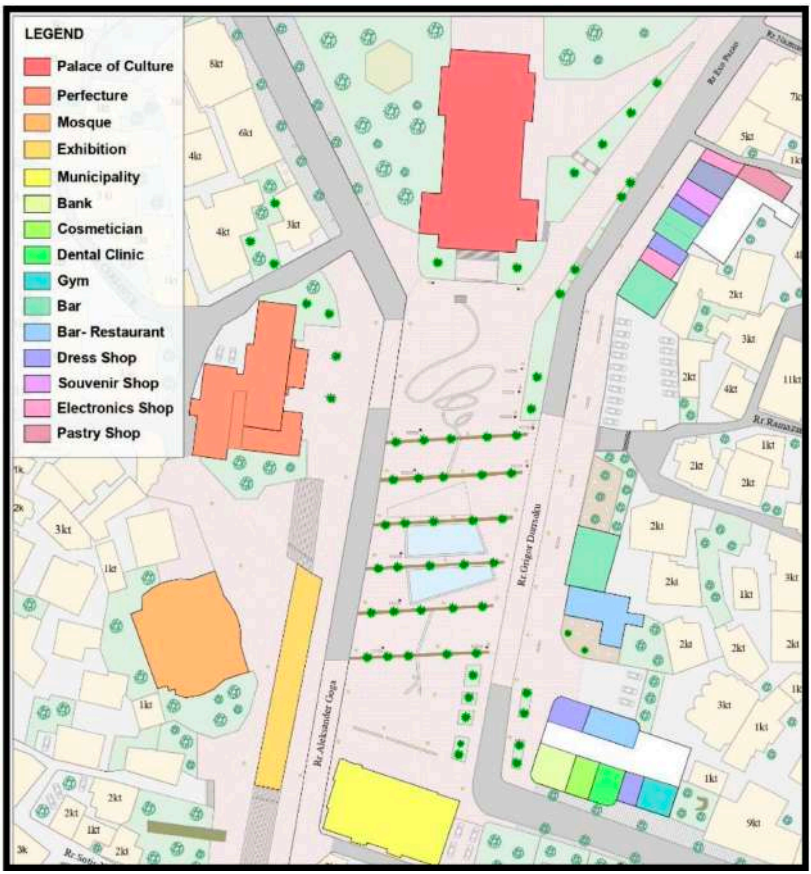



Figure 1: Durres city center with the functions of the buildings, streets and the greenery

The mentioned objects carry distinct historical, architectural, and social significance, coexisting in the same vicinity over time. They assert their individual identities while collectively contributing to shaping "the spirit of the site". So, the square serves as both a functional and symbolic representation of a multicultural and multi-religious society, embodying traces of a rich and intricate past and present. This reflects a diverse and well-organized community, evident in lifestyle choices and individual as well as collective behaviors (Rovigatti, P., 2010). All these elements that are present in the area and surrounding make “Liria” Square a city center whit an historical character, that could be preserved and integrate with the context.

The analysis focuses on evaluating various physical aspects of the area, which collectively influence how users perceive the space. Key factors include accessibility, which looks at how easily people can reach and navigate the area; scale and proportion, which consider the dimensions and spatial relationships within the area; and the surrounding environment, which examines how the area interacts with its context and

neighboring spaces. Additionally, the landscape, including natural elements and greenery, and urban furniture, such as benches, lighting, and other amenities, are also scrutinized. This comprehensive examination not only highlights the physical qualities of the area but also sheds light on the external influences that shape users' overall experience and perception of the studied square.

## 3.2. TOOLS AND METHODS

To achieve the goals of this study, a mixed-methods approach was employed, utilizing both qualitative and quantitative methods.

Firstly, starting to conduct research about the concept of public spaces, definition of a city centre and the historical context of the area selected. “Liria” Square is one of the most exemplary urban features of Durrës city and it has been proposed as a case study for this research. Therefore, it is important to understand the relationship between the old and the new. So, the selection criteria were because it is the heart of the city but also for its historical nature.

Secondly, through desk research an extensive literature review was conducted to understand existing frameworks, theories, and key indicators for understanding and evaluating public open spaces. Additionally, the research analysis the physical and the non-physical factors of the public open space. This includes assessing the accessibility, scale, surrounding, landscaping, safety, sense of community, social interaction, amenities and overall design.

During all the process, documenting the existing conditions provides a baseline for a final evaluation. Moreover, on-site observations were undertaken to understand user behavior within the public space. We documented patterns of movement, social interactions, and the utilization of various amenities. This qualitative data complemented survey responses and provided insights into actual usage patterns. During the days of observation, videos were also recorded on the four corners of the square, for greater help in identifying more accurately their gender, age and the number of people entering in the square and into service buildings.

To understand better the flux of the people, the usage of GIS Software was helpful to organize and to visualize this type of analysis. So, the data collected from these observations were used as part of overlay and data analyses in ArcMap functions through the specific tools. The analysis was conducted in three different scenarios (non-holiday days, holiday days and after the holiday days). The data were collected at two different times within the same day in two-time intervals (Morning- 11:00 am- 11:10 am) (Afternoon 16:00 pm- 16:10 pm) and the observation and videos lasted 10 min each time.

Indeed, for the user centred aspect, surveys were used to understand how public spaces affect people both physically and psychologically. The main focus was on the unique features of “Liria” Square and how users perceived these characteristics. The questionnaire was done anonymously both online and on-site and involved a total of 200 participants. The survey is composed of duration of stay, gender and age, preferred paths and activities, with a focus on the physical movement. It included questions about spatial layout, safety, relaxation, aesthetics, recreational opportunities and overall satisfaction.

## 4. RESULTS

The beginning of the analyses were on-site observations. Initially, using a checklist and map, all elements in the square were documented, revealing limited seating, trees, and no greenery. Verification was done through an aerial view to ensure the accuracy of the recorded elements.

So, the observations of people entering "Liria" Square during different days of the Christmas period revealed variations in foot movement across four key entry points. Across all three days, Point C consistently attracted the most people, while Points A and D fluctuated in terms of activity. Point B, associated with service buildings like the EGT Tower and Sema Restaurant, saw moderate attendance but experienced declines in the afternoons. Overall, more women than men frequented the square, except for Point C, where more men entered. Weather conditions and the timing of observations influenced the flow of people, with total daily entries ranging from around 424 to 553. Despite these variations, the study highlighted that certain corners, particularly Point C, remained consistently busy, while others showed less engagement, reflecting the impact of the square's layout and surrounding activities on pedestrian movement.

Figure 2: Access points and our position when we counted the number of citizens that use the square

Concerning spatial layout, the users were asked to evaluate the key elements of public spaces to understand how their perception were regarding this features in the case of “Liria” Square. The element considered during the survey were based on theoretical background and were used a five-grade grading system for the evaluation. Respondents were asked about if this public square is geometrically well-defined, an average of 83% state that it seem them good with a negative response of 17%, while 80% result that there the space is eough good with a 20% that the situation is negative, after that 70% declare that the accessibility is somewhat good for everyone, but 30% state the countrary.

Moreover, the area is 69% somewhat good walkable with a 31% of negative response, meanwhile 48% of the respondents think that pedestrian can easily orient around the square with a little majority of 52% that state is difficult to orient in the area. About 67% of people say that the situation regarding the presence of bike lanes is very bad because they are not available in all public space, only 33% state that

there isn't an issue for them. The same situation is for parking, in fact around 78% declare that there is not enough availability with only one private car park, in fact 22% of people that rate it as good and because they are workers in the area and have reserved parking. There were also many complaints about nearby public transportation, around 72% state that the situation is bad and the area needs to be better connected to the city.

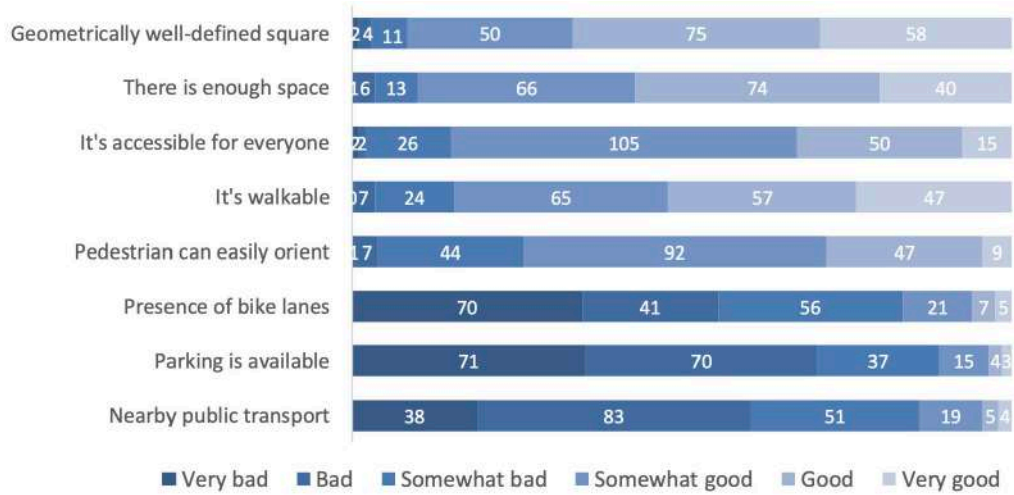



Figure 3: Evaluation of users for physical aspects.

Users were surveyed to see if the public space fosters social interaction, with 66.5% reporting no interactions that day and 33.5% saying they did. The main reasons for interaction included participating in activities (21.6%), sitting nearby others (20.5%), work (20.5%), children (17%), and voluntary work (2.3%). When asked what would encourage them to spend more time at the square, 87% wanted more greenery, 76% preferred more spaces for children, 74% sought additional activities or events, 72% desired shaded areas, 63% wanted more seating, 52% suggested heated spots for winter, and only 10% felt more lighting was necessary. Overall, greenery and activities were seen as key to making the space more appealing.

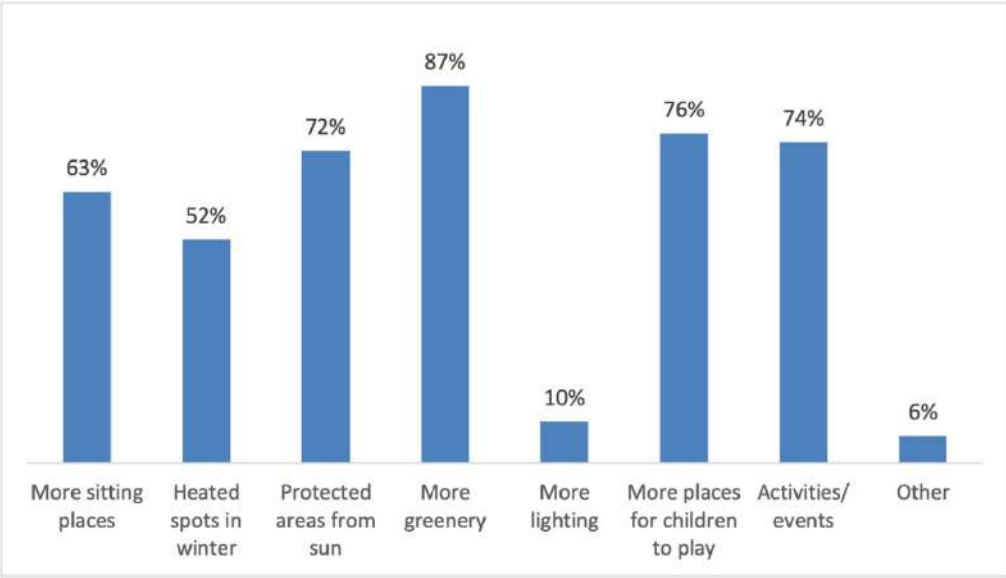



Figure 4: Chart showing what would make people spend more time at the area

Understanding users' activity preferences and whether more variety is needed is crucial for boosting interaction, extending time spent in the area, and attracting more visitors. A significant majority (90.5%) expressed a desire for additional activities, while only a small portion (1%) felt current offerings were adequate. The primary factors influencing participation include the variety of activities (30.5%), timing (22%), and accessibility (22%), with the quality of amenities also being important (18%). Promotion and advertising were less influential (6%).

Users showed a preference for children's play areas (32%), outdoor concerts or performances (25%), and cultural exhibitions (18%), while others favored food festivals (14%) and fitness or yoga sessions (8%). This highlights the need for diverse, family-friendly, and cultural activities.

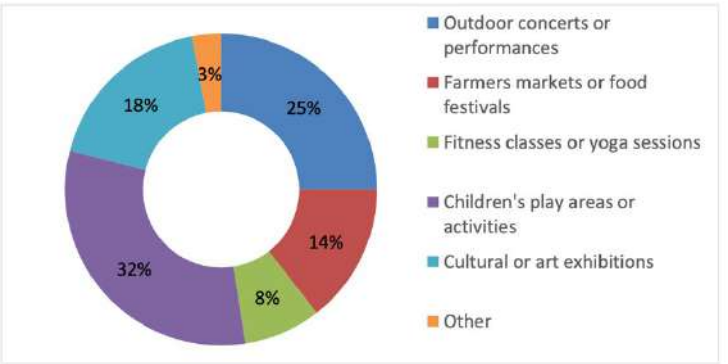



Figure 5: Chart showing what types of activities do users most enjoy participating

Users were also asked to evaluate factors that contribute to the vitality of the square, using a five-point scale ranging from "not important" to "very important." The presence of people engaging in activities was considered important by 63% of respondents. The factors rated as very important were the diversity of programming and the square's aesthetics (69%), accessibility (66%), the presence of greenery (69%), and a vibrant atmosphere (70%). These elements are seen as essential for enhancing the vitality of the area.

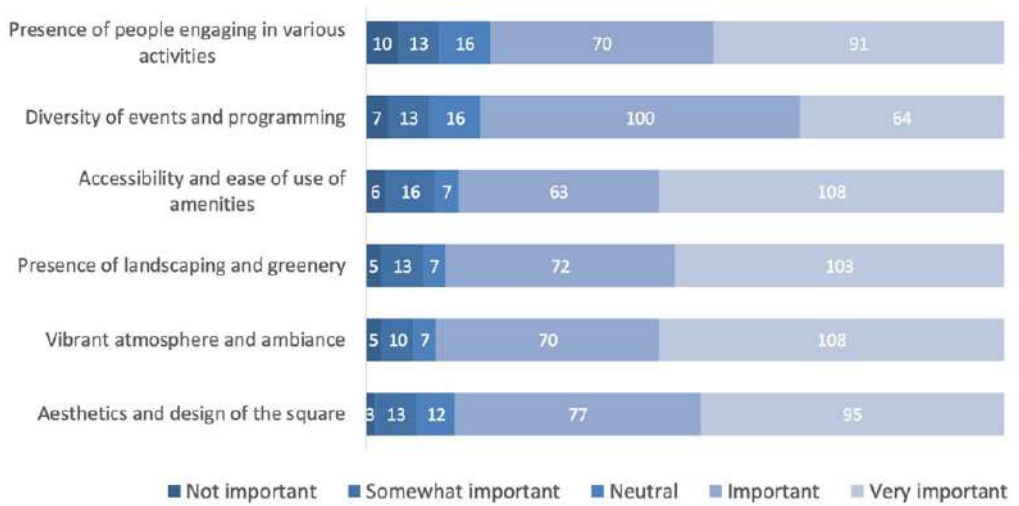



Figure 6: Evaluation of users for the vitality of the area.

Relaxation is a key feature for any public space, and areas that allow users to spend time in peace should be prioritized. When asked about their satisfaction with tranquility in the square, 50% of respondents were neutral, 30.5% were somewhat satisfied, and only 17% were very satisfied. A small percentage (5.5%)

expressed dissatisfaction. The main reason people chose the square as a place to relax was its proximity to home or work (41%).

When asked about factors influencing their choice of the square for relaxation, 44.7% cited proximity to home or work, and 24.8% mentioned its peaceful atmosphere. Fewer people chose the square for seating availability (11.2%) or its aesthetic appeal (9.3%).

Key relaxation elements were evaluated: seating areas were important for 75%, while shaded areas or trees were important for 77%. Water features were important for 56% of users. The presence of greenery was valued by 76%, and 83% considered quiet zones or designated relaxation areas as essential. These results indicate a need for more greenery and urban furniture to improve user satisfaction.

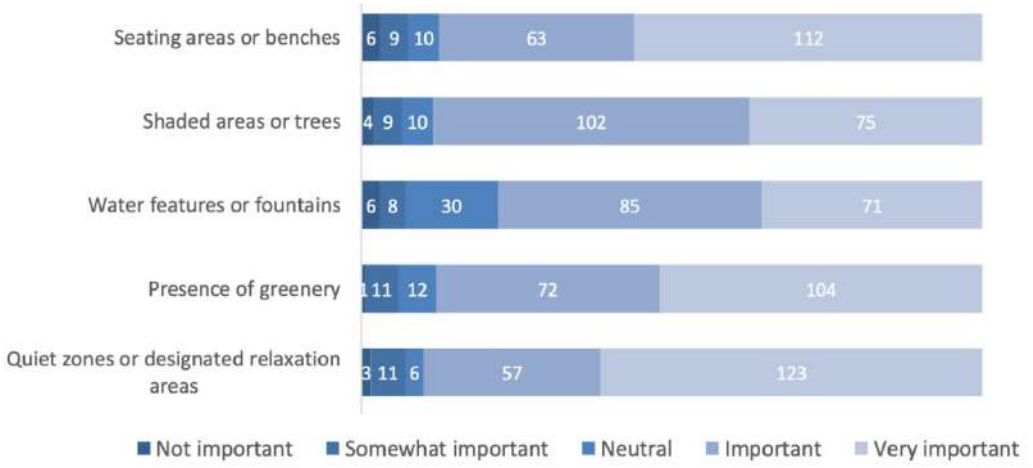



Figure 7: Evaluation of users regarding the relaxation elements of the area

When asked about their sense of safety in the square, 57.5% of respondents felt mostly safe, while 20% were neutral. Only 14.5% felt very safe, with a small portion feeling somewhat unsafe (6%) or very unsafe (2%). Most respondents (86.5%) never avoided the area due to safety concerns, though 8.5% had occasionally avoided it, and 5% felt unsafe.

Key safety factors for users include the visible presence of security personnel, which 69% rated as important, while 75% emphasized the importance of adequate lighting. Greenery was considered important by 51%, and the maintenance and cleanliness of the surroundings were valued by 70%. The availability of emergency assistance was important to only 39% of users, while clear visibility and sightlines across the square were considered important by 64%. These insights highlight the need for visible security measures, good lighting, and well-maintained surroundings to enhance the feeling of safety.

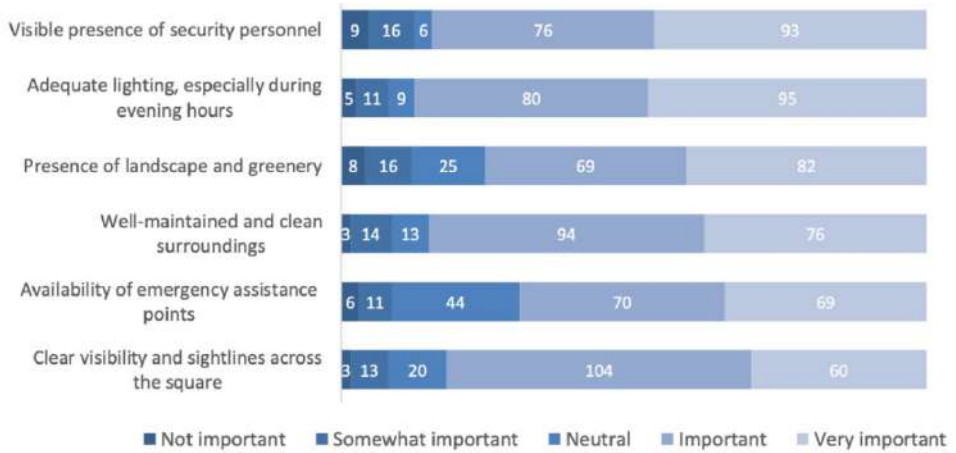



Figure 8: Evaluation of the factors that the users consider important to make themself feel safety.

As regards the last question, on the elements the citizens would like to change from the square, 48.5% of the responses were that they wanted to see more greenery in the area, while 35.5% stated the lack of activities for children and therefore suggested a better organization to be able to involve all age groups. In fact, one of the users expressed his opinion as follows: “There should be more greenery and more activities.” The remaining part would like to see dedicated lanes for bicycles and have more possibilities to park their cars to improve circulation and reach more people. Indeed, another user says: “There should be more public parking and bicycle lanes”. The shortcomings regard particularly greenery, activities and parking spots with the presence of bicycle lanes.

## 5. DISCUSSION

The design of public spaces is crucial for urban society, as it impacts various aspects of urban life, including the area's image, economic vitality, mobility, and users' well-being. The study of “Liria” Square incorporates multiple data sources, including literature reviews, user questionnaires, and both online and physical surveys. By employing a mixed-methods approach that combines qualitative and quantitative research, the study provides a comprehensive evaluation of the square's physical characteristics, user perceptions, and overall quality. This integration of data and observations allows for an analysis of the current conditions and offers valuable insights for potential strategic interventions to enhance the quality and usability of public spaces, fostering vibrant and inclusive urban environments. The analysis of “Liria” Square treats both its physical characteristics, including spatial layout and architectural elements, as well as non-physical aspects, such as psychological factors influencing user experience. This comprehensive evaluation reveals a dual nature: while the square boasts significant historical and architectural features such as the Mosque, Municipality, and Palace of Culture it also grapples with notable challenges related to accessibility, spatial organization, greenery, and available activities. User surveys were instrumental in gathering insights

from a diverse demographic, encompassing residents, workers, students, and visitors. While many respondents frequent the square daily, they voiced concerns about the lack of greenery, limited activities for children, and insufficient parking facilities. This feedback emphasizes the pressing need for a user-centered approach in urban planning and design, which could pave the way for targeted improvements in accessibility, community programming, and safety measures. By incorporating user preferences and needs into the design process, policymakers can work towards revitalizing “Liria” Square as a dynamic and engaging urban hub.

The evaluation of the square's spatial layout reveals a generally positive reception, yet users identify specific issues that impede functionality, particularly regarding public transportation and parking. Despite having adequate space, users express that accessibility could be significantly improved. The presence of physical barriers, such as stairs in the eastern part of the square and uneven terrain, poses challenges for individuals with mobility limitations (Carmona et al., 2010). Consequently, users advocate for infrastructure enhancements, including the addition of ramps and improved pathways that facilitate mobility for all individuals.

Moreover, the absence of dedicated bike lanes and sufficient parking facilities further complicates accessibility, indicating a crucial need for infrastructure improvements that accommodate various modes of transportation. Enhancing connectivity through better public transport options is essential for integrating surrounding areas into the daily routines of users (Wang et al., 2019). Additionally, users have expressed a strong desire for increased greenery and landscaping within the square, which are vital for enhancing the overall ambiance, usability, and aesthetic appeal. Francis et al. (2012) highlight the significant role of landscaping in improving residents' and visitors' experiences, but currently, the square offers limited greenery—primarily palm trees and small grass patches.

Urban furniture also plays an essential role in defining the character and functionality of the square. Effective urban furniture design fosters social interaction and creates an inviting environment (Hourakhsh Ahmad Nia, 2021). However, the placement of seating areas appears random and lacks cohesion, leading to missed opportunities for community engagement. Additionally, the absence of shaded areas and adequate seating further detracts from the square's potential to serve as a welcoming space for relaxation and socialization.

Open public spaces are fundamental in fostering social interaction and cultivating a sense of belonging within the community. The insights from the analysis indicate that “Liria” Square currently lacks essential elements that promote community interaction, resulting in limited engagement among users. Most interactions appear to occur for work-related reasons or when children gather, rather than fostering a vibrant community atmosphere. The decline in social interaction can be attributed to the lack of activities, recreational spaces, and green areas, which are essential for encouraging people to come together and engage with one another. One user poignantly stated, "I would like this public space to have more greenery and to organize more activities for all age groups," highlighting the community's desire for a more inclusive environment that caters to diverse interests.

Activities within public spaces are crucial for enhancing both mental and physical health. Research indicates that recreational amenities, such as sports courts and playgrounds, promote physical activity among individuals of all ages, thereby encouraging healthier lifestyles and reducing the risk of chronic

illnesses (Veitch et al., 2017). The survey results clearly show a strong desire from users for a wider variety of activities within “Liria” Square. Users expressed interest in seeing cultural events and recreational activities that cater to all age groups, which could help enrich the square's vibrancy and appeal. Public spaces play a pivotal role in fostering a sense of community identity by celebrating local customs, arts, and heritage through cultural events (Cohen, 2010). The absence of such programming is a missed opportunity for the square to act as a focal point for residents and visitors alike, fostering community ties and a sense of belonging.

Vitality in public spaces is characterized by their ability to attract a diverse range of users and accommodate various activities over time. The study highlights several factors that contribute significantly to this vitality, including atmosphere, diverse programming, aesthetic appeal, accessibility, and the presence of greenery (Jalaladdini & Oktay, 2012). Users consistently rated these elements highly, emphasizing their importance in enhancing the vitality of urban squares. However, many users reported that the current lack of activity and greenery diminishes the sense of vitality within “Liria” Square, making it less appealing as a community gathering spot.

Public spaces should also offer opportunities for relaxation, serving as essential components of urban life. The square must provide tranquil environments, comfortable seating, and a calming atmosphere for users to unwind. Research links stress reduction and improved relaxation to access to green spaces and nature (Kuo et al., 2018). Although “Liria” Square features water sources and seating areas, users reported a neutral stance regarding its tranquility. Many indicated that they primarily choose this location for its proximity to home or work rather than its relaxing amenities. A lack of adequate greenery and urban furniture compromises the space's potential to foster a serene environment conducive to relaxation and socialization.

Safety and security considerations are paramount for users when choosing to visit public spaces. Key factors identified by respondents include the visible presence of security personnel, adequate lighting, and well-maintained surroundings (Jalaladdini & Oktay, 2012). The analysis reveals that perceptions of safety significantly influence users' experiences within the square. Adequate lighting and clear sightlines enhance visibility, which is crucial in deterring criminal activity and creating a welcoming atmosphere (Carmona et al., 2010). “Liria” Square is generally well-lit, with a sufficient number of street lights present. Most users reported feeling safe and indicated that they rarely experience fear about visiting the square, highlighting the importance of these safety measures in fostering positive urban experiences.

## 6. CONCLUSION

It is already agreed that public spaces play a crucial role in urban environments, serving not only as physical locations but also as dynamic networks that cater to the diverse needs of users. They act as hubs for social interaction and contribute significantly to urban vitality. However, modern urban planning has often overlooked the human experience in favor of political and economic factors. A paradigm shift towards human-scale design is essential to ensure these spaces fulfill not only physical needs but also support psychological well-being. Understanding the relationship between users and their environment requires a multidisciplinary approach, combining environmental psychology with urban design principles.

This research focuses on two primary factors influencing user experiences: physical and non-physical aspects of public spaces. Using a model proposed by various authors such as Alexander et al.

(1977), Gehl (2010), and PPS (n.d.), the research evaluates how well users' needs and experiences are integrated into public open spaces in Albania, specifically examining “Liria” Square in Durrës.

The study begins by exploring theoretical perspectives on public spaces to highlight the elements that shape user perception. It emphasizes the significance of accessibility and inclusivity, as outlined by the Project for Public Spaces and Tibbalds (1992). The historical context of “Liria” Square is also examined, underscoring the importance of urban centers in encouraging interaction with cultural history and promoting community identity (Ryberg-Webster & Kinahan, 2013).

Research methodologies informed by various studies were utilized to assess public spaces effectively. Notable methodologies include:

a) Pietrzyk (2020): Integrated direct and remote methods in small historic cities, combining local insights with broader spatial considerations.

b) Cao & Tang (2022): GIS and remote sensing techniques for medium to large cities, providing a macro and micro perspective on public space renewal.

c) Oktay (2012): Mixed-methods approach in small towns, capturing both qualitative and quantitative data on user activities and perceptions.

d) Rahman et al. (2020): Observation and mapping techniques in urban commercial streets, emphasizing the vitality of public spaces.

The research highlights the evolution of urban centers and the importance of human-scale design in creating livable environments. The findings suggest that public spaces are vital for community engagement, heritage preservation, and enhancing residents' well-being. The study of “Liria” Square reveals significant transformations over the years, particularly between 1994 and 2018, with ongoing efforts to improve urban furniture and water features.

Observations and user surveys reveal that while the square has sufficient space and accessibility, it lacks bike lanes and adequate parking, with users expressing a desire for a wider variety of activities to encourage social interaction. Furthermore, the presence of relaxation elements, such as greenery and seating, is insufficient, impacting user satisfaction regarding tranquility. Nevertheless, the square's safety is viewed positively, attributed to effective lighting.

The research leads to several key conclusions:

1. Public spaces must include ramps for accessibility.
2. Proximity to public transportation and well-connected routes is essential.
3. Adequate parking facilities are necessary.
4. A variety of activities for all age groups can enhance user engagement.
5. Increasing greenery and shaded areas is vital for relaxation.

In summary, the study highlights significant challenges and opportunities for improvement in public spaces, particularly regarding accessibility, greenery, and activities. The insights gleaned from user feedback and empirical observations underscore the importance of adopting a user-centered approach in urban design. By prioritizing inclusivity, accessibility, and user satisfaction, urban planners and policymakers can create vibrant, sustainable, and socially cohesive environments that enhance the quality of life for all residents and visitors.

## REFERENCES

Abdul Rahman, N. and G. I. 2020. Rethinking Urban Public Space: Physical and Functional Analysis through Visual Surveys, IOP Conference Series, 409(1), Malaysia.

Alexander, C., et al. 1977. A Pattern Language: Towns, Buildings, Construction, Oxford University Press.

Bigdeli, V., Ȧ. R. and Ngah, I. 2013. The Role of Public Spaces in Promoting Social Interactions, International Journal of Current Engineering and Technology.

Carmona, M., Heath, T., Oc, T. and Tiesdell, S. 2010. Public Places, Urban Spaces: The Dimensions of Urban Design, Routledge.

Churchman, A. 2014. The Importance of Public Space for People of Varied Characteristics, Needs and Preferences in Landscape Architecture and Environmental Policy, H. Fischer, S. Ozacky-Lazar and J. Wolkschke-Bulmahn, Eds., Vol. 13, AVM Edition, München, pp. 129–138.

Francis, J., Giles-Corti, B., Wood, L. and Knuiman, M. 2012. Creating Sense of Community: The Role of Public Space, Journal of Environmental Psychology, 32(4), pp. 401–409.

Gehl, J. 2010. Cities for People, Island Press.

Gehl, J. 2011. Life Between Buildings: Using Public Space, Island Press.

Goltsman, S., Gilbert, T. and Wohlford, G. 1993. The Accessibility Checklist, Publisher.

Hmood, K. 2022. Conservation of Urban Heritage in Historical Centres of Contemporary Cities.

Kengyel, U. D. 2016. What Makes a Public Open Space Liveable?, Ecology and the Environment, Germany.

Madanipour, A. 2003. Public and Private Spaces of the City, Routledge.

Nia, H. A. 2021. The Role of Urban Aesthetics on Enhancing Vitality of Urban Spaces, Khulna University Studies.

Oktay, S. J. 2011. Urban Public Spaces and Vitality: A Socio-Spatial Analysis in the Streets of Cypriot Towns, Procedia – Social and Behavioral Sciences, 35, pp. 664–674.

Pietrzyk, A. S. 2020. An Evaluation of Public Spaces with the Use of Direct Methods, Land, 9(11), pp. 419.

PPS (Project for Public Spaces). What is Placemaking?

Quigley, J. M. 1998. Urban Diversity and Economic Growth, Journal of Economic Perspectives, 12(2), pp. 127–138.

Rovigatti, P. 2010. Un Piano per Durazzo: Durres Master Plan, Sala 2000, Pescara.

Rovigatti, P., Vangjush, D., Adrian, C. and Luca, Z. 2011. A Square for the City / Una Piazza per la Città: Images and Projects for Liria Square in Durres.

Ryberg-Webster, S. and Kinahan, K. L. 2013. Historic Preservation and Urban Revitalization in the Twenty-First Century, Journal of Planning Literature, 29(2), pp. 119–139.

Tang, Y. C. 2022. Evaluating the Effectiveness of Community Public Open Space Renewal: A Case Study of the Ruijin Community, Shanghai, Land, 11(4), pp. 476.

Tibbalds, F. 1992. Making People Friendly Towns, Longman Group.

Tibbalds, F. 2004. Making People-Friendly Towns: Improving the Public Environment in Towns and Cities, Spon Press.

Turley, A. C. 2015. Urban Culture: Exploring Cities and Cultures, Routledge.

Veitch, J., Ball, K., Crawford, D., Abbott, G. R. and Salmon, J. 2017. Park Improvements and Park Activity: A Natural Experiment, American Journal of Preventive Medicine, 52(3), pp. 283–290.

Zamanifard, H., Alizadeh, M. and Bosman, R. 2018. Towards a Framework of Public Space Governance, Journal of Architecture and Urban Planning, 25(2), pp. 78–95.

# USER EXPERIENCE DESIGN (UXD) IN HIGHER EDUCATION: A MULTI-SCALE HUMAN-CENTRIC DESIGN STRATEGY OPTIMIZING UNEQUAL SPATIAL DESIGN FOR QUALITY OF LIFE

**Khloud Khalid ElDamhiry , Mai Karam Toama**
The British University in Egypt, Department of Engineering
El-Sherouk, Egypt
EGIS (School of Energy, Geoscience, Infrastructure and Society), Adjunct Faculty
Heriot-Watt University in Dubai, Dubai, UAE
*eldamshiry@hotmail.com, Mt2099@hw.ac.uk*

## ABSTRACT

In the contemporary landscape of Higher Education (HE), the physical environment serves as a critical determinant of pedagogical efficacy and stakeholder Quality of Life (QoL). This research addresses the persistent phenomenon of "Unequal Spatial Design," where environments fail to provide equitable affordances for diverse users across the three pillars: Micro, Meso, and Macro spatial scales.

To rectify this, the study proposes and validates a novel Multi-Scale User Experience (UX) Framework Model, which systematically integrates UX design principles across three distinct spatial scales: Micro (Interior Design), Meso (Architecture Design), and Macro (Urban Design). Utilizing a Human-Centric Design (HCD) approach, the framework is designed to optimize campus environments to enhance QoL.

The methodology adopts a mixed-methods, multi-scalar approach to evaluate the Campus User Experience, structured to capture both subjective perceptions and objective spatial behaviors. This process included four phases: the Theoretical Phase, where an extensive literature review established the definitions of UX and HCD in the built environment, focusing on the convergence of digital UX and physical Experience; the Empirical Case Study, which utilized Heriot-Watt University in Dubai as the primary site of investigation; Spatial Heat Mapping, which involved using observational data to track occupancy density and social friction nodes and included a visualization of the student's chronological path from the Micro through the Meso to the Macro scale to pinpoint emotional peaks and valleys; and finally, Framework Synthesis, where data from the case study was synthesized into the Multi-Scale UX Framework Model to demonstrate how synchronized interventions can rectify spatial inequality.

The findings demonstrate that a synchronized multi-scalar strategy effectively mitigates spatial inequality, fosters institutional belonging, and significantly improves the holistic educational experience, ultimately affirming that enhancing QoL in HE is inextricably linked to the provision of equitable affordances.

**KEYWORDS:** User Experience Design (UXD), Higher Education, Human-Centric Design, Multi-Scale Strategy, Spatial Equality Design, Unequal Spaces, Quality of Life.

## 1. INTRODUCTION

The global landscape of higher education is undergoing a fundamental transformation, shifting from teacher-centric models to learner-centric ecosystems (El Moussaoui & Krois, 2025). In this context, the campus is no longer viewed as mere background infrastructure but as a dynamic "learning landscape" (Ellis & Goodyear, 2023). User Experience (UX) design, which prioritizes the seamless interaction between users and systems (ElDamshiry et al., 2025a), offers a powerful lens through which to evaluate and optimize these physical environments across the Micro (Interior), Meso (Architecture), and Macro (Urban) scales. Despite the evolution of modern pedagogical theories, a significant gap persists between the architectural intent of campus buildings and the actual lived experience of their users (ElDamshiry & Moussa 2025b). This discrepancy results in "Unequal Spatial Design", a phenomenon characterized by an inconsistent distribution of spatial quality across three critical environmental scales (Soja, 2010): lack user-centric flexibility and tactile comfort

**Pillar 1:** Micro Scale (Interior Design): While substantial institutional investment is often directed toward high-visibility interior environments, such as "smart classrooms" or high-tech laboratories, these spaces often lack user-centric flexibility and tactile comfort, leading to localized "UX Debt" (Choi et al., 2020)

**Pillar 2:** Meso Scale (Architecture Design): The transitional architectural spaces, corridors, atriums, and entrances, are frequently neglected or poorly ventilated, creating "disrupted journeys" that increase cognitive load and social friction (Jamshidi et al., 2020; Devlin, 2014)

**Pillar 3:** Macro Scale (Urban Design): Many campuses suffer from isolated, un-walkable perimeters and a lack of biophilic urban integration. In education hubs like Dubai, the "outdoor-indoor" transition often fails to meet the basic thermal and navigational needs of the user (Suwanwamee et al., 2024; Chen et al., 2024)

The lack of "equitable affordances" spatial features that offer the same functional and emotional value to all users regardless of their location on campus leads to a sense of institutional exclusion (Kim & Yoon, 2023). Without a synchronized strategy bridging Interior, Architecture, and Urban design, the campus remains a collection of isolated high-performance nodes rather than a cohesive, high-quality learning ecosystem. Therefore, the primary aim is to develop a Multi-Scale UX Design strategy that optimizes Higher Education HE environments for improved Quality of Life.

**RO 1:** To define the theoretical parameters of UX and HCD within the physical learning environment.

**RO 2:** To identify the characteristics of "Unequal Spaces" and their impact on user wellbeing.

**RO 3:** To establish a Multi-Scale UX Framework Model bridging Interior, Architecture, and Urban scales.

**RO 4:** To validate the model through an empirical case study of Heriot-Watt University in Dubai

The research hypothesizes as illustrated in figure 1, that the systematic integration of UX design principles across Micro, Meso, and Macro scales reduces spatial inequality and creates a more inclusive environment, thereby directly enhancing the Quality of Life and social engagement of university stakeholders.

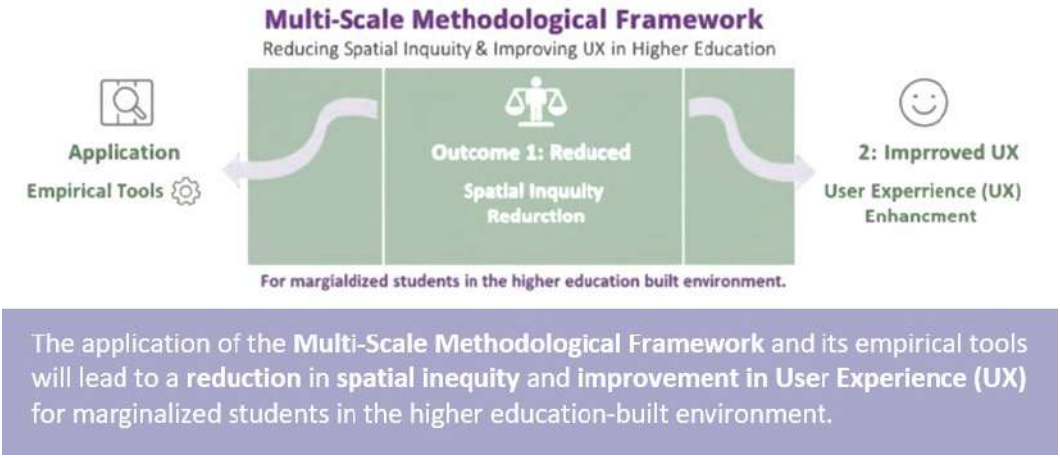



Figure 1: Multi-scale Methodological Framework Hypothesis (authors, 2026)

To focus the investigation into the multi-scalar nature of campus UX, this research seeks to answer the following four questions:

**RQ 1:** How can User Experience (UX) and Human-Centric Design (HCD) principles be effectively translated from digital domains to the multi-scalar physical environment of Higher Education?

**RQ 2:** What are the specific characteristics and indicators of "Unequal Spaces" within a university campus, and how do they impact student wellbeing across different scales?

**RQ 3:** In what ways does a synchronized multi-scale design strategy (Micro, Meso, Macro) mitigate spatial inequality compared to traditional, siloed architectural approaches?

**RQ 4:** How do data-driven tools, such as heat mapping and occupancy heat maps, reveal hidden "UX debt" in the architectural transitions of a modern campus like Heriot-Watt University Dubai?

## 2. METHODOLOGY

This study adopts a mixed-methods as shown in figure 2, multi-scalar approach to evaluate the Campus User Experience. The methodology is structured to capture both subjective perceptions and objective spatial behaviors:

[1] **Theoretical Phase**: An extensive literature review establishes the definitions of UX and HCD in the built environment, focusing on the convergence of digital UX and physical "Architectural Experience"

[2] **Empirical Case Study:** The research utilizes Heriot-Watt University in Dubai as a primary site of investigation.

[3] **Spatial Heat Mapping:** Observational data was utilized to track occupancy density and "social friction nodes," identifying which spaces are high-performing and which remain "cold" or underutilized due

to design inequality. A visualization of the student's chronological path through the campus from (Macro) through the (Meso) to (Micro),to pinpoint emotional peaks and valleys.

[4] **Framework Synthesis:** Data from the case study is synthesized into the Multi-Scale UX Framework Model to demonstrate how synchronized interventions across Interior, Architectural, and Urban design can rectify spatial inequality.

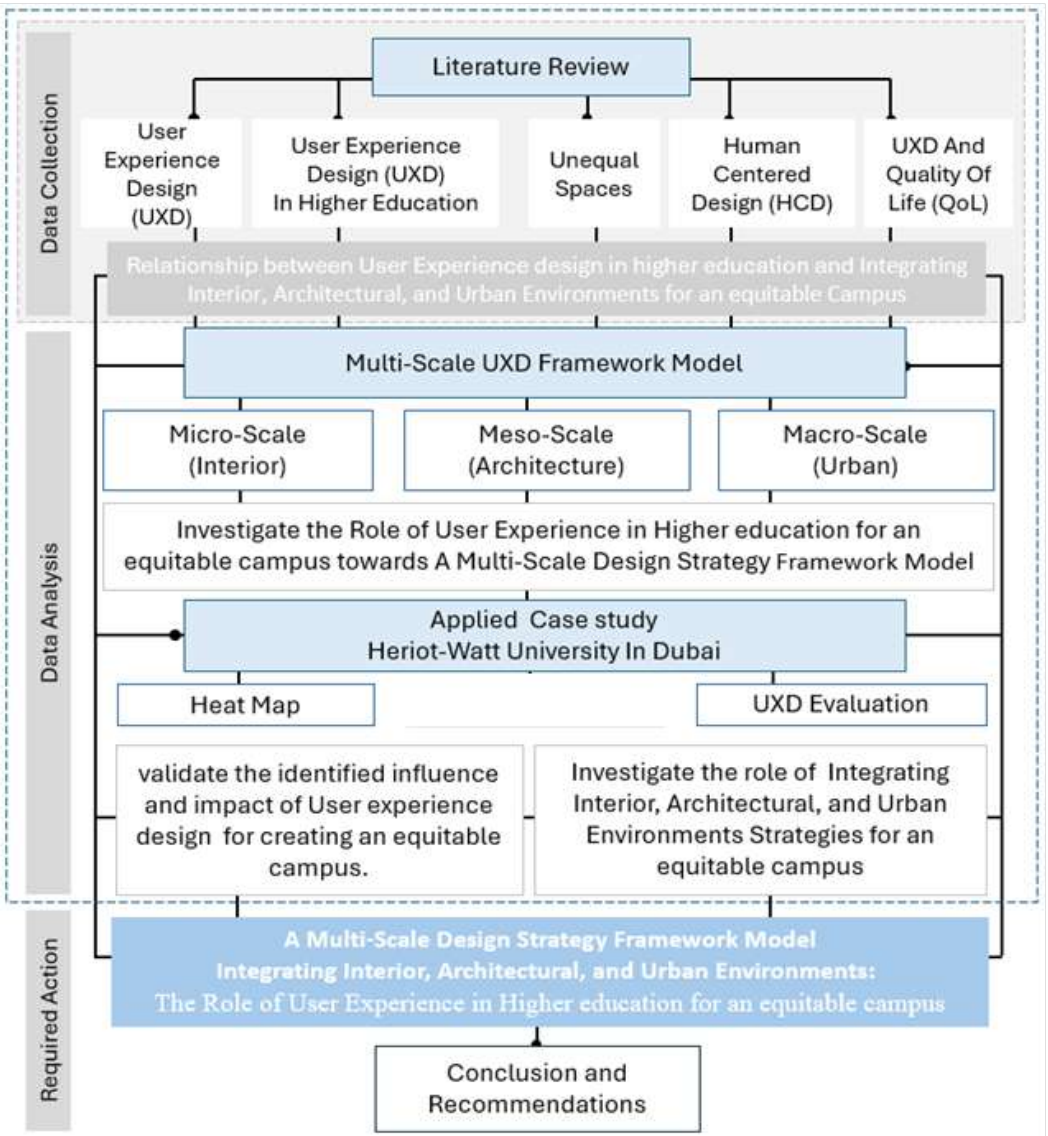



Figure 2: Methodology (authors, 2026)

## 3. LITERATURE REVIEW

The traditional definition of User Experience (UX), once confined to Human-Computer Interaction (HCI), has undergone a "spatial turn." Recent scholarship defines the architectural user experience sometimes termed Architectural Experience (AX) as the totality of a person's perceptions and responses resulting from the use or anticipated use of a physical environment (Boztepe, 2021). Unlike traditional functionalism, AX emphasizes the emotional and visceral response to space. Cook & Das, (2012) argue that the "Ambient Intelligence" of modern institutional buildings creates a continuous loop of interaction where the user and the space co-evolve (ElDamshiry et al., 2025b). In the post-2020 era, the physical campus must compete with the extreme convenience of digital flexibility; thus, the physical environment must offer "experiential premiums", sensory and social values that digital interfaces cannot replicate (Cleveland et al., 2021).

This transformation is intrinsically linked to pedagogical shifts where the "campus-as-a-service" model is replacing the "campus-as-a-container" model Ellis & Goodyear, (2023). Matthews and Adams (2022) identify the rise of the "Social Learning Space", transitional areas like cafes, widened corridors, and library atriums, as critical elements for student retention. These spaces facilitate informal peer-to-peer learning, which accounts for significant knowledge acquisition in modern pedagogy (Barron, 2006). Furthermore, hybrid learning demands "Activity-Based Learning Landscapes" that support individual focus and large-scale urban events with equal efficacy (Montgomery, 2013).

### 3.1 USER EXPERIENCE DESIGN (UXD): THEORETICAL FOUNDATIONS AND THE SPATIAL TURN

The conceptual evolution of User Experience (UX) has transitioned from a narrow focus on human-computer interaction (HCI) to a broad, multi-disciplinary framework for understanding human-environment transactions (ElDamshiry & Mossa, 2025a). Originally popularized by Donald Norman, UX prioritizes the psychological, emotional, and behavioral outcomes of an interaction between a person and a system. In the built environment, this has manifested as "Architectural Experience" (AX), shifting the focus from formalist aesthetics to the "lived experience" of space (Boztepe, 2021). Contemporary UX theory in architecture posits that spaces are not inert containers but dynamic interfaces; thus, design must account for "Ambient Intelligence," where responsive spatial affordances adapt to the evolving cognitive and physical needs of the user (ELDamshiry & Moussa, 2025b). This requires a shift from viewing users as passive occupants to active "participants" whose perceptions are shaped by sensory stimuli, ease of navigation, and emotional safety.

### 3.2 USER EXPERIENCE DESIGN IN HIGHER EDUCATION (HE): THE LEARNING LANDSCAPE

The paradigm of Higher Education (HE) facilities is undergoing a fundamental shift from "instructional containers" to "learning landscapes" (Ellis & Goodyear, 2023). As pedagogical models move toward hybrid and learner-centric structures, the physical campus must provide an "experiential premium" to justify the physical presence of students (Cleveland et al., 2021). Scholarly focus has intensified on "Social Learning Spaces",the transitional Meso-scale nodes such as atriums, widened corridors, and informal hubs,as these

areas facilitate the peer-to-peer interaction that accounts for nearly 70% of knowledge acquisition in modern pedagogy (Freeman et al., 2014). Consequently, HE UX design is now measured by its ability to support "Activity-Based Learning," providing a spectrum of environments that cater to high-focus individual tasks (Micro-scale) and large-scale urban socializations (Macro-scale) with equal efficacy (Newton & Fisher, 2023).

### 3.3 Unequal Spatial Spaces: Spatial Justice and UX Debt

The phenomenon of "Unequal Spatial Spaces" describes a systemic inconsistency in design quality across a campus, leading to what is termed "UX Debt" (Preiser et al., 2015). with institutional life Grounded in the "Spatial Justice" theories of Edward Soja and Henri Lefebvre, this phenomenon suggests that an environment's failure to provide "equitable affordances" constitutes a form of social exclusion (Wen et al., 2023). When institutional investment is concentrated solely on high-visibility interior rooms while neglect persists in transitional or perimeter areas, "dead zones" emerge. These zones signal a lack of institutional care, negatively impacting the sense of belonging for marginalized user groups (Kim & Yoon, 2023). In the specific context of the Middle East, "climatic inequality" acts as a major driver of unequal spaces, where a lack of shaded or thermally regulated pathways at the Macro-Urban scale creates a fragmented, high-stress campus experience (Elshabshiri, 2025).

### 3.4 Human-Centered Design (HCD): A Multi-Scalar Methodology

Human-Centered Design (HCD) serves as the primary interventionist strategy to bridge the gap between architectural intent and user reality (Giacomin, 2014). This methodology operates through a synchronized multi-scalar lens to ensure holistic optimization:

Micro-scale (interior design): focuses on neuro-architecture and the sensory envelope. Research confirms that localized control over light, air quality, and acoustics can reduce user cortisol levels and significantly boost cognitive performance (poldma, 2024; choi et al., 2020).

Meso-scale (architecture design): focuses on wayfinding legibility and "social friction." design at this scale aims to reduce navigational anxiety and create "collision points" that invite spontaneous collaboration (seker & uzun, 2022).

Macro-scale (urban design): focuses on campus-wide connectivity and biophilic urbanism. "green ux" principles are employed to provide psychological restoration and ensure the campus is integrated into the wider urban fabric (lopes et al., 2024).

Crucially, Barker, (1968) argues that these scales are interdependent; a design failure at the macro-scale (e.g., poor walkability) can negate the high-performance value of a micro-scale interior (e.g., a state-of-the-art classroom).

### 3.5 UXD and Quality of Life (QoL): Performance and Wellbeing

The synthesis of UX and spatial design ultimately aims to elevate the user's Quality of Life (QoL). Within the academic context, QoL is a multi-dimensional construct comprising physical comfort, institutional belonging, and social safety (Wen et al.2023). also (Wen et al., 2023) demonstrate a direct correlation between high-quality spatial affordances and academic engagement (ElDamshiry et al., 2025b), ; students who perceive their environment as supportive and equitable report higher levels of mental wellbeing and institutional loyalty. The transition toward data-driven UX evaluation, utilizing Student Journey Mapping and Heat Mapping, allows for a "Phenomenological Post-Occupancy Evaluation" (P-POE). This enables designers to move beyond assumed functional requirements toward evidence-based solutions that actively optimize the human experience and, by extension, the overall Quality of Life within the educational ecosystem (Preiser et al., 2015; Soja, 2010).

The concept of "Unequal Spaces" highlights how design failures manifest as spatial injustice when environments do not provide "equitable affordances" (Soja, 2010; Kim & Yoon, 2023). "Dead zones" in campus planning signal institutional neglect and contribute to a sense of exclusion Kim & Yoon (2023). In the Middle East, "climatic inequality",the lack of shaded transitional spaces, prevents equitable use of the Macro-Urban scale, forcing users into fragmented and stressful campus experiences.

Consequently, human wellbeing must be viewed as a multi-scalar phenomenon. At the Micro-scale (Interior), neuro-architecture research (Poldma, 2024) shows that localized control over light and air reduces cortisol levels. At the Meso-scale (Architecture), wayfinding legibility reduces social anxiety (Seker & Uzun, 2022), while at the Macro-scale (Urban), "Green UX" through biophilic urbanism is essential for psychological restoration (Lopes et al., 2024). Evaluation methods have thus evolved to include "Phenomenological Post-Occupancy Evaluation" (P-POE), combining user sentiment with data-driven tools like Student Heat Mapping to identify and resolve these multi-scalar spatial inequalities (Preiser et al., 2015)

## 4. FRAMEWORK MODEL: THE MULTI-SCALE UX STRATEGY

The proposed framework addresses the "Unequal Space" problem through a three-tiered intervention strategy pillars as shown in figure 3.

Figure 3: The solution- An integrated Muti-scale Strategy (authors, 2026)

[1] Micro Scale (Interior Design)

The focus is on the immediate sensory envelope. Parameters include:

Adaptive Ergonomics: Furniture that supports "active sitting" and varied pedagogical modes.

Ambient Intelligence: User-controlled lighting and thermal comfort.

Acoustic Privacy: Zoning for both deep-focus work and collaborative noise.

[2] Meso Scale (Architecture Design)

This scale bridges the room and the site. Parameters include:

Legibility & Wayfinding: Utilizing visual cues and architectural "landmarks" to reduce navigational anxiety.

Social Friction Nodes: Atriums and widened corridors that invite spontaneous interaction.

Threshold Design: Creating "soft edges" between the building and the outdoors.

[3] Macro Scale (Urban Design)

The focus is on campus-wide connectivity. Parameters include:

Walkability & Connectivity: Frictionless pathways between buildings.

Biophilic Urbanism: Integrated green spaces and "pocket parks."

Urban Integration: Accessibility to public transport.

To provide a structured framework for architectural and interior design interventions, the following analysis categorizes user experience (UX) strategies across three scales: Micro, Meso, and Macro. This multi-layered approach moves from the intimate, sensory experiences of interior design to the broader considerations of architectural flow and urban planning. Each level is designed to address specific core needs and mental states,such as deep focus, navigational clarity, and community belonging,through targeted actionable interventions and cross-scale integration mechanisms.

The following table 1 details how these design mechanisms work together to enhance the overall quality of life (QoL) for building users.

Table 1: Multi-Scale UXD Framework Model (authors, 2026)

| Design Mechanism | Core Need / Mental State | Actionable Intervention | Integration Mechanism |
|---|---|---|---|
| **I. The Micro-Scale: Cognitive Tuning and Interiority (Interior Design Focus)** | | | |
| **UX Goal: Optimize Mental State and QoL through Sensory Tuning.** | | | |
| Acoustic Contrast (Noisy vs. Calm) | Need: Control over external stimuli, deep work. State: High Attentional Focus. | Create three zones: 1. Quiet Pods (STC 50+); 2. Semi-Private Areas (White/Pink Noise); 3. Open Collaboration. | Feeds Meso-Scale IEQ: Requires building structure (Meso) to position quiet zones away from transport cores and use high-NRC materials. |
| Sensory Variation (Biophilia/Haptic) | Need: Cognitive restoration, sensory grounding. State: Reduced Cognitive Load. | Implement Biophilic Design using varied textures (rough wood, smooth stone), controlled natural light, and dynamic plant arrangements. | Feeds Macro-Scale Access: Furniture oriented to maximize exterior views onto Macro-scale green spaces for restorative benefit. |
| Emotional Regulation Support (Retreat Spaces) | Need: Stress reduction, emotional resilience. State: Emotional Resilience. | Incorporate Dedicated Reflection Spaces (e.g., soundproof recharge corners) with a low Enclosure Ratio for emotional grounding and digital detox. | Feeds Meso-Scale Safety: Requires architecture (Meso) to provide private, secure access and robust acoustic isolation for true retreat. |
| Ergonomic Choice (Fixed vs. Flexible) | Need: Musculoskeletal comfort, physical autonomy. State: Sense of Control (Agency). | Offer Unequal Seating Options: standing desks, deep focus chairs, casual lounge areas, and highly reconfigurable tables. | Feeds Meso-Scale Functionality: Requires architecture (Meso) to provide decentralized, high-density power and data access points. |
| **II. The Meso-Scale: Legibility and Environmental Integrity (Architecture Focus)** | | | |
| **UX Goal: Enhance Building Flow, Functionality, and Environmental Integrity (IEQ) for Daily QoL.** | | | |
| Spatial Contrast (Vastness vs. Narrowness) | Need: Orientation, clear functional transitions. State: Reduced Navigational Stress. | Use large Atriums/Commons (High Volume) as intuitive orientation points, contrasting sharply with Narrower Corridors and clear circulation paths. | Feeds Micro-Scale UX: The vast atrium is the primary source of natural light penetration, supporting Micro-scale biophilic goals. |
| Visual Contrast (Transparency vs. Opacity) | Need: Intuitive wayfinding, clarity of building use. State: Trust and Clarity. | Strategic use of Glass/Transparency for public-facing elements, contrasted with opaque, thermally-controlled envelopes for deep-focus or technical areas. | Feeds Macro-Scale Permeability: Transparent ground floors create visual 'Porosity' with the surrounding urban environment, connecting to the streetscape. |
| IEQ Zonation (Warm/Cool vs. Ambient) | Need: Physical comfort, localized environment tuning. State: Physical Comfort (Flow State). | Implement Zoned HVAC Systems to allow minor thermal customization in designated 'Micro-climate' zones, maintaining a stable baseline in circulation areas. | Feeds Micro-Scale Well-being: Architecture provides the stable Thermal Foundation necessary for Interior Design to add personalized Micro-scale controls efficiently. |
| **III. The Macro-Scale: Community, Restoration, and Urban Connection (Urban/Campus Planning Focus)** | | | |
| **UX Goal: Foster Community, Restoration, and Institutional Belonging for Holistic QoL.** | | | |
| Density Contrast (Vast Green Space vs. Dense Mixed-Use) | Need: Social energy release vs. quiet decompression. State: Restoration & Belonging. | Program Vast, Passive Green Spaces (reflection, nature walks) contrasted with Dense, Active Mixed-Use Corridors (retail, transit hubs) to manage energy and social load. | Feeds Micro-Scale Restoration: Ensures the campus contains sufficient high-quality restorative landscapes, providing the essential "Views of Nature" required by the Micro-scale. |
| Boundary Contrast (Permeable vs. Defined) | Need: Institutional identity, seamless city access. State: Institutional Trust. | Design Permeable Campus Edges (seamless transit, shared public realm) for city integration, contrasted with Defined Campus Cores (e.g., car-free central quads) for identity and safety. | Feeds Meso-Scale Legibility: Building orientation (Meso) must align with Macro-scale pedestrian flow, using landmark buildings as legible gateways. |
| Connectivity Contrast (Slow vs. Fast Transit) | Need: Timely resource access, physical accessibility. State: Reduced Fatigue. | Plan Slow-Moving Pedestrian/Bike Paths for daily interaction, contrasted with Fast, Integrated Public Transit Hubs for metropolitan connection. | Feeds Spatial Equity: Eliminates the 'Resource Desert' problem by ensuring that resources located at the Macro-scale edges are quickly and safely accessible. |

## 5. CASE STUDY

The research utilizes the Heriot-Watt University Dubai (HWUD) campus as shown in figure 4, located in Dubai Knowledge Park, as the primary laboratory for validating the Multi-Scale UX Framework. Opened in 2021, the campus represents a modern, vertically integrated institutional building within a dense urban hub. This site was selected because it presents complex environmental transitions from the high-temperature urban exterior (Macro) to the expansive communal atrium (Meso) and finally to specialized learning studios and classrooms (Micro). The vertical nature of the campus provides a unique opportunity to study how UX is maintained or fragmented across multiple floor levels and functional zones.

Figure 4: Case-study (authors, 2026)

## 5.1. SPATIAL HEAT MAPPING

Heat mapping was employed to quantify occupancy density and identify "Social Friction Nodes" across the campus layers based on 48 hours of observation. At the Macro-Scale, the mapping identified "Cold Spots" at the campus perimeter, where a lack of street-level engagement and biophilic urbanism resulted in underutilized exterior spaces. At the Meso-Scale, the atrium and café zones were identified as "Hot Spots" with high social density, confirming their role as successful social learning nodes. However, heat maps also revealed "Dead Zones" in upper-floor corridors where the architectural design lacked informal seating or visual transparency, leading to a localized sense of spatial inequality between floors. Within the Micro-Scale, mapping in learning studios showed activity concentrated at the center, with "unused corners" indicating that furniture layouts did not optimize the full interior for diverse learning modalities, further contributing to unequal affordances within the classroom environment. A Student Journey Mapping exercise was conducted to track the chronological and emotional path of users as they navigated the campus layers. The analysis revealed a significant "Emotional Valley" at the Macro-to-Meso transition, where thermal stress and a lack of shaded arrival infrastructure in the Knowledge Park perimeter created a negative initial touchpoint. While the "arrival experience" was technically functional, it lacked the biophilic comfort necessary for a high-quality transition. Conversely, an "Emotional Peak" was identified within the central atrium (Meso-scale), where high vertical volume, natural lighting, and social visibility fostered a sense of community. However, the journey often fragmented at the Micro-scale; while classrooms were technologically advanced, the journey map highlighted "UX Debt" in the form of rigid spatial configurations that did not fully support the fluid transition between formal instruction and informal peer-to-peer collaboration, leading to a drop in engagement scores during extended sessions.

The Heat Map identified the "Arrival journey Experience" (Micro – to – Meso – to – Macro) as shown in figure 5,

**Hot Spots:** The "Student Hub" and informal seating areas near the cafe.

**Cold Spots:** Corridors on upper floors and certain outdoor perimeter paths, identified as "Unequal Spaces".

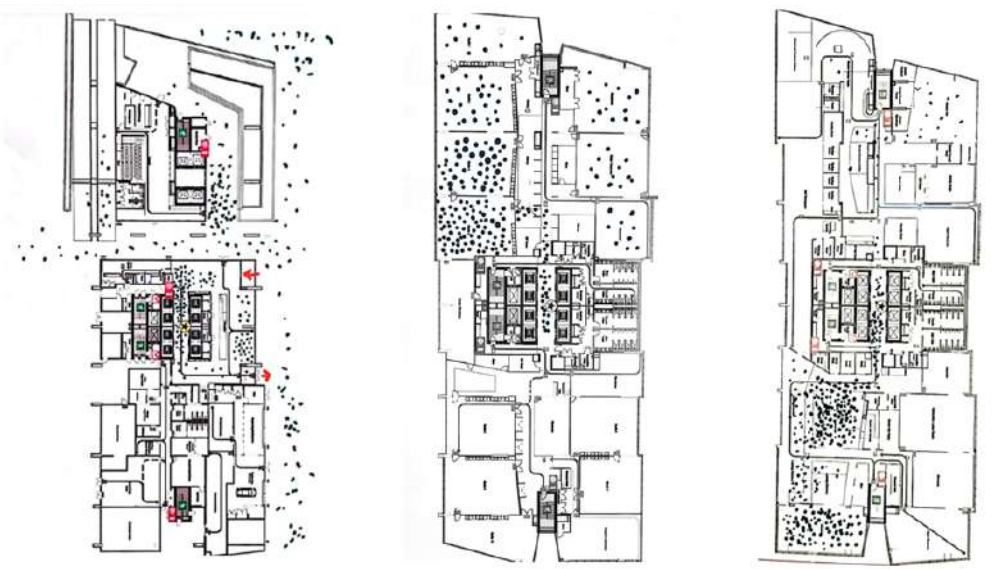


Figure 5: Case-study Heat Mapping (authors, 2026)

## 6. MULTI-SCALE UX EVALUATION RESULTS

The synthesis of heat mapping through the Multi-Scale UX Evaluation revealed that "Unequal Spaces" are most prevalent in the transitional zones between scales. The evaluation scored the campus highly on Meso-scale social potential but identified significant "Performance Gaps" in Micro-scale flexibility and Macro-scale climatic resilience. By identifying these gaps, the research suggests that a synchronized intervention, such as integrating biophilic cooling at the urban entrance and modular furniture in the interior, would harmonize the user experience. These findings underscore the necessity of a multi-scalar strategy to rectify spatial inequality and ensure that the campus functions as a cohesive, high-performance learning ecosystem that supports the overall Quality of Life of its users.

To provide a comprehensive view of the user experience, the following analysis is divided into three distinct scales: Macro, Meso, and Micro. This tiered approach evaluates how the architecture functions as a civic entity, how it manages internal flow and legibility, and finally, how it supports the individual's cognitive and sensory well-being at a granular level. Together, these categories outline a strategy for enhancing the quality of life (QoL) for students and staff through intentional design interventions.

## 6.1. MICRO-SCALE UX ANALYSIS: COGNITIVE TUNING AND INTERIORITY

**UX Goal**: Optimize mental state and quality of life through sensory tuning and biophilic interior design.

**Analysis & Interventions**

**Acoustic Contrast (Noisy vs. Calm):** Studio clusters have minimal acoustic separation from workshops, leading to high cognitive load. Recommendations include adding sound absorption panels or "green" acoustic walls in studios.

**Sensory Variation (Biophilia / Haptic):** There is a green corner lounge and wooden finishes, but distribution is limited. Integrating "biophilic pockets" (small plant shelves) between studios would maintain cognitive freshness.

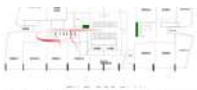
**Emotional Regulation Support (Retreat Spaces):** A lounge corner exists, but circulation pressure reduces privacy. Creating micro-retreat pods or alcove seating within studios would enhance emotional resilience.

**Ergonomic Choice (Fixed vs. Flexible):** Fixed tables limit physical autonomy. Adding movable partitions, adjustable desks, and modular benches would improve adaptability for group or solo work.

**Lighting & Visual Comfort:** Large south-facing glazing provides a strong daylight gradient, though interior zones are less illuminated. Introducing adaptive shading or tunable lighting can harmonize the balance.

**Micro-Scale UX Analysis – Cognitive Tuning and Interiority (4th Floor Plan)**

**UX Goal:Optimize mental state and quality of life through sensory tuning and biophilic interior design.**



| Design Mechanism | Observed Features (4th Floor) | UX Evaluation | Recommended Enhancement |
|---|---|---|---|
| **Acoustic Contrast (Noisy vs. Calm)** | The studio cluster (1–4) and digital review room are enclosed with minimal acoustic separation from corridor and workshop. The gallery and corridor act as noise channels. | 🔴 High cognitive load due to overlapping sound zones and workshop noise spillover. | Add **sound absorption panels** near gallery and corridor; use **green acoustic walls** or felt partitions in studios. |
| **Sensory Variation (Biophilia / Haptic)** | Green corner lounge near corridor and tactile wooden finishes in gallery; studios mostly neutral materials. | 🟢 Positive biophilic cue but limited distribution — sensory restoration happens only in one zone. | Integrate **biophilic pockets** between studios (small plant shelves, natural light diffusers) to maintain cognitive freshness. |
| **Emotional Regulation Support (Retreat Spaces)** | Lounge corner near washroom functions as a brief retreat area, but circulation pressure reduces privacy. | ⚠️ Limited retreat depth — semi-public feeling prevents full cognitive reset. | Create **micro-retreat pods** or **alcove seating** within studios or beside gallery to enhance emotional resilience. |
| **Ergonomic Choice (Fixed vs. Flexible)** | Fixed tables in studios with modular spacing; minimal reconfiguration options. | 🔴 Reduces physical autonomy and adaptability for group vs. solo work. | Add **movable pin-up partitions, adjustable desks, and modular benches** for flexible collaboration setups. |
| **Lighting & Visual Comfort** | Large south-facing glazing in studios provides strong daylight gradient; interior zones less illuminated. | 🟢 Promotes alertness and reduces fatigue if balanced properly. | Introduce **adaptive shading** or tunable lighting in deep zones to harmonize luminance balance. |

**Strengths:** Excellent daylight access, restorative natural textures (wood/greenery), and a visual connection to the city.

**Weaknesses:** Uneven acoustic zoning increases stress, and a lack of flexible furniture limits user autonomy.

**Recommendations:** Enhance acoustic resilience with baffles or "quiet buffer" walls and reinforce biophilic continuity by spreading greenery evenly across all studios.

## 6.2. MESO-LEVEL ANALYSIS: LEGIBILITY, FLOW, AND ENVIRONMENTAL INTEGRITY

**UX Goal:** Enhance building flow, functionality, and environmental integrity for daily quality of life (QoL).

### Analysis & Interventions

**Spatial Contrast (Vastness vs. Narrowness):** A compressed, linear entry leads to the lift core before opening into wider seating areas upstairs. This causes a transitional imbalance and spatial stress. Interventions should include gradual spatial transitions, such as skylight shafts, to reduce cognitive load between floors.

**Visual Contrast (Transparency vs. Opacity):** Visual continuity is only partial due to long opaque walls, leading to low legibility. Use of transparent partitions (glass) or material color accents is recommended to mark the direction and purpose of paths.

**IEQ Zonation (Warm/Cool vs. Ambient):** Natural light is strong in seating areas but artificial lighting dominates corridors. Adding tunable lighting and localized ventilation near corridors can maintain comfort consistency.

**Functional Zoning & Circulation:** There is functional clarity but limited cross-floor integration. Vertical visual connections, such as voids or glass balustrades, should be considered to make the circulation spine perceptible from both floors.

**Environmental Integrity (Thermal & Acoustic Comfort):** Hard flooring and enclosed corridors cause echoes. Installing sound-absorbing panels in transition corridors will help harmonize acoustic zones.

**Meso-Level Analysis – Legibility, Flow, and Environmental Integrity**
**UX Goal: Enhance building flow, functionality, and environmental integrity for daily quality of life (QoL).**

| Design Mechanism | Observation from Ground & First Floor Plans | UX Evaluation | Recommended Intervention |
|---|---|---|---|
| **Spatial Contrast (Vastness vs. Narrowness)** | The ground floor shows a compressed, linear entry route leading from reception to the lift core. The first floor opens up into wider seating and student well-being areas. | ⚠ Transitional imbalance — compressed ground-level corridors heighten spatial stress before release into open areas upstairs. | Introduce gradual spatial transitions (e.g., skylight shafts, visual thresholds) to reduce abrupt cognitive load between floors. |
| **Visual Contrast (Transparency vs. Opacity)** | Visual continuity from reception to the atrium is partial; long opaque walls limit intuitive wayfinding. | 🔴 Low legibility — users rely on signage or prior knowledge. | Use transparent partitions or material contrasts (glass, color accents) to mark direction and purpose of each path. |
| **IEQ Zonation (Warm/Cool vs. Ambient)** | Strong daylight penetration in seating and classrooms; artificial lighting dominates corridors. | 🟢 Balanced environmental zoning for activity-based areas. | Add tunable lighting and localized ventilation near corridors to maintain comfort consistency. |
| **Functional Zoning & Circulation** | Main flow: Reception → Lift lobby → Classrooms (Ground) → Student Well-being → Support Areas (First). Vertical transition via stair core near midpoint. | 🟡 Functional clarity but limited cross-floor integration of experience. | Consider vertical visual connections (voids, glass balustrades) to make the circulation spine perceptible from both floors. |
| **Environmental Integrity (Thermal & Acoustic Comfort)** | Hard flooring + enclosed corridors cause echo; seating zones are acoustically softer. | ⚠ Uneven acoustic experience — may reduce focus in classrooms near open café areas. | Install sound-absorbing panels in transition corridors to harmonize acoustic zones. |

**Strengths:** Clear zoning between public and semi-private levels, intentional grouping of well-being areas, and use of natural light.

**Weaknesses:** Poor transparency reduces intuitive navigation, compressed corridors increase cognitive load, and acoustic/lighting contrasts are not optimized.

**Recommendations:** Enhance wayfinding via light gradients and floor textures, reduce spatial stress by shifting ceiling heights, and integrate environmental consistency in lighting and acoustics.

## 6.3. MACRO-SCALE ANALYSIS: COMMUNITY, RESTORATION, AND URBAN CONNECTION

**UX Goal:** Foster community, restoration, and institutional belonging for holistic well-being.

**Analysis & Interventions**

**Density Contrast (Vast Green vs. Dense Mixed-Use):** The ground floor opens toward landscaped areas and large green walkways, while indoor spaces appear denser and service-oriented. This offers positive restorative potential. To improve this, designers should strengthen the continuity between interior learning zones and outdoor green spaces by adding shaded seating or semi-open study pods.

**Boundary Contrast (Permeable vs. Defined):** There is a clearly defined building edge with visible pedestrian paths, but moderate permeability means students likely use limited access points. The recommendation is to introduce multiple micro-entries or transparent façade zones to visually connect the street and campus interior.

**Connectivity Contrast (Slow vs. Fast Transit):** The plan shows direct pedestrian circulation with nearby parking, showing good physical accessibility but low emphasis on slow, restorative paths. Adding dedicated pedestrian/bike loops with wayfinding nodes for reflection is suggested.

**Community Integration (Social Hubs / Gathering Nodes):** Central courtyards and external seating act as social buffers, promoting informal engagement. This can be enhanced by adding digital screens or interactive installations that display student work.

**Urban Interface (Institutional Legibility):** The building has a strong front façade identity and visible signage. Layering greenery and lighted signage can further enhance the night-time identity and spatial warmth.

**GROUND FLOOR PLAN WITH THE URBAN CONTEXT**

**Macro-Scale Analysis – Community, Restoration, and Urban Connection**

UX Goal: Foster community, restoration, and institutional belonging for holistic well-being.

| Design Mechanism | Observed Campus Feature | UX Evaluation | Recommended Intervention |
|---|---|---|---|
| **Density Contrast (Vast Green vs. Dense Mixed-Use)** | The ground floor opens toward landscaped areas and large green walkways. Indoor spaces appear denser and more service-oriented (labs, admin). | ✅ Positive restorative potential through open green areas and daylight exposure. | Strengthen visual and physical continuity between interior learning zones and outdoor green spaces—add shaded seating or semi-open study pods. |
| **Boundary Contrast (Permeable vs. Defined)** | Clear defined building edge with visible pedestrian paths and vehicle drop-off zones. | ⚠️ Moderate permeability—students likely use limited access points, reducing flow diversity. | Introduce multiple micro-entries or transparent façade zones to visually connect the street, plaza, and campus interior. |
| **Connectivity Contrast (Slow vs. Fast Transit)** | The plan shows direct pedestrian circulation with nearby parking and shuttle access outside. | 🟢 Good physical accessibility but low emphasis on slow, restorative paths. | Add dedicated pedestrian/bike loops around the perimeter with wayfinding nodes for reflection and calm transition. |
| **Community Integration (Social Hubs / Gathering Nodes)** | Central courtyard and external seating areas function as social buffers. | ✅ Promotes informal social engagement and sense of belonging. | Add digital screens / interactive installations that display student work or campus events to enhance emotional attachment. |
| **Urban Interface (Institutional Legibility)** | Strong front façade identity facing main street axis; visible signage. | 🟢 Provides a clear institutional image and gateway legibility. | Layer greenery and lighted signage to enhance night-time identity and spatial warmth. |

**Strengths:** Green landscape integration, legible frontage, and a central public realm that facilitates collaboration.

**Weaknesses:** Limited permeability between interior/exterior, linear circulation that reduces contemplative pauses, and few "transition thresholds" for mental decompression.

**Recommendations:** Embed passive green quads, create a "student promenade" linking key zones with tactile art, and redefine edges with transparent facades or arcades.

## 6.4. SYNTHESIS: FROM UNEQUAL SPACES TO SPATIAL EQUITABLE STUDENT EXPERIENCE

In this model, spatial equity is not the homogenization of experience but the balanced orchestration of difference.The Heriot-Watt campus demonstrates that spatial inequality, the deliberate use of varied spatial and sensory conditions can be an effective strategy for achieving spatial equity when designed with intent. Rather than striving for uniformity, the campus leverages unequal experiences across scales to engage students cognitively, emotionally, and socially. At each spatial layer, distinct sensory contrasts, vastness vs. narrowness, open vs. enclosed, calm vs. noisy create alternating states of activation and restoration that guide students through an experiential rhythm. This rhythmic journey supports mental well-being, cognitive focus, and institutional belonging.

Micro Scale – Interior Design Level

**Purpose:** Cognitive performance, focus, and emotional regulation.

**Unequal space expression:** Varying acoustic intensity, lighting gradients, and material tactility between studios, corridors, and lounges.

**Experience:** Students experience alternating stimulation and calmness, corridor noise, classroom focus, lounge restoration.

**Equity impact:** When well-zoned, these micro contrasts empower users to self-regulate, finding the environment that fits their momentary emotional or cognitive needs.

**Spatial equity here** is psychological: each student can choose between concentration and social recharge zones.

Meso Scale – Architectural / Building Level

**Purpose:** Functional legibility, navigational clarity, and environmental integrity.

**Unequal space expression:** Compression and expansion in corridors, stair cores, and atriums provide alternating sensory intensities.

**Experience:** Students transition from narrow circulation paths (cognitive load ↑) to open atrium commons (emotional release ↓).

**Equity impact:** When these transitions are well-calibrated, they ensure every user, novice or experienced, can navigate intuitively and feel in control.

**Spatial equity here** is cognitive: everyone gains legible access and environmental comfort, regardless of prior familiarity.

Macro Scale – Urban / Campus Level

**Purpose:** Restoration, belonging, and community integration.

**Unequal space expression:** Alternation between open green restorative zones and dense mixed-use edges creates a dynamic environmental rhythm.

**Experience:** Students decompress as they move from the dense city edge into shaded, open green zones.

**Equity impact:** The varied density ensures all users, regardless of schedule or mood, find environments matching their mental state restful or socially active.

**Spatial equity emerges** through equal access to quality outdoor and indoor microclimates.

## 7. CONCLUSION

This research has successfully demonstrated that User Experience (UX) in Higher Education (HE) is not a localized phenomenon but a multi-scalar construct that necessitates a synchronized design strategy across Micro (Interior), Meso (Architecture), and Macro (Urban) environments. By investigating the phenomenon of "Unequal Spatial Design," the study revealed that spatial inequality often arises from a lack of coordination between these layers, leading to "UX Debt" where high-quality interior learning spaces are rendered less effective by poor architectural transitions or disconnected urban connectivity.

The application of the Multi-Scale UX Framework at Heriot-Watt University in Dubai provided critical empirical evidence of these environmental transactions. Through the use of data-driven tools such as Student Journey Mapping and Heat Mapping, the research identified specific "social friction nodes" and thermal bottlenecks that negatively impact the student's daily experience. The findings suggest that when Human-Centric Design (HCD) principles are applied at every scale,ensuring adaptive ergonomics in the classroom, legible wayfinding in the atrium, and biophilic connectivity in the urban perimeter,the campus transforms into an equitable "learning landscape." This optimization significantly mitigates the sense of spatialized exclusion, fostering a deeper sense of institutional belonging and social engagement among students and faculty.

Furthermore, the study concludes that enhancing the Quality of Life (QoL) in HE is inextricably linked to the provision of "equitable affordances." Designers and institutional stakeholders must move beyond viewing the campus as a set of functional instructional containers and instead treat it as a responsive ecosystem. The research recommends that future developments prioritize:

**1. Synchronicity:** Ensuring that interior upgrades (Micro) are supported by robust architectural legibility (Meso) and site connectivity (Macro).

**2. Evidence-Based Iteration:** Utilizing phenomenological evaluation tools (P-POE) to continuously identify and resolve spatial inequalities.

**3. Climatic and Social Inclusivity:** Addressing climatic barriers at the Macro scale to ensure that the entire campus remains an accessible resource for all stakeholders.

Ultimately, a multi-scale UX strategy provides a diagnostic and generative tool for architectural practice, ensuring that higher education environments are not only pedagogically efficient but also humanly restorative and socially just. Future research should expand this framework to include longitudinal studies on the impact of multi-scalar UX on academic performance and neuro-diverse student populations, further solidifying the link between spatial design and human wellbeing.

## REFERENCES

Barron, B. (2006). Interest and self-sustained learning as catalysts of development. Human Development, 49(4), 193–224. https://doi.org/10.1159/000094368

Barker, R. G. (1968). Ecological psychology: Concepts and methods for studying the environment of human behavior. Stanford University Press.

Boztepe, S. (2021). The human-centered design of the built environment: From UX to architectural experience (AX). Journal of Interior Design, 46(2), 15–32. https://doi.org/10.1111/joid.12189

Chen, L., et al. (2024). Influence of elevated walkways on outdoor thermal comfort in hot and humid regions. Sustainable Cities and Society, 110, 105583. https://doi.org/10.1016/j.scs.2024.105583

Choi, J. H., et al. (2020). Impacts of indoor environmental quality on student productivity. Building and Environment, 172, 106720. https://doi.org/10.1016/j.buildenv.2020.106720

Cleveland, B., Fisher, K., & Sharples, S. (2021). Learning spaces frameworks for higher education. Springer. https://doi.org/10.1007/978-981-15-8425-7

Matthews, K. E., & Adams, P. (2022). Social learning spaces and student engagement in higher education. Higher Education Research & Development, 41(6), 1927–1941. https://doi.org/10.1080/07294360.2021.1979643

Cook, D. J., & Das, S. K. (2012). Ambient intelligence. Wiley. https://doi.org/10.1002/9780470976601

Devlin, A. S. (2014). Wayfinding in healthcare facilities: Contributions from environmental psychology. Behavioral Sciences, 4(4), 423–436. https://doi.org/10.3390/bs4040423

ElDamshiry, K.K. & Moussa, R.R. 2025. Architectural Pedagogy in the Age of Artificial Intelligence: A Case Study on Integrating AI into the Core Programming and Design Education Course. 4th International conference on computational intelligence and knowledge economy ICCKIE, AMITY University Dubai, UAE.

ElDamshiry K.K. & Moussa R.R. 2025. Architecture Education Curriculum Adaptation: The Role of Pedagogical Innovation In Teaching Strategies: Interior Design Module - BUE FoE as a Case Study. Journal of Engineering Science (JES).

ElDamshiry, K.K., ElMetwally, Y.S. & Oteifa, S.M. 2025. Designing For Inclusion: Strategic Approaches For Students With Disabilities Experiential Design In Higher Education. Journal of Engineering Science (JES).

ElDamshiry K.K., Abubakr A., ElAttar M.E. 2025. Implementing Vertical Gardens In Educational Buildings To Reduce Energy Consumption And Achieve Low Carbon Emmissions. In the 16th international conference on civil & Architectural engineering (ICCAE-16). 12-15 May 2025.

Ellis, R. A., & Goodyear, P. (2023). Spaces of teaching and learning: Integrating perspectives on research and practice. Routledge. https://doi.org/10.4324/9781003158580

El Moussaoui, M., & Krois, K. (2025). Architectural pedagogy in the age of AI: The transformation of a domain. In EAAE AC 2023. Springer. https://doi.org/10.1007/978-3-031-71959-2_11

Freeman, S., et al. (2014). Active learning increases student performance in science, engineering, and mathematics. PNAS, 111(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Elshabshiri, A. (2025). Enhancing the microclimate of outdoor campus spaces in hot climates. Computational Urban Science, 5, 196. https://doi.org/10.1007/s43762-025-00196-8 link.springer.com

Giacomin, J. (2014). What is human-centred design? The Design Journal, 17(4), 606–623. https://doi.org/10.2752/175630614X14056185480186

Jamshidi, S., et al. (2020). Wayfinding in interior environments: An integrative review. Frontiers in Psychology, 11, 549628. https://doi.org/10.3389/fpsyg.2020.549628

Kim, D., & Yoon, H. (2023). Spatial injustice in urban environments. Landscape and Urban Planning, 230, 104593. https://doi.org/10.1016/j.landurbplan.2022.104593

Poldma, T. (2024). Designing interior experiences: Emotion, wellbeing, and embodied engagement. Journal of Interior Design, 49(1), 3–19. https://doi.org/10.1111/joid.12243

Şeker, S., & Uzun, N. (2022). Transitional spaces and movement behaviour in public buildings.

Space and Culture, 25(3), 357–372. https://doi.org/10.1177/12063312211039854

Lopes, A., et al. (2024). Green UX and biophilic urbanism: Psychological restoration in educational campuses. Cities, 148, 104755. https://doi.org/10.1016/j.cities.2024.104755

Montgomery, C. (2013). Happy city: Transforming our lives through urban design. Farrar, Straus and Giroux.

Newton, C., & Fisher, K. (2023). The learning landscape: Designing environments for pedagogy, participation and wellbeing. Learning Environments Research, 26(2), 271–289.

https://doi.org/10.1007/s10984-022-09421-3

Preiser, W. F. E., Rabinowitz, H. Z., & White, E. T. (2015). Post-occupancy evaluation. Routledge. https://doi.org/10.4324/9781315713519

Soja, E. W. (2010). Seeking spatial justice. University of Minnesota Press.

Suwanwamee, N., et al. (2024). Investigation of outdoor thermal comfort for campus outdoor spaces in hot–humid climates. Sustainability, 16(2), 657. https://doi.org/10.3390/su16020657

Wen, Q., et al. (2023). Evaluation of satisfaction with the built environment of academic buildings and its relationship with anxiety tendencies among students. International Journal of Environmental Research and Public Health, 20(5), 4183. https://doi.org/10.3390/ijerph20054183

# DANCER'S SPATIAL NEEDS THROUGH THE LENS OF BALLET MOVEMENT ANALYSIS; CASE OF THE BALLET "GISELLE"

**Odeta Manahasa, Orkida Malaj**
EPOKA University, Department of Architecture
Tirane-Rinas, Km. 12 1032 Vore Tirana, Albania
*odurmishi@epoka.edu.al, omalaj19@epoka.edu.al*

## ABSTRACT

This research explores the relationship between body movement and architectural space through the analysis of the ballet 'Giselle. By integrating elements of architecture, dance, design theory, and digital arts, the aim is to evaluate whether current spatial design standards sufficiently accommodate diverse movements, analyzing this by making additions to the already used methods in studying movement and spatial organization. The methodology involves an analysis of "Giselle"; performances using motion capture technology and 3D modelling. This approach is compared with traditional movement notation systems such as Laban Movement Analysis and Benesh Movement Notation. The integration of motion capture provides precise, real-time data, offering a deeper understanding of how different spatial environments impact dance movements. The findings reveal differences in movement dynamics between traditional theatre settings and open, obstacle-free spaces. Interviews with dancers provide qualitative insights, reinforcing the quantitative data. The results underscore the importance of designing flexible and adaptable spaces that can accommodate a wide range of movements and activities. Overall, this research contributes to a deeper understanding of the interplay between architecture and the performing arts, offering new possibilities for innovative and responsive design solutions that enhance human movement and experience.

**KEYWORDS:** Body Movement, Performing Arts, Space Interaction, Architecture and Choreography, Motion Capture, 3d Modelling.

## 1. INTRODUCTION AND METHODOLOGY

The connection between dance and architecture is an exploration of space and movement where each discipline learns from and completes the other. Dance, with the way that the bodies move through space, provides a unique perspective in how to perceive and understand architectural shapes and spatial

compositions. Similarly, architecture by creating different shape combinations helps and inspires the choreography of movement. This interplay puts upfront the significance of both fields in studying how space is created and occupied, and how movement interacts within that space (Foster, 2011).

Dance and architecture share a vocabulary in terms of form, line, balance and rhythm; however, the way that they are expressed through time and space is different. This goes beyond fixed forms to embrace the nature of activity (Pallasmaa, 2012). The concept of " choreography" takes inspiration from the idea that the design process has to consider how bodies move through spaces to create shapes that form movement.

Collaborations between choreographers and architects reveal possibilities, for spaces that're not only functional but also aesthetically pleasing. These spaces encourage individuals to engage with their surroundings in different ways. For instance, when architect Frank Gehry collaborated with choreographer Benjamin Millepied, their collaboration resulted in performances that blended with the elements of the venue. This collaboration gave the audience an insight of dance and design come together (Brandt, 2010).

Moreover, architects can benefit from employing spatial analysis techniques used in dance such as methods used by Rudolf Laban. These techniques offer tools for understanding and designing spaces that take inspiration from movement. They underscore the significance

The research explores the connection between body movements and architectural space examining how this integration can result in environments that're both visually appealing and functional. This research concentrates on the performing arts, and it specifically studies the dancer's movements in the ballet Giselle. Since designers nowadays work with set dimensions for different spaces, the movements of the dancers that will incorporate these spaces are not studied enough. Different dance numbers have different choreographies and different numbers of people on stage.

The objective of this study is to explore the connection between movement and architecture, investigating how body movements can be studied and used throughout the design process to help create spaces that fulfill the needs of the people incorporating it. By analyzing the human movement and the relation to spatial organization this study also suggests new ways in analyzing movement in space, taking inspiration from the already existing methods. By understanding how the movements work, we will be able to design spaces specifically for what their function will be.

The methodology used in this study is multidisciplinary and combines a variety of disciplines such as architecture, dance (specifically ballet), design theory and digital arts.

The process began with the literature review. This phase involved examining projects that explore the relationship between movement and architecture while analyzing their design approaches. One important step in the literature review was analyzing dance visualization tools and motion capture techniques. After studying different techniques, the advantages and disadvantages of each one were analyzed, and the input was used in improving the method used in this research.

The next step was starting with the analysis and using the inputs from the ballet "Giselle". We filmed the dancers in the stage of the National Theater of Opera and Ballet. The next step of the study was finding two ballet dancers who were willing to be part of our project in order to separately film them in another site that is not the theater stage. I filmed them performing movements from different acts of the ballet Giselle in an open space, in the campus of "Epoka University", without any isolated areas allowing the dancers to have enough room for any movement without any restrictions. Using a drone, the dance sequences were captured

in top view and at the same time in front view. Expanding on the use of the rotoscope technique this research incorporates motion capture technologies and 3D software's to understand how dance influences spatial dynamics. The first step of the analysis was taking each dance sequence filmed and importing the pre-recorded data in Rokoko. Rokoko is a technology specialized in motion capture solutions. After uploading the videos, the software will process the data from the sensors and track the movements of the performer's body. It visualizes the skeletal structure and geometrical shapes representing the body. The next step was making the necessary adjustments to the data, such as cleaning up any noise or errors in the tracking data. After finishing with the adjustments, I exported the videos in 3D Max format and also configured the necessary export settings, such as frame rate, scale, and included data types. After exporting the data, Rokoko will generate the file containing the tracked movements and geometrical shapes.

After that we imported the videos in 3D Max, making sure that animation and skeletal data are correctly mapped to the 3D model within 3D Max. We assigned the imported motion capture data to the 3D character models in 3D Max ensuring that the animation is correctly applied and the movements are accurately represented. After that 3D Max tools were used to refine the animation and enhance the movements. The next was setting up the camera angles, lighting, and rendering settings within 3D Max. The final step in 3D Max was rendering the animation sequence to create the final video. After finishing with 3D Max, I imported the videos in Photoshop aftereffects and used the app to add sound effects and background music. There were some unnecessary images in the background that were removed. Lastly the textures, colors and any sudden movements in the videos were fixed. After rendering the videos once again, the videos were ready to be exported and used.

The next step was the comparative analysis between the sequences filmed in the NTOB and the sequences created using the methods explained above. After getting the needed results an interview was conducted with the two dancers, which provided additional insights, supporting the findings of the study.

## 2. BODY MOVEMENT AND SPATIAL REFLECTION

Body movement and spatial reflection studies the ways in which human bodies navigate through and engage with space, along with how these movements are perceived, mirrored and integrated across disciplines (Beisswanger, 2021). In ballet and architecture this interaction takes on the form of a dialogue between the dancer's body and the architectural space itself. It shapes the creation process, perception and overall experience within both art forms.

When dancers move across the stage, they in some kind of way by different movement and stage positions shape the audience's perception of the space. Although architecture and ballet are different, both art forms capture motion and harmony. Interactive elements in both fields highlight the importance of understanding spatial dynamics and human connections. By exploring these similarities, we gain insights into how human activities influence our perception of space and movement. This deepens our appreciation for both architecture and ballet, while also revealing the relationship between humans and their environments.

While ballet heavily relies on choreography, architecture organizes space through design principles. Both disciplines establish patterns and flow within their realms resulting in a shared language of movement and form. Choreographers as architects work with elements such as balance, symmetry, rhythm though utilizing different mediums. This common vocabulary lays the groundwork, for exploring their interconnectedness (Soltani et al. 2019). Further, there is a similarity in the spatial perception that dancers transmit to audiences with the people navigate through spaces and interact with it influences their cognitive experience of those spaces. Architects like Steven Holl have emphasized the significance of phenomenology which's the study of experiences in space. This aligns well with the experiences created by ballet performances (Derya, 2004).

While ballet is characterized by motion as dancers gracefully move across the stage architecture is often seen as static. However there exists a concept known as " music" that suggests architecture, much like ballet captures movement and rhythm in a form. Architectural designs by Frank Gehry exemplify this idea with their fluidity and dynamism challenging notions of structures while drawing parallels to the graceful movements of dance (Derya, 2004). Both ballet and architecture benefit from the understanding of spaces. In ballet performances interaction occurs between dancers themselves between performers and audience members as, within the performance environment itself. Similarly in architecture it involves how occupants interact with each other within layouts of spaces (Soltani et al. 2019).

The architecture of theatre buildings, like the Palais Garnier in Paris demonstrates how various elements can enhance the ballet viewing experience by focusing on sightlines, acoustics and overall ambiance. Using the body as a reference point is crucial in both ballet and architecture (Huang, 1991). Ballet utilizes the dimensions and abilities of the body to determine movement possibilities while architecture considers human scale to establish proportions. This shared underscores the connection between these two disciplines as they both prioritize the human body in their design and performance.

## 2.1. MOVEMENT AND ITS VISUALIZATION

Notation is an important tool for communicating ideas in many fields, including dance. It functions as a link between architectural, musical, visual, and verbal realizations. The main techniques for notating dance are Benesh notation and Labanotation, both of which are developed from classical ballet and cater to highly organized and adaptable motions (Hutchinson Guest, n.d.). Labanotation, developed by Rudolf Von Laban, is flexible enough to adapt to the experimental character of new dances. Both methods analyze human body movement based on space, time, and motive.

The difficulty in movement notation is dealing with the massive quantity of data needed to capture motions of each individual body component in three dimensions of space and time. Using symbols might be a solution, but it would need a huge number of symbols, resulting in complicated notation. A notational system should be simple and legible, but completeness and correctness must be weighed against simplicity and legibility. A movement notation must include essential elements such as the body's location, direction, limb position, head, torso, and pelvic features, movement quality or dynamics, and prop manipulation. (Singh 1982). Table 1 gives a comparison of these two methods.

Table 1: General information about Laban (Laban, 1956) and Benesh methods (Benesh & Benesh, 1977) of analyzing movement.

| | | **Similarities** |
|---|---|---|
| LMN | BMN | |
| was developed in the early 20th century by Rudolf Laban | was developed in the mid-20th century by Rudolf and Joan Benesh | have the purpose of documenting and analyzing human movement |
| uses geometric shapes and lines to represent movement | uses a combination of symbols, lines and dots | use symbols and diagrams to represent movement |
| focuses on the qualitative aspects of movements such as effort, space and shape | focuses on the quantitative aspects of movement, focusing on spatial relationship and timing | are used to facilitate communication and analysis within the dance community |
| has a broader application beyond dance and is used in different fields such as movement therapy, anthropology and theater | is primarily used within the Benesh institute and associated dance programs, with a more limited application outside these contexts. | Are used to preserve different choreographies |

When explaining labanotation there are some potential areas for improvement. For example, it analyses the movement in isolation without taking into consideration the interaction that is needed with other dancers or objects. This is one of the points that we aim to fix since our analysis consists of the relation of movement with the spatial design. Labanotation is also traditionally represented using symbols on a score sheet, which may be limited in accessibility and usability for non-experts. Developing interactive visualization tools or software applications could improve this. As Labanotation uses geometric shapes and lines which is useful in our analysis since it gives a better definition of the body and the space that it needs for specific movements.

Table 2: Laban Movement Notation analysis (source: courtesy of the authors)

| | | Laban Movement Notation |
|---|---|---|
| **Origin** | | - Created by Rudolf Laban in the 1920s.<br>- Developed to record all forms of human movement, not limited to dance. |
| **Purpose** | | - Comprehensive system for documenting, analyzing, and teaching movement.<br>- Used in dance, physical therapy, ergonomics, and more |
| **Structure** | | Vertical Staff:<br>- Movement is recorded from bottom (start) to top (end).<br>- Columns: Represent different parts of the body. |
| **Symbols** | | -Geometric shapes and lines indicating direction, level, and quality of movement.<br>- Effort and space aspects are also covered. |
| **Key Components in depth** | **Symbols** | Geometric Shapes: Indicate direction (forward, backward, sideways, etc.).<br>- Lines: Show levels (high, middle, low) and pathways.<br>- Effort and Space: Symbols for effort (dynamics) and spatial factors. |
| | **Stave** | - Vertical with different columns for different body parts.<br>- Helps in visualizing movement as a continuous flow. |
| | **Movement** | - Comprehensive system including effort (how), space (where), time (when), and flow (continuity).<br>- Can notate any type of human movement. |

Benesh movement notation is similar to Labanotation. Similarly, if we add motion capture systems and digital software, we could streamline the process of BMN analysis and transcription which can improve the analysis. Benesh notation makes use of movement lines to record continuous movements. A movement line traces the path of movement in space from the starting position to the final position and summarizes an infinite number of intermediate positions. This means that adding tracing lines to the movements that we analyze may be helpful in better understanding the space that these movements occupy. Benesh links movements to rhythm since his main purpose is to preserve choreography. We do not do that in our analysis. We simply analyze the movements in space without taking into consideration rhythm or force of the movements, since our aim isn't to preserve choreography.

Table 3: Benesh Movement Notation analysis (source: courtesy of the owner)

| | | Benesh Movement Notation |
|---|---|---|
| Origin | | - Developed in the 1950s by Rudolf and Joan Benesh.<br>- Initially designed to record ballet movements but has since been adapted for other dance forms. |
| Purpose | | - Recording and analyzing dance movements, particularly in ballet.<br>- Used to communicate choreography, preserve performances, and teach dance |
| Structure | | - Five-Line Stave: Similar to music notation.<br>- Top Line: Represents the head.<br>- Second Line: Represents the shoulders.<br>- Middle Line: Represents the waist.<br>- Fourth Line: Represents the knees.<br>- Bottom Line: Represents the feet. |
| Symbols | | - Use lines, shapes, and dots to represent body positions and movements relative to the stave lines. |
| Key Components in depth | Symbols | Lines and Shapes: Represent various body parts and their movements.<br>- Dots and Other Marks: Indicate specific positions or actions.<br>- Modifiers: Adjust the meaning of basic symbols to convey more detail. |
| | Stave | - Horizontal with five lines representing different body parts.<br>- Similar to a musical stave but adapted for movement. |
| | Movement | - Detailed notation for timing, dynamics, and spatial orientation.<br>- Can represent complex sequences of dance moves. |

On the other side, when studying William Forsythe, it is noticeable the type of dance that he studies. The movements of classical ballet are replaced by unstable, complicated movements, which no longer focus on the result, but on the process of it. Even though this study focuses on the ballet movements, step by step method can be used for every type of movement. One important detail that Forsythe suggests is an interesting and creative way to explore space, by learning from the body's potential, within the frame of design and computational technology. In his project "Improvisation Technologies", there is a The CD-ROM featuring 60 video chapters of lecture demonstrations by Forsythe, showcasing the geometrical structure behind dancing movement. The problem is that there are only this video chapter so the information is limited. If there were visualization techniques and representation methods, such as 3D modeling, motion graphics, and virtual reality, it could enhance the analysis of Forsythe's spatial choreography.

Table 4: William Forsythe (2011) (source: courtesy of the authors)

| | | William Forsythe |
|---|---|---|
| Origin | | |
| Purpose | | - Redefine dance and choreography using new media and technologies.<br>- Create resources for dancers, choreographers, and audiences to explore and understand dance in new ways. |
| Structure | | -Dance Geometry: Uses geometrical principles to explore spatial relationships in dance.<br>-Improvisation Technologies: Multimedia tool that teaches improvisation through visual and verbal instructions.<br>-Synchronous Objects: Collaborative project translating dance into data to reveal choreographic structures. |
| Symbols | | -Geometric Forms: Circles, lines, planes representing spatial pathways.<br>-Digital Notations: Visualizations and annotations in multimedia applications.<br>-Movement Symbols: Abstract representations of movement patterns and choreographic principles. |
| Key Components in depth | Symbols | -Dance Geometry Symbols: Geometric shapes and lines indicating dancers' pathways and spatial relationships.<br>-Improvisation Technologies Symbols: Icons and visual markers representing specific improvisational prompts.<br>-Synchronous Objects Symbols: Data visualizations illustrating movement sequences and interrelations. |
| | Stave | -Dance Geometry: Conceptual staves as lines or planes in space guiding movement.<br>-Improvisation Technologies: Virtual staves providing a framework for improvisation exercises.<br>-Synchronous Objects: Digital staves mapping out choreography's temporal and spatial dimensions. |
| | Movement | -Physical Movements: Emphasis on the physical articulation of geometric principles.<br>-Improvisational Movements: Exploration within a structured digital environment.<br>-Choreographic Movements: Analyzed and visualized through data to understand underlying structures. |

The last to be analyzed is motion capture, which is one of the most important tools in this study. By adding lines into the videos or sequences that are analyzed with motion capture, we get more detailed

analysis about the movement and the space that each movement needs without needing symbols to capture and study the movements. This way we combine some of the most important elements of each method and come up with a new way/method of analyzing movement. Further on into the research is better explained how these methods actually come up together.

Table 5: Chrono photography and motion capture analysis (source: courtesy of the authors)

| | | Chronophotography | Motion Capture |
|---|---|---|---|
| **Origin** | | - Jules-Etienne Marey Late 19th century | - Late 20th century |
| **Purpose** | | - Study and capture motion | - Digitally capture movement for analysis and animation |
| **Structure** | | - Sequential photographs | - Markers and sensors tracked by cameras or software |
| **Symbols** | | - Individual frames, overlapping images | - Markers, digital points |
| **Key Components in depth** | **Symbols** | - Single frames | - Reflective markers or sensors |
| | **Stave** | - Film strip or photographic plate | - Digital 3D space or software interface |
| | **Movement** | - Continuous motion broken down into static frames | - Real-time recording of motion translated into digital form |

## 3. Giselle" Movement Comparison and Results: Theater vs. Open Space

After editing the videos in the software explained and getting the needed results, the videos taken in NTOB (National Theatre of Opera and Ballet) with the videos taken in an open space and the analyses made in front and top view were combined. By making this comparison and capturing different movements from segments of the videos, it makes it possible to define the space that these movements need and also if the space occupied is the same in the theatre and in the open space. First analyzed are two solo segments one from the boy and one from the girl. Here we are presenting only the. Boy. Analyzing solo segments allows for a clear and focused examination of individual movement patterns without the complexity of interactions between multiple dancers. These segments are analyzed through lines that trace the body movements and give a better definition of the shapes created through the movements and also the spaces occupied. The traced lines offer a definition of the shapes formed by the body movements. This helps in understanding how different movements create distinct spatial forms. Analyzing the spaces occupied by the movements helps in understanding the dancer's spatial awareness and the effective use of space in performance. It also provides insights into how different movements fill the performance area and interact with the spatial boundaries.

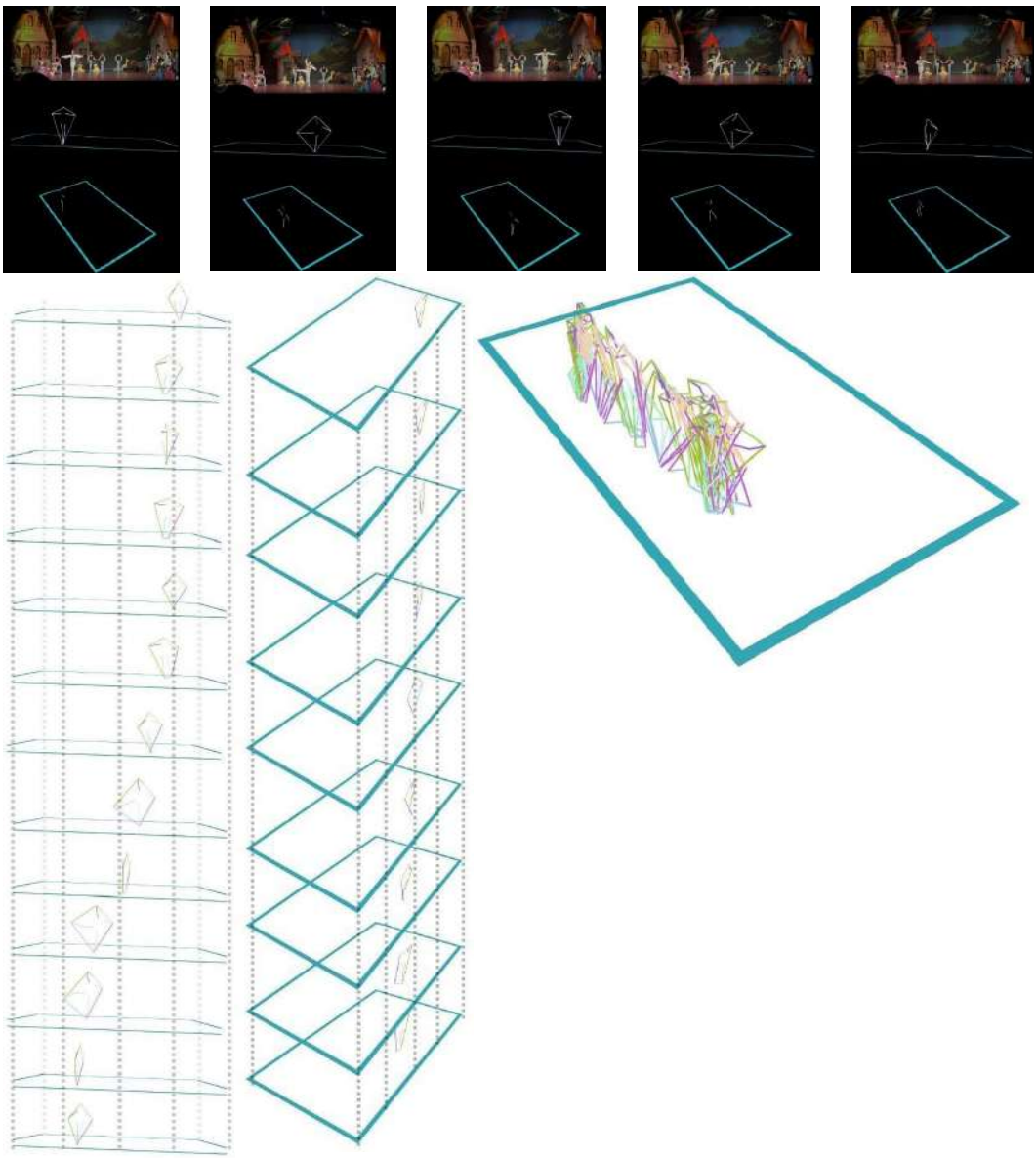


Figure 1: First solo dance sequences(up) and exported frames of the geometrical shapes tracing the dancers' body in top and front view. Overlapped movement shapes of the dancers and the space it occupies in front view (source: courtesy of the authors)

The collages below with the shots captured from the videos are listed as followed: In each shot the top image is the video filmed in the NTOB(National Theatre of Opera and Ballet), showcasing a dancer performing a specific move, middle Image is the same move performed in an open space, analyzed through tracing movement from a front view. And the bottom image, is the same move performed in an open space, analyzed through tracing movement from a top view. This exact listing is followed in each analyzes.

When analyzing the movements, the application works as rotoscope. It captures every movement in each moment and it forms different shapes. As seen in figure 1 these are some of the first shapes that are formed because of the movements of the dancers. Here we can clearly see the impact that shape has in dance and the correlation to architecture. Each movement, shape, has its own needed space and this way we can better find and study the space that this movements need. The initial shapes formed by the dancers' movements illustrate the dynamic interaction between the dancers' bodies and the space. The variation in shapes shows how each movement requires specific spatial dimensions, highlighting the relationship between movement and space. By overlapping the movements with one another we create a pattern and flow of each sequence, by getting this way the space that this specific dancer needs. By knowing the space that is occupied is easier to decide the movement of background dancers and also stage objects. This way we organize and arrange the spatial configurations by taking the consideration how the space will be used. The resulting pattern provides insights into the flow and rhythm of the dance. This information is important for planning the placement of other dancers and stage elements, ensuring an efficient use of space.

## 4. DISCUSSION AND CONCLUSION

This study makes some suggestions that might help in the fields of architecture and spatial movement. Firstly, the integration of motion capture technology and 3D modeling, which provided a detailed and dynamic analysis of how different spatial environments impact dance movements. This approach offered deeper insights into the relationship between movement and space, informing the design of more responsive and adaptable environments. The combination of traditional movement notation systems with modern motion capture techniques represents another method approach. This approach enhances the precision and clarity of movement analysis.

The study introduced and used several key terms to improve the analysis and understanding of dance movements within architectural spaces. Motion Capture (MoCap), refers to the technology used to record the precise movements of dancers, capturing detailed data that traditional methods might miss. 3D Modeling, which involves creating a three-dimensional representation of the captured movements, providing a comprehensive view of spatial interactions. The term Kinesphere, from Laban Movement Analysis was used to describe the personal space within which a dancer moves, emphasizing the spatial dimensions of movement. Geometric Pathways that represent the trajectories of movements in space, crucial for visualizing and analyzing dance dynamics. Spatial Awareness, highlighting the dancers' conscious understanding of the space around them, which is essential for performing in various environments. Dynamic Analysis refers to the real-time evaluation of movements, allowing for immediate feedback and adjustments. Temporal and Spatial Dimensions are terms used to describe the aspects of movement related to timing and the use of

space, respectively. Symbolic Notation from traditional systems like Laban and Benesh involves using symbols to represent different movement elements. Integrative Methodology, which is a term used to describe the combination of quantitative data from motion capture with qualitative insights from dancer interviews. Performance Quality, that explains the overall effectiveness and expressiveness of the dance, influenced by spatial design and movement freedom. These terms contributed to a more precise and nuanced analysis of how different spatial environments impact dance movements.

The findings of this study highlight several important aspects and implications. Firstly, the analysis showed that open, obstacle-free spaces allowed for more expansive and expressive movements compared to traditional theater settings. Dancers reported a greater sense of freedom and fluidity, which was corroborated by the motion capture data. In traditional stages, fixed dimensions and limited depth-imposed restrictions on dancers, requiring them to modify or adapt their choreography. This sometimes compromised the performance quality, as noted in both qualitative interviews and quantitative data. The combination of traditional movement notation systems (like Laban and Benesh) with modern motion capture techniques provided a new tool for movement analysis. This approach increased the precision and clarity of the data, allowing for clearer insights into movement dynamics. The integration of 3D modeling enabled a more detailed visualization of movements, making it easier to understand and analyze the spatial interactions of dancers.

The findings offer recommendations for architects on how to incorporate movement analysis into the design process. By considering the spatial needs and preferences of dancers, architects can create more functional performance spaces. Recommendations include creating flexible and adaptable stages, using modular design elements, and ensuring sufficient space for dynamic movements and transitions. The study highlights the potential for cross-disciplinary collaboration between architecture and dance. By drawing on concepts and methodologies from both fields, the study opens up new possibilities for innovation and creative exploration.

## REFERENCES

Beisswanger, L. (2021). Architecture and/as Choreography: Concepts of movement and the Politics of space. Dimensions - Journal of Architectural Knowledge, 1(2), 23–50. https://doi.org/10.14361/dak-2021-0204.

Benesh, R., & Benesh, J. (1977). Reading dance: The birth of choreology (A Condor book). Souvenir Press.

Brandt, A. (2010). Art in motion: Collaborations between architects and choreographers. Princeton Architectural Press.

Derya Yorgancioğlu (2004). Steven Holl: A Translation of Phenomenological Philosophy into The Realm of Architecture.

Foster, S. L. (2011). Choreographing empathy: Kinesthesia in performance. Routledge.

Forsythe, W. (2011). Choreographic objects. In S. Spier (Ed.), William forsythe and the practice of choreography: It starts from any point (pp. 90–92). Routledge.

Huang, E. R.-P. (1991). Body in space: The sensual experience of architecture and dance [Master's thesis, Massachusetts Institute of Technology]. DSpace@MIT. https://hdl.handle.net/1721.1/67399

Hutchinson Guest, A. (n.d.). Dance notation. In Encyclopædia Britannica. Retrieved from https://www.britannica.com/art/dance-notation

Laban, R. (1956). Principles of dance and movement notation. Macdonald & Evans.

Pallasmaa, J. (2012). Encounters 2: Architectural essays (P. MacKeith, Ed.). Rakennustieto.

Singh, B. (1982). A graphics editor for Benesh movement notation (Master's thesis, University of Waterloo). University of Waterloo Digital Archive. Retrieved from https://www.cs.ubc.ca/~ksbooth/PUB/docs/BSingh1982.pdf

Soltani, Saeid & Kırcı, Nazan. (2019). Phenomenology and Space in Architecture: Experience, Sensation and Meaning. International Journal of Architectural Engineering Technology. 6. 10.15377/2409-9821.2019.06.1.

# URBAN & LANDSCAPE

# NATURE AS A CURE FOR REPAIRING THE RELATIONSHIP BETWEEN HUMANS AND SPACE: THE PHOENIX-SEE CASE IN DORTMUND

Nicole Passoni, Emanuele Garda
University of Bergamo, Department of Engineering and Applied Sciences
Viale Marconi (Building B) room B2.08, Dalmine, Bergamo, Italy
*n.passoni1@studenti.unibg.it; emanuele.garda@unibg.it*

## ABSTRACT

This contribution analyses the impacts of the Phoenix-See urban regeneration project, investigating how the reclamation and renaturation of a former industrial area in Dortmund have transformed the urban landscape and enabled its ecological and social re-signification. The study aims to assess the regenerative potential of the area by examining the relationship between brownfield redevelopment, soil restoration environmental quality, and the promotion of health and well-being, with particular attention to the restoration of environmental and social equity in a context previously characterized by strong spatial inequalities and high environmental pressure.

The Phoenix-See project represents a medium-scale regeneration intervention based on the redevelopment of a disused industrial site into an integrated green and blue infrastructure, including an artificial lake, green spaces, residential areas and public spaces. The project can be interpreted as a restorative regeneration process capable of restoring the environmental and social degradation caused by industrialization and reintroducing ecological and public functions within the new district.

Following a review of the scientific literature on renaturalisation processes, the methodology is based on a comparative analysis of pre- and post-intervention environmental indicators, in specific terms water, green areas, as well as biodiversity levels. Particular attention is devoted to the identification and evaluation of the Nature-based Solutions (NbS) adopted and their impacts on environmental quality, public health and collective well-being.

The expected outcomes are part of a broader research project that aims to empirically validate an innovative methodological framework, demonstrating how Phoenix-See can serve as a replicable model for repairing contexts characterized by extensive urbanization processes and fostering more equitable, resilient and health-oriented urban spaces.

KEYWORDS: Brownfield, Urban Regeneration, Nature-Based Solutions, Biophilic Design Frameworks.

## 1. INTRODUCTION

Urban brownfields—former industrial sites left abandoned after decades of human activity—represent critical landscapes in contemporary cities. These areas are often characterized by soil contamination, extensive impermeabilization, and a profound loss of ecosystem services, leading to environmental degradation and negative impacts on human well-being (Costanza et al., 1997). For these reasons, brownfield regeneration has increasingly become a central concern in urban policy and research. Beyond the remediation of polluted land, the transformation of such sites is widely recognized as an opportunity to reactivate underused urban spaces, stimulate local economies, create new employment opportunities, and contribute to a renewed and more positive perception of urban life. In this sense, brownfield redevelopment operates not only as an environmental intervention but also as a strategic process capable of generating social, economic, and symbolic value for urban communities (De Sousa, 2002). While such degraded soils are incapable of sustaining the full range of ecological functions, they can unexpectedly host the emergence of spontaneous nature. Flora and fauna slowly recolonize these seemingly empty spaces, creating life quietly and invisibly, until human intervention again reshapes the environment (Gandy, 2022). The process of human disengagement from these sites highlights an intrinsic truth: nature possesses a restorative potential that humans increasingly recognize. In response, urban planning strategies have evolved. Where once disused sites were mainly addressed through demolition or redevelopment driven by functional and economic priorities, contemporary urban approaches increasingly emphasize environmental responsibility, social equity, and collective well-being. Within critical urban theory, urban space is understood as a dynamic and socially constructed process rather than a fixed physical container. From this perspective, demolition can be interpreted as a moment of rupture within an existing spatial order, enabling the transformation of obsolete and compromised structures into new forms of urban space. Such a rupture creates the conditions for the emergence of renewed social relations, ecological functions, and shared meanings, allowing cities to regenerate in ways that are more resilient, inclusive, and integrated with nature (Lefebvre, 1991). This moment of rupture opens the space for a deeper rethinking of the human–environment relationship. As the limits of purely functional and material urban development became evident, renaturalization emerged not only as a planning strategy (Falco et al., 2024) but as a necessary response to human needs. The spontaneous return of nature to abandoned sites revealed that ecological processes could persist even in highly compromised contexts, anticipating a broader awareness: humans cannot merely fill space but must restore the natural systems that sustain physical, emotional, and social well-being. Renaturalization thus represents a deliberate reintroduction of nature into urban life—no longer accidental, but intentionally planned—transforming post-industrial spaces into environments capable of supporting both ecological functions and human flourishing. The theoretical foundation of this perspective draws on Edward O. Wilson's biophilia hypothesis, articulated in the 1980s, which emphasizes humans' intrinsic need to connect with nature. Wilson also foresaw the ecological consequences of human activity, highlighting the ongoing "Sixth Mass Extinction" and advocating for biodiversity conservation as a moral and practical imperative (Pievani, 2013). Today, these ideas inform the planning of biophilic cities (Beatley, 2011), where urban ecosystems are intentionally designed to integrate nature and enable movement between habitats. By reintroducing natural elements into brownfields, planners can restore ecosystem

services, support biodiversity, and enhance human health and safety. In this sense, urban regeneration through nature-based interventions is not merely aesthetic but a critical strategy for sustaining life and well-being in contemporary cities.

## 2. METHODOLOGY

This study adopts a structured methodological framework to evaluate the role of Nature-based Solutions (NbS) in urban regeneration and their potential to restore green and blue infrastructures and human well-being. The approach combines theoretical review and performance assessment of implemented interventions. The first phase consists of a review of the literature on 'nature designed' urban interventions and the concept of Biophilic Cities. This phase establishes the theoretical basis for understanding how planned natural elements can be integrated into urban environments to enhance biodiversity, ecosystem functions, and human health (Kellert, 2008; Beatley, 2011). The second phase focuses on the assessment of pre- and post-intervention conditions in urban regeneration projects where NbS have been applied. This involves examining ecological restoration, spatial reorganization, and the reintroduction of natural elements in previously degraded areas. The third phase aims to evaluate whether the regeneration process has effectively restored the degraded brownfield and contributed to the ecological and social healing of the urban environment. To achieve this, the study employs the biophilic design framework systematised by Stephen R. Kellert and Calabrese E. in 2015, building upon Kellert's original 2008 formulation. This framework conceptualises three complementary kinds of experience of nature—(1) the direct experience of nature, (2) the indirect experience of nature, and (3) the experience of space and place—which together provide a comprehensive toolset for assessing biophilic qualities in regenerated urban environments. Applying these experiential categories, the analysis evaluates the extent to which the Phoenix-See project fosters biodiversity and supports meaningful human–nature interactions, thereby assessing how biophilic the regenerated space is and its potential contribution to resilient, inclusive, and nature-integrated urban living. While the 2015 framework constitutes the primary analytical structure, the interpretation of results is informed by the nine Principles of Biophilic Design articulated by Kellert in his 2018 publication, which refine and strengthen the earlier framework by emphasising integration, immersion, authenticity, emotional attachment, and long-term ecological performance. This combined approach enables a robust assessment of how Nature-based Solutions can contribute to both ecosystem functionality and human well-being in post-industrial urban contexts.

## 3. SCIENTIFIC BACKGROUND

The concept of biophilia describes the innate biological affiliation between humans and the natural world, rooted in evolutionary processes that shaped human perception, cognition, and well-being long before the emergence of contemporary urban environments (Wilson, 1984). Human evolution occurred primarily in direct interaction with natural systems, rather than within artificially engineered settings, which explains why

contact with vegetation, water, animals, and natural landscapes continues to exert measurable benefits on physical and mental health (Kellert and Calabrese, 2015; Ryan et al., 2014). Although urbanisation, industrialisation, and large-scale food production are often perceived as 'normal' conditions of modern life, they represent a relatively recent phase in human history. The long evolutionary legacy of close human–nature interaction underpins the restorative effects associated with natural views, gardens, parks, and everyday encounters with biodiversity, particularly in highly urbanised contexts. Building on this premise, biophilic design emerged as an approach aimed at re-establishing meaningful relationships between nature and the built environment. Rather than treating nature as a decorative or residual element, biophilic design integrates natural systems, materials, and processes into architectural and landscape interventions, seeking to enhance human health, reduce stress, and support ecological functionality (Kellert, 2008). This perspective implies a shift from domination over nature toward coexistence, recognising natural systems as fundamental infrastructure for urban life. As climate change intensifies environmental pressures and urban populations continue to grow, reconnecting cities with nature has become a central strategy for promoting resilience, well-being, and sustainability. In recent years, this thinking has expanded from the scale of individual buildings to the broader urban dimension through the concept of biophilic cities. Biophilic cities place nature at the core of urban planning and governance, promoting daily, multisensory contact with natural elements across all spatial scales—from interiors and streetscapes to neighbourhoods, river corridors, and regional ecological networks (Beatley, 2016). These cities are characterised not only by the quantity of green and blue spaces, but by the intensity, accessibility, and continuity of human–nature interactions. Biodiversity, tree canopy coverage, restored waterways, and connected green infrastructures become essential components of urban form, enabling cities to function as complex socio-ecological systems rather than purely technical constructs. In this context, rivers and post-industrial landscapes have gained renewed significance. Historically, urban development has heavily modified river systems, often channelising, burying, or degrading them to accommodate industrial production, transport, and waste disposal. Such transformations have contributed to ecological fragmentation, increased flood risk, and the loss of ecosystem services. In response, European environmental policies, including the Water Framework Directive and Flood Risk Management Directive, have encouraged a shift toward river restoration and more adaptive, nature-based approaches to water management. Urban river restoration is now widely recognised as a key strategy for enhancing city resilience, improving water quality, mitigating climate risks, and providing accessible spaces for recreation and psychological restoration (Prominski et al., 2012). Nature-based Solutions (NbS) have emerged as an operational framework to translate these principles into planning and design practice. Defined as actions inspired by, supported by, or derived from natural processes, NbS aim to restore degraded ecosystems, enhance biodiversity, and deliver multiple co-benefits for climate adaptation, risk reduction, and human well-being (Scott et al., 2016). Applied to urban regeneration, NbS move beyond site-specific conservation toward multifunctional and connected green–blue infrastructures that integrate ecological, social, and spatial objectives. More recently, the concept of re-naturing the city has further advanced this discourse by framing cities as hybrid socio-ecological systems in which natural and artificial components are deeply intertwined. This perspective challenges purely technological or engineering-driven models of sustainability, advocating instead for regenerative approaches that work with natural processes across multiple scales (Beatley, 2011; Lennon et al., 2014). Re-naturing urban

environments entails restoring ecological functions, reactivating ecosystem services, and reshaping urban metabolism to support both present and future needs. In post-industrial contexts, such as former brownfields, this approach offers a powerful lens for understanding urban regeneration as a process of ecological and social repair. Within this theoretical landscape, the regeneration of Phoenix-See in Dortmund can be interpreted as a paradigmatic example of nature-based urban transformation. The project embodies a shift from industrial degradation toward a biophilic and regenerative model of urban space, where water, vegetation, and biodiversity play a central role in redefining human–space relationships. By evaluating Phoenix-See through established biophilic design frameworks, this study situates the case within the broader scientific debate on how nature can function as a curative agent in repairing damaged urban environments and fostering healthier, more resilient cities.

## 4. STUDY AREA: ANALYSIS OF NBS IN THE PHOENIX-SEE PROJECT

Between the late nineteenth and early twentieth centuries, Dortmund's rapid urban expansion led to the formation of highly compact working-class neighbourhoods. Among these, Hörde—located approximately five kilometres south-east of the city centre—hosted from 1841 the Hermannshütte steelworks, on the site now occupied by Phoenix-See. The close spatial proximity between housing and heavy industry, typical of the nineteenth-century English industrial urban model adopted in the Ruhrgebiet, produced a dense and poorly permeable urban fabric, largely devoid of public open spaces and green areas (Benevolo, 1991). Unsealed surfaces were almost entirely replaced by paved yards, and industrial storage areas, which severely polluted local watercourses. In addition, ground subsidence caused by mining activities prevented the construction of a closed sewer system, leading to the transformation of the Emscher River into an open-air wastewater channel. Its course—and that of its tributaries—was straightened, canalised, and lined with concrete embankments. In this context, the Hoesch Kanal, built about eight metres below the Hermannshütte plant, functioned both as a combined sewer and as the main conduit for the river flow over a stretch of approximately two kilometres. Similarly, the smaller Hörder Bach stream, located on the western edge of the area, was buried in the early twentieth century during the construction of the steel complex (Wantzen et al., 2022). Following the decline of the steel industry and the dismantling of the plant at the end of the twentieth century, the Dortmund City Council unanimously approved, in 2000, a major urban regeneration project promoted within the ten-year Dortmund-Project programme, aimed at the city's economic and spatial restructuring. After the demolition of the above-ground industrial structures and the acquisition of the site by the municipality, the operational phase began in 2005, at that time one of the largest construction sites in Europe (Figure 1).

Figure 1: The transformation process of Phoenix-See (Google Earth Pro).

More than 2.5 million $m^3$ of soil and approximately 420,000 $m^3$ of reinforced concrete demolition material were relocated to create the lake basin and the new development areas. During the works, the Emscher valley was reopened and the river course was diverted to the northern edge of the basin. The flooding of the lake with groundwater and freshwater started on 1 October 2010 and was completed in May 2011. Within this regeneration process, the spatial reconfiguration of the former industrial site was largely driven by the implementation of Nature-based Solutions (NbS), understood as interventions inspired by and based on natural processes, capable of delivering environmental, social, and economic benefits while enhancing territorial resilience (Tang et al., 2021). NbS introduce ecological elements and processes into urban environments through context-specific solutions that respond to local environmental challenges. In the Phoenix-See project, these solutions take the form of a coordinated system of blue and green infrastructures that reshaped the area's hydrological regime, public space network, and ecological functioning. Among them, Sustainable Urban Drainage Systems (SUDS) play a central role as a specific typology of NbS related to water management. SUDS consist of vegetated and often wet open spaces designed to complement conventional sewer systems by promoting soil permeability, water retention, and infiltration, while simultaneously improving microclimatic conditions and landscape quality. From a hydrological perspective, the main urban devices implemented in the Phoenix-See area can be interpreted as blue infrastructures functioning as SUDS. These include the artificial lake itself, the renaturalised Emscher River, and the reopened Hörder Bach stream (Figure 2).

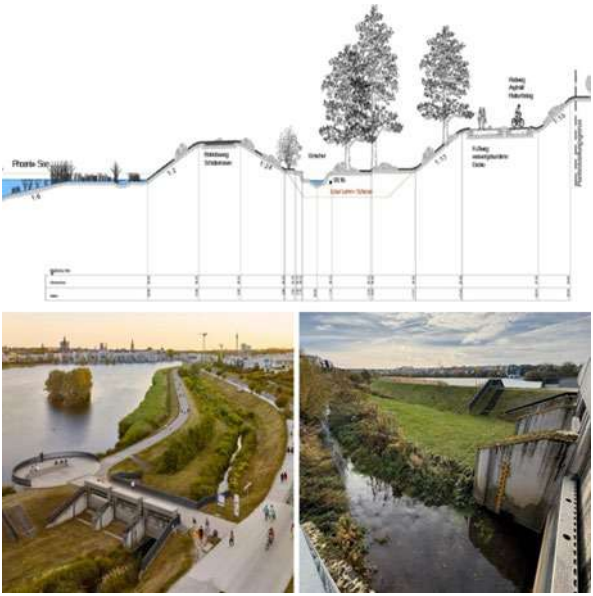


Figure 2: Phoenix-See Sustainable Urban Drainage Systems (photos by Stadt Dortmund and https://www.eglv.de/emscher/neueemscher/)

Together, they form an integrated water management system designed to mitigate flood risk, restore natural hydrological processes, and enhance the environmental quality of the site. The Phoenix Lake operates as a naturalistic artificial retention basin with a total capacity of approximately 840,000 $m^3$, of which around 240,000 $m^3$ are reserved for flood retention from the upper Emscher catchment (van de Weyer et al., 2024). Beyond its recreational function, the lake plays a key hydraulic role in collecting, temporarily storing, and regulating stormwater flows. The effectiveness of this system was tested during an extreme rainfall event on 14 July 2021, when approximately 160,000 $m^3$ of water from the Emscher were diverted into the lake via a bypass, triggering the overflow threshold for the first time since its construction. Post-event monitoring confirmed that all technical elements—such as the separation dam, inflow and outflow structures, and bottom outlet—functioned as designed, preventing flooding of the surrounding residential areas and critical infrastructure, including the U41 metro line (Emschergenossenschaft 2023). The event also highlighted challenges related to water quality: the inflow of mixed stormwater and sewage led to a temporary increase in nutrient concentrations, phytoplankton proliferation, and reduced oxygen levels, resulting in a short-term deterioration of the lake's ecological status under the EU Water Framework Directive (Volkens et al., 2023). However, water quality subsequently improved through a combination of natural purification processes—driven by aquatic vegetation—and technical measures, notably an advanced phosphate removal system based on adsorption on iron hydroxide granules. Recent chemical analyses have not detected contamination linked to the former steelworks (Emschergenossenschaft 2023). Complementing the blue infrastructures, the regeneration project introduced an extensive system of green

areas and public spaces that significantly transformed the former industrial landscape. Public green areas cover approximately 11 hectares, while public roads, paths, and plazas extend over about 12 hectares, creating a continuous and accessible open space network around the lake. Phoenix-See has become a major recreational destination for both residents and visitors, offering a dense network of pedestrian paths and cycling routes that encircle the lake and connect it to adjacent green spaces. These infrastructures support everyday leisure activities and promote active mobility, reinforcing the role of green spaces as integral components of urban well-being. The green infrastructure system is enriched by a variety of recreational facilities, including bocce courts, children's playgrounds, wooden seating elements integrated into landscaped areas, and piers supporting water-based activities. The artificial hill known as the Kaiserberg, formed using excavation material from the site, contributes to the morphological diversification of the landscape while offering panoramic viewpoints over the lake and surrounding neighbourhoods. In addition to horizontal green spaces, several residential and commercial buildings surrounding the lake incorporate green roofs, enhancing ecological connectivity and urban biodiversity. The architectural design of these buildings, featuring expansive reflective glazing, amplifies the visual integration with the surrounding environment, mirroring the sky at upper levels and the lake and vegetated areas below. In parallel with hydrological regulation and public space provision, the Phoenix-See project has generated significant ecological benefits, particularly in terms of biodiversity. The renaturalisation of water bodies and the creation of heterogeneous habitats along the lake's perimeter have facilitated spontaneous ecological succession in the absence of direct anthropic interventions. In 2012, NABU—the largest environmental association in Germany—recognised Phoenix Lake as the water body with the highest bird species diversity in the Dortmund area (Figure 3).

Figure 3: Bird biodiversity at Phoenix Lake (photos by the authors, 2023-2025).

A monitoring campaign conducted in 2014 recorded 46 bird species, including 12 regionally threatened species, with continued growth observed in subsequent years. The lake's extensive reed belt, which covers more than half of its shoreline, provides essential breeding and refuge habitats for avifauna, supporting stable populations of both migratory and resident species, such as tufted ducks, reed buntings, common gulls, moorhens, and red-crested pochards. The presence of approximately 60–70 Canada geese and wild geese per season further indicates the habitat's ecological suitability. At the benthic level, the lakebed is characterised by a dense (>90%) coverage of stonewort algae (Chara sp.), intentionally introduced to enhance ecological quality and limit the spread of invasive aquatic species. Despite the temporary disturbances caused by the 2021 flood event, biological indicators point to a progressive ecological recovery, with monitoring reporting up to 129 taxa of aquatic invertebrates (Web-1). Overall, the transformation of Phoenix-See represents a profound shift from a degraded, impermeabilized, and heavily polluted industrial site—with buried and contaminated rivers, soil loss, and restricted access—to a dynamic, multisensory, and publicly accessible urban environment. What was once a closed, static, and divisive space dominated by the steelworks has been replaced by a lively landscape that restores soil vitality and fosters human–nature interactions. This complete turnaround not only regenerates the physical environment but also sets the stage for a deeper exploration of how biophilic design principles, as articulated by Kellert, can enhance sensory engagement, well-being, and ecological integration in post-industrial urban spaces.

## 5. DISCUSSION

This discussion examines the extent to which the regeneration of Phoenix-See can be considered biophilic, understood as the capacity of nature-based urban transformation to repair degraded environments while restoring meaningful and sustained relationships between people and space. The assessment is grounded in the biophilic design framework articulated by Kellert (2008) and systematised by Kellert and Calabrese (2015), which organises human–nature relationships into three complementary domains: (1) direct experience of nature, (2) indirect experience of nature, and (3) experience of space and place. This analytical structure is intentionally retained, as it provides a robust interpretative lens through which to evaluate the multisensory, spatial, and experiential dimensions of urban regeneration. At the same time, the discussion is informed by Kellert's later work (2018), in which biophilic design is further strengthened through the formulation of nine overarching principles that define the conditions under which biophilic strategies effectively enhance human health, wellbeing, and ecological performance. Rather than introducing a new evaluative framework, these principles are used here to clarify how and why the biophilic qualities identified through the 2015 framework can be considered coherent, integrated, and enduring. Direct experience of nature (1) refers to physical and sensory contact with living systems and natural processes, including water, vegetation, wildlife, light, air, and seasonal dynamics (Kellert, 2008). In post-industrial contexts, such experiences are particularly relevant, as ecological restoration can counteract both environmental degradation and the sensory impoverishment typical of former industrial landscapes. At Phoenix-See, direct engagement with nature is structured around a continuous and integrated blue–green infrastructure system that restores hydrological processes while embedding ecological functions within everyday urban life. The artificial lake, together with the renaturalised Emscher River and the reopened

Hörder Bach stream, reintroduces visible, audible, and dynamic water systems that support flood regulation, water purification, and habitat creation. These features exemplify what Kellert (2018) identifies as a core condition of effective biophilic design: nature must advance human physical and mental health through sustained and meaningful exposure, rather than through isolated or decorative elements. The surrounding green spaces, pedestrian paths, and cycling routes promote prolonged, repeated, and immersive contact with natural elements, aligning with the principle that biophilic design should encourage engagement and immersion in natural features and processes. Biodiversity recovery—evident in reed belts, avifauna, and aquatic organisms—enhances ecological complexity and reinforces perceptions of authenticity, seasonal change, and non-human presence. In this sense, Phoenix-See supports direct biophilic experiences that function as part of an interconnected ecological whole, rather than as fragmented or episodic encounters. Indirect experiences of nature (2) involve symbolic, material, and representational connections to natural systems, including the use of natural materials, forms inspired by ecological patterns, and design strategies that convey information richness, time, and transformation (Kellert & Calabrese, 2015). These dimensions play a crucial role in reinforcing cognitive and emotional relationships with nature within the built environment. At Phoenix-See, indirect biophilic experiences emerge through architectural and landscape strategies that visually, materially, and symbolically integrate the built environment with its ecological setting. Green roofs contribute to urban biodiversity and ecological connectivity, while wooden seating elements and landscaped public spaces provide tactile and visual references to natural materials. Reflective glazed surfaces amplify visual connections by mirroring sky, water, and vegetation, strengthening continuity between architecture and landscape. Beyond materiality, the project incorporates memory and narrative as indirect biophilic elements. The Kulturinsel Phoenixsee and the preservation of industrial relics embed ecological regeneration within the historical structure of the site, reinforcing a sense of continuity rather than rupture. This approach resonates with Kellert's (2018) emphasis on emotional attachment and authenticity: biophilic environments are most effective when they foster meaningful relationships grounded in place identity and cultural memory, rather than presenting nature as an abstract or artificial construct. Experiences of space and place (3) refer to spatial configurations that support prospect, refuge, movement, and social interaction—qualities historically linked to human evolutionary adaptations to natural environments (Kellert, 2008). In biophilic design, these spatial attributes contribute to wellbeing by balancing exploration, safety, and social engagement. Phoenix-See offers a legible and accessible spatial structure characterised by continuous pathways that facilitate intuitive wayfinding and active mobility. Elevated viewpoints, such as the Kaiserberg, provide prospect over the lake and surrounding neighbourhoods, while smaller-scale elements—covered piers, sheltered seating, and wooden platforms—offer refuge within more open spaces (Figure 4).

Figure 4: View from the lake and view from Kaiserberg (photos by the authors, 2023-2025).

These features align with Kellert's (2018) principle that biophilic design should create integrated settings in which the ecological whole is experienced as more than the sum of its parts. Social interaction is further supported through installations such as the Whisper Bridge, which transforms spatial distance into playful communication, and through the enogastronomic path, which introduces seasonal, cultural, and sensory dimensions connected to local ecological processes. Collectively, these spatial strategies foster a sense of community that includes both human and non-human actors, reinforcing nature's role as an active mediator of social life.

## 6. CONCLUSION

Overall, the regeneration of Phoenix-See demonstrates a high degree of biophilic integration achieved through the coherent interaction of ecological processes, multisensory experiences, and spatial structures. Interpreted through the 2015 biophilic design framework and reinforced by the nine principles articulated by Kellert in 2018, the project shows how nature can function as a structuring agent of urban regeneration rather than a decorative addition. However, the transformation also reveals critical tensions. Feelings of nostalgia and loss related to the site's former industrial identity persist, as historically rooted functions have been replaced by commercial and recreational uses (Frank, 2021). Moreover, processes of gentrification influence access to the regenerated landscape, potentially limiting the equitable enjoyment of designed nature and constraining its therapeutic and social benefits. These findings suggest that while Phoenix-See could represent a model for biophilic regeneration in post-industrial contexts, its long-term effectiveness depends on integrating social equity and accessibility into biophilic design and planning. In

line with Beatley's perspective on biophilia at the urban scale, biophilic regeneration should be understood as a socio-ecological project that simultaneously repairs ecosystems, restores human–nature relationships, and ensures inclusive access to the benefits of urban nature.

## REFERENCES

Beatley, T. 2011. Biophilic Cities: Integrating Nature into Urban Design and Planning, Island Press.

Beatley, T. 2016. Handbook of Biophilic. City Planning and Design, Island Press, London.

Benevolo, L. 1991. Le origini dell'urbanistica moderna, Laterza, Bari.

Costanza, R., d'Arge, R., de Groot, R. et al. 1997. The value of the world's ecosystem services and natural capital, Nature, vol. 387, pp. 253-260.

De Sousa, C. A. 2002. Brownfield redevelopment in Toronto: an examination of past trends and future prospects, Land Use Policy, vol. 19, issue 4, pp. 297-309.

Emschergenossenschaft 2023. PHOENIX See. Ergebnisse des Monitorings für das Jahr 2021, Essen.

Falco, E., Garda, E., Zardo, L., et al. 2024. Learning from Two Early Brownfield Redevelopment Projects in Italy: Soil Desealing, Cooling Effects, and Implementation of Nature-Based Solutions Through Traditional Planning Tools, Land, vol. 13, no. 10, pp. 1700.

Frank, S. 2021. Gentrification and neighborhood melancholy. Collective sadness and ambivalence in Dortmund's Hörde district, Cultural Geographies, vol. 28, no. 2, pp. 255-269.

Gandy, M. 2022. Natura Urbana. Ecological Constellations in Urban Space, MIT Press.

Kellert, S. 2008. Dimensions, elements, and attributes of biophilic design, Biophilic Design, pp. 3-20.

Kellert, S. 2018. Nature by design: The practice of biophilic design, New Haven, Yale University Press.

Kellert, S., Calabrese, E. 2015. The Practice of Biophilic Design.

Lefebvre, H. 1991. The Production of Space, Blackwell.

Lennon, M., Scott, M., O'Neill, E. 2014. Urban Design and Adapting to Flood Risk: The Role of Green Infrastructure, Journal of Urban Design, vol. 19, no. 5, pp. 745–758.

Pievani, T. 2014. The sixth mass extinction: Anthropocene and the human impact on biodiversity, Rendiconti Lincei, Scienze Fisiche e Naturali, vol. 25, no. 1, pp. 85–93.

Prominski, M., Stokman, A., Zeller, S. et al. 2012. River Space Design. Planning Strategies, Methods and Projects for Urban River, Birkhauser, Basel, Switzerland.

Ryan, C. O., Browning, W. D., Clancy, J. O. et al. 2014. Biophilic design patterns: Emerging nature-based parameters for health and well-being in the built environment, Archnet-IJAR: International Journal of Architectural Research, vol. 8, no. 2, pp. 62–76.

Scott, M., Lennon, M., Haase, D. et al. 2016. Nature-based solutions for the contemporary city/Re-naturing the city/Reflections on urban landscapes, ecosystems services and nature-based solutions in cities/Multifunctional green infrastructure and climate change adaptation: brownfield greening as an

adaptation strategy for vulnerable communities?/Delivering green infrastructure through planning: insights from practice in Fingal, Ireland/Planning for biophilic cities: from theory to practice, Planning Theory & Practice, vol. 17, no. 2, pp. 267–300.

Tang, S., Jiang, J., Zheng, Y. et al. 2021. Robustness analysis of storm water quality modelling with LID infrastructures from natural event-based field monitoring, Science of the Total Environment, vol. 753.

van de Weyer, K., Meis, S., Sümer, G. 2024. Entwicklung von Flora und Vegetation im PHOENIX See (Dortmund) – zwölf Jahre nach Anpflanzungen mit Armleuchteralgen unter besonderer Berücksichtigung des Starkregenereignisses im Jahr 2021, Rostocker Meeresbiologische Beiträge, vol. 33, pp. 70-86.

Volkens P., Wilbertz M., Petruck A. et al. 2023. PHOENIX See: Die Folgen des Starkregenereignisses im Juli 2021 für den See und seine Ökologie", in Gesellschaft für Limnologie (ed.), Ergebnisse der Jahrestagung 2022 (Konstanz), Essen.

Wantzen, K. M., Piednoir, T., Cao, Y. et al. 2022. Back to the surface – Daylighting urban streams in a Global North–South comparison, Frontiers in Ecology and Evolution, vol. 10.

Wilson, E. O. 1984. Biophilia, Harvard University Press.

## WEBSITES AND THE DATE CONSULTED

Web-1 https://www.dortmund.de/dortmund-erleben/freizeit-und kultur/phoenixsee/natur-und-umwelt/

# "URBAN HYDROSYSTEMS: THE INTERPLAY OF WATER AND DESIGN IN UAE CITY DEVELOPMENT"

Dr. Cristiano Luchetti
American University of Ras Al Khaimah
*crikx@yahoo.com*

## ABSTRACT

Since ancient times, the process of urbanization of human settlements has been based on the presence of water. Historically, cities have indeed grown around navigable waterways or seaports. Water has been a crucial means of transportation for goods and people. Furthermore, it is a fundamental element for the livability of functional and residential aggregations and for shaping the built environment. It is crucial to ensure the survival, development, and well-being of urban communities, directly influencing multiple aspects of city life, from basic provision to environmental quality and economic sustainability. In Gulf countries, characterized by arid climates, such a symbiotic relationship between water and cities is even more stringent.

The paper will address predominantly design-related themes that consider urban requalification of sites in different ways influenced by the presence or absence of water. These sites, located both on the coast and in the desert, demonstrate their strategic potential and high relevance for the sustainable future of Gulf Arab cities. Projects, developed by students within architectural design courses in both local and international architecture programs, have interpreted the relationship with water as foundational to the urban characteristics of the sites. To obtain a multiplicity of viewpoints, the selected projects describe a variety of scenarios. The presence of water can condition possible future urban solutions by stimulating the drafting of various design approaches, assuming specific spatial potentialities from time to time. The paper will investigate the characteristics of artificial manipulation of coastal geography and how architecture, acting as a catalyst for environmental requalification, can promote sustainable real estate developments. In another case, the theme of requalification of industrial port areas will be addressed. Over time, the expansive process of many contemporary cities has changed the identity nature of the original port areas. These areas, initially conceived as purely productive and peripheral, become central and strategic for the redefinition of contemporary urban planning. They require design attention that promotes and assigns a new identity, both spatially and functionally. Finally, albeit in different ways, the desert has also witnessed housing developments closely linked to the presence of water. The ancient trade routes through the inland territories of the Arabian Peninsula connected points on maps indicating the presence of oases. Along these routes, we can now identify modern road axes connecting major contemporary urban centers. In such environments, some Bedouin communities have developed from nomadic to settled, thanks to government-sponsored

housing programs. Desert settlements today require a reexamination of their antagonistic identity, both in relation to urban centers and contemporary urban peripheries.

In conclusion, the design ideas and architectural solutions represented in the works developed by students demonstrate the transformative power of water. They confirm the possibility of applying social and environmental sustainability principles to different areas. Still, they all share a foundational relationship with water, which has become a fundamental design element for their architectural redefinition.

KEYWORDS: Arabian Gulf Cities, Water, Urban Development, UAE

## 1. INTRODUCTION

Throughout history, the process of urbanization has been deeply intertwined with the presence of water. In their earliest forms, cities emerged around navigable waterways or seaports, utilizing water for their survival and as a vital mode of transportation for goods and people. This crucial element has not only shaped the physical environment but also ensured the survival, development, and well-being of urban communities [1]. Its influence permeates multiple aspects of city life, from essential services to environmental quality and economic sustainability. In the Gulf countries, where arid climates prevail, this symbiotic relationship between water and cities is even more pronounced, underscoring the central role of water in shaping the physical environment and urban planning.

In the UAE and neighboring nations, global warming is causing increasingly high temperatures and low precipitation rates. However, Emirati cities' rapid growth and urbanization have triggered an unprecedented demand for water. Furthermore, the luxurious lifestyle and lack of conservation measures among residents have led to high levels of water consumption and waste. In the UAE, per capita water consumption is 550 liters per capita per day, compared to a global national average of 250 liters per day [2].

As the demand for water continues to rise, the nation's resources are becoming increasingly strained. A stark projection suggests that per capita water availability in the MENA region could be halved by 2050, posing severe threats to the region's already-stressed aquifers and natural hydrological systems [3]. Presently, the country relies heavily on seawater desalination to meet its needs, including the production of drinking water [4].

Dubai, known for its grandeur and architectural prowess, never ceases to amaze the world with its spectacular real estate projects, often seeking water geographical connection. Other Gulf cities have assimilated Many lucrative urban planning and land modeling strategies pioneered in the emirate. This refers, above all, to the redefinition and artificial lengthening of the coastline, which tends to increase the number of buildings lots with direct access to the sea. This relationship with water, always considered an addition to the value of real estate, is pursued on the coast and within the urban agglomeration. An example is the completion of the Dubai Canal, which extended the Dubai Creek to the sea in the Jumeirah area.

On the one hand, this urban planning operation has allowed for a better environmental structure of the waters of the saltwater arm. However, the value of the real estate areas adjacent to the new waterway has enormously increased. A fact confirmed by the nature of the luxury residential projects currently under construction along that portion of the canal but also by the boost that the Business Bay area has benefited from [5]

Recently, the relationship with water has been expressed mainly through creating new areas of the city that have artificially conquered the stretch of sea in front of the coast (The palms, La Mer, Dubai Islands, etc.). Recently, water has become an attractive and dominant element of the real estate offer both in terms of characterizing public spaces and amenities offered with the purchase of newly built apartments and from an eminently architectural point of view. The city's skyline, characterized by towering skyscrapers and innovative designs, seems to continue to push the boundaries of luxury. In the most luxurious examples, the practice of proposing a facade that hosts private swimming pools attached to the balconies of luxury apartments is emerging [6].

It is an architectural trend that appears to compensate for the impossibility of pursuing the creation of green facades that are proposed in some new buildings in other continents and which, for obvious reasons of efficient maintenance, encounter difficulties in being created in arid climates like the UAE. Therefore, to maintain its opulence, the city seems to rely on the freshwater it does not have. To overcome this shortcoming, Dubai and the rest of the UAE turn to the sea, using energy-intensive desalination technologies that help hydrate the rapidly growing metropolis. All this has a cost. Experts say Dubai's reliance on desalination harms the Persian Gulf, producing a brackish waste known as brine, which, along with chemicals used during the desalination process, increases salinity in the Gulf. Furthermore, it increases the temperature of coastal waters and damages biodiversity, fisheries, and coastal communities [7].

The environmental impact of urban and architectural operations is not the main focus of this writing, although it is fundamental. In contrast to the examples mentioned earlier, the focus is on research conducted through design developments exploring water beyond its speculative value. These urban hydrosystems aim to engage with water in various ways to propose sustainable and innovative designs. The projects discussed in this text serve as illustrations of contemporary urban water-related issues in the Gulf cities. Below, we have chosen to discuss urban and architectural projects designed by students who have worked on the reconversion of port areas that are no longer productive, the relationship between the artificially modified coastline and its possible improvement in environmental conditions, and finally, the potential for urban development of settlements linked to the presence of oases in the desert.

## 2. THE RECONVERSION OF THE DISMISSED INDUSTRIAL HARBOR

The first project we illustrate addresses the theme of the functional reconversion of industrial areas that have lost their productive vocation over time. Given their centrality concerning the city's urban expansion, they remain strategic if considered integral parts of the overall urban development. This theme unites many metropolitan areas in the Gulf, but not only. In fact, since the beginning of the 2000s, political economists have produced a wide range of publications on urban regeneration projects and their potential

for the functional reconversion of city areas (Swingedouw et al., 2002; Orueta & Fainstein, 2008; Guironnet & Halbert, 2014).

Within the general theme, the reconversion of port areas represents a specific chapter. In many cases, cities and their ports have established a relationship regulated by precise balances, which have determined the lines of their morphological structure, influencing their economy and the organization of social life [11]. Over the years, this relationship has, in many cases, deteriorated, often creating territorial fractures due to the transformation of technologies for transporting and moving goods. In some cases, the growth in the volume of operations required moving the original structures to new, larger, and more efficient ports. Given their predominant coastal nature, this problem can be observed in several Emirati cities.

Except for Al Ain, all the major cities of the UAE are located on the southern coast of the Persian Gulf. This location depends on the various factors that historically caused their settlement. Since ancient times, the first villages that gave rise to the current contemporary metropolises have benefited from their strategic position inserted in the sea and land routes of intercontinental trade. At the same time, the primary sources of subsistence, such as pearl cultivation and fishing, in an area with a hostile climate and somewhat stingy with natural resources came from the sea. Therefore, it is evident that this connection with the sea for the cities of the United Arab Emirates has continued and consolidated up to the present day.

In many cases, immediately after the foundation of the first urban centers, the areas containing port equipment and infrastructure played a central role in their urban development. One example is the Mina Zayed area in Abu Dhabi, where the Zayed Port is located. Opened in the early 1970s, Zayed has been Abu Dhabi's central port for over 40 years and has played a fundamental role in promoting the emirate's international trade [12]. Furthermore, this central commercial maritime hub has extended its activities over time, offering essential tourist cruise facilities [13].

The port is flanked by a vast logistical support area that overlooks Al Lulu Island and is the terminal location of the Corniche, Abu Dhabi's seafront. Beyond Mina Zayed, overlooking the canal that separates the center of Abu Dhabi from its urban branches to the northeast on Sadiyaat Island, the new architectural jewels of the city stand out. A series of public buildings, predominantly cultural, completed or still under construction, designed by contemporary star architects such as Jean Nouvel, Norman Foster, Frank Ghery, and Mecanoo, to name a few.

Therefore, it can be argued that if in the past Mina Zayed, at least from a geographical point of view, constituted the terminal coastal element to the north-east of the capital's urban system, today it is taking on the role of a fundamental node in the framework of strategic development of the city'. Beyond Mina Zayed, there is no longer the emptiness of the desert but, rising rapidly, the area of Sadiyaat, that of the great museums, which aspires to become a point of reference for cultural tourism on a global level. Perhaps also for this reason, the industrial role of the Zayed Port was almost completely dismantled in 2012 with the transfer of critical shipbuilding activities relating to containers to the Khalifa Port—a 7.2-billion-dollar operation [14]. Further from the city, strategically positioned halfway between Abu Dhabi and Dubai, the new port seems to be able to collect and sort "heavy" trade in a much more modern and efficient way.

The operation frees Mina Zayed from the yoke of industrial vehicle traffic which is now unsustainable for the city center and incompatible with the urban planning ambitions linked to the area's new identity. For these reasons, a near future needs to be planned for Mina Zayed. The large storage area, filled with identical

warehouses arranged according to a functionally obsessive spatial grid, becomes an opportunity to rethink its typological destination. Mina Zayed indeed represents one of the first and most important examples of necessary coastal industrial urban regeneration in the United Arab Emirates and perhaps in the entire Gulf [15].

In an urban cultural scenario that is not yet able to reflect on the me errors caused by the sudden growth that has characterized the last decades of the Emirates' metropolitan landscape, a new question arises for the first time: What will be the future spatial character (and functional) associated with Mina Zayed and all similar places in the region that are gradually undergoing the same transformation?

The design choices must first establish the level of identity change these areas must undergo. If, at a superficial glance, places like Mina Zayed seem to take on purely industrial roles that are far from proposing specific social and community realities, we may understand something else through a close analysis. In the Gulf cities, these areas are often inhabited by the same immigrants who work there. Over time, they consolidate their presence by becoming bearers of a cultural expression beyond their mere productive contributions. It has been a long time since Mina Zayed became part of the collective urban imagination of Abu Dhabi as a place in itself. Over the years, the cultural multitude has built a plant souk, a fruit and vegetable market, a meat market, a carpet souk, a date souk, and a further wholesale souk [16]. Within each market, hundreds of men and women have settled and have found a home in this city: Iranians, Indians, Syrians, Pakistanis, Bangladeshis, and many others [17]. While the urban regeneration of coastal cities in the United Arab Emirates is receiving global attention from researchers and scholars, almost no literature has examined the transformations taking place in the local communities present on the coastal strip in the country [18]. For this reason, the theme of the redevelopment of Mina Zayed becomes a model of architectural and urban research that contains global suggestions. They go beyond the specificity of the site in question to attempt to define "strategic directions" that can be applied in any similar context.

The interests at stake are multiple and of great importance. Consequently, the projects underway also reflect this specific urban weight. The recent architectural regeneration interventions of some warehouses that have been converted into cultural or educational centers demonstrate a regenerative process already present. Furthermore, other project proposals have remained on paper for a long time but are becoming more and more realistic and in the process of being built [19]. For example, Modon Properties has announced the start of work on the redevelopment plan for the entire area into a predominantly tourist/commercial destination, also providing for a residential program for almost three million square meters [20]. This process began with the demolition of the Mina Plaza, an unfinished building; it was a symbol of potential for many years but never resolved real estate interest. The Mina Zayed redevelopment project will constitute the geographical point of connection between the modernist city center of Abu Dhabi and the new urban areas planned for Saadiyat Island. It will have to accommodate cultural and social multiplicity demands, converting them into new and appropriate architectural languages and urban spatialities.

Starting from this analysis, which focuses on both the urban and cultural characteristics of the context, the students of the Architectural Design course for the Enhancement and Conservation of the Architectural Heritage of the Polytechnic University of Marche supervised by Prof. Gianluigi Mondaini and the writer, have developed a project proposal for the requalification of a part of the area. The project

proposes adding multiple innovative functions to create a new significant urban centrality. The area's transformation occurs without altering the pre-existing industrial context through minimal removals and the addition of an architectural superfetation consisting of a new layer of designed elements.

The central road is the generator and catalyst of redevelopment. It divides the two linear and parallel blocks of the warehouses. A series of new volumes define the large pedestrian axis, creating new urban fronts. The added volumes mainly provide catering functions to the reclaimed road. Compared to the existing geometric order, their particular and differentiated shapes stand out on the central avenue, creating a perceptive dynamism. This functional buffer is between the central public axis and the new functions in the renovated existing warehouses. In addition to the added functions, it provides a new access system to the volumes behind it. The new Auditorium is a telescope-shaped element that unites four warehouses and overlooks the volumetric panorama, becoming a landmark visible at night. The new art galleries, spaces dedicated to coworking, and laboratories are versatile and suitable for various functions that can be modified over time as needs change. The commercial functions are strategically positioned on the main pedestrian routes, while some are dedicated to outdoor sports (football, skateboarding, and climbing).

The new volumes influence the landscape design of the entire area. Their geometries overlap with the linear pattern of the flooring, creating green spaces and bodies of water that improve user comfort from both a perceptive and environmental point of view. The road network connection is resolved by identifying drop-off areas and car parks near the primary nodes of the project.

## 3. THE GREEN LAGOON

The "Green Lagoon" is a multifunctional project proposed for the body of water called Al Khan in Sharjah. It is an urban development that combines the possibility of building prestigious residential units, public spaces, and related services, considering the intervention's high sustainability, especially from the point of view of improving the lagoon's general environmental conditions.

The lagoons of Al Khalid, Al Khan, and Al Mamzar are among the most critical natural resources of the Emirate of Sharjah, as they play an essential role in the coastal socioeconomic environment of the area [21]. They are located at the center of the contemporary development of the city of Sharjah and are surrounded by a series of high-rise residential towers. Although lagoons are characteristic of the coastline of the city of Sharjah, they are not a natural morphological phenomenon, having been created artificially [22].

The Al Khan area, as depicted in the first aerial photos, was predominantly characterized by what the Arabs refer to as 'Sabkha' (سبخة). This is a coastal and supratidal mudflat that sits just above normal high tide levels, graded between land and intertidal zone within narrow coastal plains. While the nearby Khalid Lagoon was built and stabilized around 1980, the Al Khan Lagoon remained in its original 'Sabkha' condition until the early 1990s, marking a significant phase in its evolution.

In 2000, the Al Qasba Canal was built, connecting the two lagoons, Al Khan and Al Khor. This project has had a positive impact on the general environmental quality of the area. The connection between the two artificial lakes improved water quality by allowing tidal flow from one lagoon to the other. However, despite

the Al Qasba Canal's positive environmental impact, the water quality in some areas of the Al Khan Lagoon still has pollution problems. In fact, these water bodies built in urban areas resemble small and shallow semi-closed lagoon systems but have long washing times and limited water exchanges [23].

The "Green Lagoon" project, designed by Tigran Kostandyan and supervised by the writer, intends to address this problem by proposing an alternative real estate strategy. The proposal involves the establishment of a residential neighborhood through the use of innovative water disposal and recycling systems. Furthermore, introducing the mangrove biome as the main element of the landscape proposal will allow for improving the general quality of the lagoon waters. Mangroves are taxonomically diverse, primarily woody plants commonly found in the intertidal zone on the fringes of tropical and subtropical coasts. They are salt-tolerant trees that grow on tidal flats [24].

Mangrove species are uniquely suited to tolerate the dynamic and physiologically stressful intertidal environment, facing extreme conditions such as anoxic and fluid sediments, repeated tidal flooding, high salinity, and a limited time window available for rooting and establishment [25]. They can maintain high rates of photosynthesis and growth in saline sediment conditions because they have structural and anatomical characteristics that confer water use efficiency [26]. Mangrove forests are present in the United Arab Emirates, especially along the coast of Umm al Quwain, Abu Dhabi, and Fujairah. Qualitatively, it has long been known that mangrove forests provide different types of services due to their physical environment and biological characteristics [27]. Among these capabilities, the one that interests us most here is the ability to play an important role in recharging aquifers and maintaining water quality by filtering river and tidal waters from sediments, minerals, contaminants, and nutrients. The dense root structures of mangrove trees allow them to function as natural filters by capturing fine sediments.

The project involves two linear platforms anchored to the bottom of the lagoon, which connect the public spaces of the Al Qasba canal with a pedestrian bridge. The two "floating" avenues are surrounded by mangrove forests, which, as previously described, in addition to constituting an attractive landscape solution, contribute to improving the water quality in the lagoon. The entire project area is pedestrian but proposes a small-scale autonomous electric transport system connecting various areas and buildings.

The two main directions of the project are characterized according to functional areas. The areas surrounding Al Qasba contain functions that replace an ideal continuation of the public vocation of the canal. In the more central areas of the lagoon, the residential functions are positioned in a way that benefits from greater privacy, a direct relationship with the surrounding lagoon, and broad views of the water and the city skyline. An exchange car park is located at the opposite end of the lagoon. From it, there is access to an electric rail transport service that connects the various parts of the project and allows rapid movement for the complex's inhabitants.

Unlike many artificial islands built in the region, "Green Lagoon" does not involve dredging operations. The project is elevated above the water by a structural grid anchored to the ground, allowing water to flow beneath it. The project was defined as considering local environmental conditions by providing large public spaces within the lagoon. Therefore, the sustainable design strategy adopted considers the concept of "eco-system" as a founding element of the new architecture proposed for the lagoon.

## 4. AGRICULTURAL HYDROSCAPES OF THE DESERT

In the internal regions of the United Arab Emirates, far from the crowded coastal metropolises, lies a vast desert characterized by harsh terrain, where several little-known Bedouin villages are located. Such settlements witness the delicate balance between human survival, rich cultural heritage, and the local landscape's extreme natural and climatic conditions, dominated by dunes and rocky mountains. Sometimes, however, it is possible to identify water sources that have allowed the formation of original communities in these landscape areas, commonly known as oases. Traditionally, scholars of the urban and architectural phenomena of the Gulf have focused mainly on urban centers, neglecting the villages present in the internal areas. However, recently, due to a seemingly unstoppable expansion towards the desert, local authorities have begun to turn their attention to studies and proposals for the redevelopment and development of inland settlements [28]. A significant example is represented by the Dubai Rural and Countryside Development Master Plan, approved by Sheikh in November 2022 [29]. These settlements can be viewed as strategic locations to counter urban over-expansion by expanding into the desert in search of land for economic development. Numerous scholars have studied the negative impacts of this phenomenon, including increased energy consumption and pollution, traffic congestion, and the loss of identity in urban areas. The natural environment is also suffering severe consequences, with the destruction of wildlife habitats and the fragmentation and degradation of natural areas. [30] From this point of view, the valorization and development, both functional and spatial, of desert villages can create a sustainable alternative to urban expansion that can benefit local populations and the natural environment. Below, we will explain in detail the context and illustrate the design results of a collaboration that took place in 2022 between the Architectural Design VII courses held at the American University of Ras Al Khaimah in the UAE and Architectural Design for the Enhancement and Conservation of the Architectural Heritage held at the Polytechnic University of Marche in Italy.

The main goal of the research collaboration was to create project proposals that would enhance the appeal of the areas for the benefit of current and future residents. In order to achieve this, it was important to thoroughly analyze the local landscape, as well as the urban, economic, and cultural characteristics, in order to develop design solutions that would reinforce and optimize the existing features. This approach was considered crucial due to the unique nature of the context [31].

## 5. ADAPTATION AND AGRICULTURE: LIVING IN THE UAE DESERT

Despite extreme environmental challenges and water scarcity, local communities have inhabited deserts for centuries, shaping a unique lifestyle and culture. Although many of these places have undergone significant modernization, residents continue to maintain their traditions and distinctive cultural heritage. From Bedouin craftsmanship to agricultural techniques, such settlements are a testament to Emirati resilience, ingenuity, and respect for the environment [32]. Such cultural richness must be preserved, and the government's recent efforts to preserve and promote such communities are starting to bear fruit, especially in the tourism sector, which is bringing significant economic benefits to the country.

For example, the Dubai government is allocating significant resources to domestic infrastructure to stimulate economic development and boost tourism. Several projects have been initiated, including road construction, electricity supply, and water supply management, to improve accessibility and quality of life in these areas. At the same time, the focus was on tourism promotion through creating high-level accommodation facilities and offering various leisure activities. These efforts have attracted a constant flow of tourists, fascinated by the unique combination of tradition and modernity, pristine landscapes and rich cultural heritage.

Consequently, settlements in inland areas continue to play a fundamental role in the country's economic and cultural development. This is due not only to the previously mentioned reasons but also to the significant role of agriculture in desert communities. Although the UAE is primarily known for its oil and gas resources, the government has aimed to diversify the national economy and reduce dependence on the oil sector [33]. One of the ways is to support agriculture in the desert, which, as one can easily imagine, turns out to be a very challenging task due to the numerous limitations linked to the climate, the quality of the soil, and, above all, the scarcity of water [34]. Agriculture has always been a traditional practice in the region. Limited initially to date palm cultivation and based on the falaj irrigation system: a thousand-year distribution of water made up of underground tunnels, small streams, and canals [35]. After the discovery of oil, which marked the beginning of the modern commodity frontier, agriculture took on a secondary role to improve the standard of living and facilitate the transition from traditional to modern social structures [36]. Recently, local authorities have identified agriculture as a critical sector for diversifying the economy and ensuring food security. In 2014, the government launched the National Food Security Strategy to improve food production and reduce import dependency. According to this strategy, the UAE will produce 60% of its food needs nationally by 2050.

Dubai, the United Arab Emirates' most populous city, has been at the forefront of national efforts to support desert agriculture. In recent years, the Dubai government has launched several initiatives to promote agriculture, even in urban areas. One such initiative is the Dubai Food and Water Security Strategy, which aims to increase local food production by 25% by 2025. This strategy focuses on three main pillars: innovation, research and development, and investment. The innovation pillar promotes sustainable food production techniques such as hydroponics and vertical farming. The research and development pillar aims to develop new crop varieties and improve irrigation methods. The investment pillar seeks to attract local and foreign investors into the agricultural sector. The DFSC has launched several initiatives to support desert agriculture, providing training in hydroponics, aquaculture, and other sustainable agricultural techniques and offering financial support to future farmers to start their agricultural businesses [37].

A further initiative the DFSC promotes is the "Grow your own food" campaign. These campaigns incentivize residents to grow their food both at home and in community gardens, offering them training and resources for growing fruit and vegetables using sustainable techniques such as hydroponics and vertical farming [38]. Additionally, the UAE government is investing in research and development to improve desert agriculture. The Dubai Future Accelerators program, launched by the Dubai Future Foundation, supports startups in the agricultural sector. The program allows startups to collaborate with government bodies and develop innovative solutions for the agricultural sector [39]. The relevant authorities have also established Dubai's International Center for Biosaline Agriculture (ICBA). ICBA is a research center that focuses on using

saltwater and marginal lands for agriculture. The center conducts research and development to develop crops resistant to salinity and drought. The center also provides training and technical support to farmers in the UAE and other countries in the region [40].

Urban life extends toward the desert, integrating tourist activities such as excursions, parachuting, safaris, and glamping into these contexts. With local and sustainable tourism on the rise, even desert farming is becoming an attraction thanks to the UAE's agritourism program. This program not only offers visitors a unique experience but also has a significant impact on local communities. By taking visitors through local farms and allowing them to learn about traditional and modern agricultural techniques, animal husbandry and crops, it is increasing the demand for local food products and contributing to the sustainable development of the region. [41]

In summary, the central government, through the local authorities of the various emirates, has made significant efforts to promote desert agriculture. The results of these efforts are evident in communities spread across the desert. For instance, Margham, a desert settlement, has been chosen as a pilot site for experimental projects in this field.

## 6. THE PROJECT SITE

Dubai is mainly configured as a linear city that develops its infrastructure along the coast but has always maintained an intense and intricate connection with the internal desert regions [42]. The scarce and scattered water sources attracted the settlement of communities that constituted the main nodal points along the desert routes. This geographical system forms what can be defined as Dubai's network of "peri-urban oases", which generally also coincide with the presence of agricultural land.

Since the 1970s, these areas have traditionally been the focus of government strategies aimed at providing settlement for traditionally nomadic populations and making parts of the desert suitable for cultivation and productivity [43]. One such settlement is the village of Margham. The local desert area is abundant in flora and fauna, with many unique species of plants and animals found nowhere else, such as the Arabian oryx, sand gazelle, and other animals in the neighboring Dubai Desert Conservation Reserve [44].

The geographical location of the settlement is unique as it is located between two major cities: Dubai and Abu Dhabi. It is bordered by the Saih Al Salam and Sabkha Desert to the north, the Dubai Desert to the east, and the Hatta Mountains to the south. Its development was facilitated by its position as it is located on the ancient trade routes that connected Arabia to Persia, India, and China. The village has, therefore, been a point of reference for caravan traders and desert travelers since ancient times. [45] Despite its long history, however, Margham remained a sparsely populated area until the discovery of oil in the 1960s. The development of oil fields in the area has led to an influx of people and investment into the region. Over the years, the desert area was transformed into pastures, and the first agricultural activities started at the end of the last century. Soon, Margham became home to nomadic Bedouin tribes who traditionally lived from livestock and farming.

The Margham settlement exemplifies human resilience and prosperity even in extreme environments. With government support, Margham could become a hub for ecotourism, developing new

approaches to desert living. Like many other villages, the urban structure is characterized by single houses, with one or two floors, positioned in the center of lots delimited by perimeter walls, following the modern Emirati tradition. The village's layout includes a central space intended to provide essential services to the community, although in most cases, it has remained unused, except for the mosque's mandatory presence. The authors searched for information on the urban plan defined by Dubai Municipality but did not find clear answers; they defined this typology as a "pinwheel." The homes are arranged around this empty space, with the residential lots developing progressively from the center outwards, following a centrifugal movement over time. In addition to the residential settlement, the Margham area is characterized by a series of agricultural lands arranged along the main artery. Here, Emirati tribal families coexist, albeit clearly separated, with migrant workers who reside in temporary housing, sometimes built independently, near the cultivated fields.

## 7. THE PROJECT

A comprehensive historical analysis of the area's morphological and social characteristics was crucial in identifying its design potential. After thoroughly evaluating the site, the students developed a master plan to define the volumes and functions for the designated areas outlined in the initial program. Integrating agriculture into development and redevelopment strategies could establish a robust and recognizable local identity. Consequently, students proposed adding two significant categories of functions to the existing ones. The central idea was to enhance Margham with activities that contribute to a broader plan. This proposal envisions a city spread across the desert, consisting of villages with distinct identities. Specifically, for Margham, the creation of three thematic clusters was suggested:

- Agri-Tech
- Commercial-Museum
- Residential

Although the students carefully studied each area, only one of the projects developed in the residential cluster will be described here. The main objective was to find a solution for the previously mentioned areas that remained empty in the system's center, which consisted of residential lots. The design for this site proposes a complex that is inclusive and caters to various needs. It integrates various "local" functions, such as a civic center, a kindergarten, and commercial services, to serve the immediate community. Furthermore, functions intended for external visitors are planned. The fruit and vegetable market was included to celebrate local agricultural activity and attract customers interested in locally grown vegetable products. Additionally, "co-working" spaces will offer remote working opportunities to reduce residents' travel to major cities. The addition of a "wedding hall" was also planned to serve the inhabitants of the surrounding villages and provide a location for wedding celebrations, following the traditions of the desert

The concept behind the master plan is based on the fundamental difference in size scale between humans and the surrounding landscape. While the desert presents a vast and imposing infinite scenario, human living requires defined and familiar spaces and proportions. For this reason, the decision to create a

porous enclosure, like a boundary wall, was taken to highlight the transition between the external landscape and the new spaces of the project, sized specifically for humans, both outside and inside.

Even a symbolic aspect deserves attention. It emerges in reference to the traditional perimeter walls of the surrounding lots, which are distinctive of residences in the United Arab Emirates. These walls delimit the intimate and familiar space, carefully concealing privacy from the external view. In contrast, the perimeter wall in the project is designed to be highly permeable, highlighting its public nature. The accesses to the neighborhood, arranged along the perimeter, define a series of pedestrian passages covered by shelters that, crossing the entire complex, connect the different living areas up to the existing mosque. The mix of open spaces and buildings creates a unique urban fabric, offering desert dwellers a new spatial and functional experience. Within this new urban context, buildings alternate with open spaces, allowing for a flexible experience adaptable to changing climatic conditions (winter/summer) and community needs.

The various types of buildings and open spaces were designed considering the local community's cultural peculiarities. However, the focus is not limited to simply creating high-quality spaces; they must also be sustainable. The synergistic integration of living systems and environmentally friendly materials/technologies was a key feature from the beginning of the design process. In particular, dealing with the extreme desert climate is one of the main challenges. Temperatures can exceed 50°C during the summer, making an adequate air conditioning system essential to ensure a habitable environment.

Consequently, it is essential to design structures capable of withstanding adverse weather conditions and equipped with both artificial and natural cooling systems. Furthermore, the scarcity of water resources represents another significant obstacle. In the United Arab Emirates, most water is obtained through desalination plants. Therefore, it is crucial to design technological solutions in buildings that minimize water consumption [46].

## 8. CONCLUSIONS

The findings from this study emphasize the critical role of water in the urbanization process and the development of urban communities. Throughout history, cities have emerged and expanded around water resources, which have been essential for the survival and progress of human societies [47]. This interdependent relationship between water and cities is particularly evident in the Gulf countries, where the scarcity of water underscores its strategic significance for community sustainability.

The examination of urban redevelopment projects created by students illustrates how water continues to play a central role in shaping the characteristics and design of urban spaces. The various design approaches used demonstrate the impact of the presence or absence of water on urban solutions. Whether creatively utilizing coastal geography, transforming industrial port areas, integrating oases into desert urban landscapes, or supporting settled Bedouin communities, the importance of water is clear in shaping sustainable future solutions for Arab Gulf cities.

The project proposals confirm the potential to apply social and environmental sustainability principles to diverse urban areas using architectural and urban planning models that provide high spatial quality. All projects share a fundamental connection with water, which becomes a vital element in the architectural and urban redefinition of these urban and peri-urban areas. Ultimately, the role of water in urban design remains

highly relevant, as it continues to shape and influence the built environment and our way of life in the future cities of the Arab Gulf.

## REFERENCES

Maria Monteleone, “Evolution of the relation between human society and urban water from ancient roman times to modern urbanization,” Water Science & Technology: Water Supply 8(5), December 2008.

Khalifa Al Suwaidi, “UAE’s water problem: why waste, waste water?” https://www.linkedin.com/pulse/uaes-water-problem-why-waste-khalifa-alsuwaidi/ (accessed May 21, 2024)

Sylvia Szabo, “The Water Challenge in the UAE.” Dubai School of Government Policy brief, Policy Brief No. 29, December 2011.

Omnia Al Desoukie, “Skyscrapers in the Desert: The UAE Tries to Defy Its Water Scarcity,” Goethe institute, August 2020, https://www.goethe.de/prj/ruy/en/dos/wil/21943292.html (accessed May 21, 2024)

Cristiano Luchetti, “Dubai Creek: from commercial dock to strategic urban infrastructure”, Compasses, pp. 37-42 / Vol 26, 2017.

Dubai's Balcony Swimming Pools: Ultimate Luxury or Safety Concern? fäm Properties, August 25, 2023, https://famproperties.com/blog/dubais-balcony-swimming-pools (accessed May 21, 2024)

Arielle Paul, “Dubai’s Costly Water World,” New York Times, January 12, 2024, https://www.nytimes.com/2023/11/18/business/dubai-water-desalination.html (accessed May 21, 2024)

Erik Swyngedouw, Frank Moulaert, and Arantxa Rodriguez, “Neoliberal Urbanization in Europe: Large–Scale Urban Development Projects and the New Urban Policy.” Antipode 34 (2007): 542–77.

Fernando Orueta and Susan Fainstein, “The New Mega-Projects: Genesis and Impacts.” International Journal of Urban and Regional Studies, 32 (2008): 759-767.

Antoine Guironnet and Ludovic Halbert, “The Financialization of Urban Development: Projects, Concepts, Processes, and Implications.” Document de travail du LATTS –Working Paper, n° 14-04, December 2014.

Stefano De Vito, “La riqualificazione delle aree portuali come progetto urbano.” Bollettino della Societa’ Geografica Italiana, Roma – serie XII, vol. IV (1999), Pag 75-104.

Nandini Kochar, “Into the UAE: A Tribute to Mina Zayed, Stories of Labor and Love”, The Gazelle, 2020. https://www.thegazelle.org/issue/191/features/tribute-to-mina (accessed May 18, 2024)

Abu Dhabi Ports web site. https://www.adports.ae/ports-terminals/commercial-ports/zayed-port/ (accessed May 15, 2024)

Wam, “Khalifa Port now fully operational.” Emirates 24/7, 2012. https://www.emirates247.com/business/economy-finance/khalifa-port-now-fully-operational-2012-12-09-1.486555 (accessed May 15, 2024)

Gianluigi Mondaini, Cristiano Luchetti, Francesco Chiacchiera, “Upgrading Mina Zayed: Strategie di rigenerazione dell’ex area portuale di Abu Dhabi. Progetti di riuso adattivo di aree commerciali e industriali nel contesto degli Emirati Arabi.” IX Forum ProArch. November 17-19, Cagliari, Italy. In proceedings: IX

Forum ProArch. Transizioni. L'avvenire della didattica e della ricerca per il progetto di architettura. Società Scientifica nazionale dei docenti di Progettazione Architettonica. (2023) Pag 127-132.

Mondaini, Luchetti, Chiacchiera, 2022.

Kochar, 2020.

Baraah Hamdoon, Khaled Ahmed, "Towards socially sustainable waterfront urban regeneration: the case of zayed port design, Abu Dhabi." WIT Transactions on Ecology and the Environment, Vol 253, (2021), Pag 335-346.

The National, "A look inside the planned new markets for Mina Zayed." 2020. https://www.thenationalnews.com/uae/heritage/a-look-inside-the-planned-new-markets-for-mina-zayed-1.1119461 (accessed May 15, 2024)

The National, 2020.

Mohamed N. Singer, Geórgenes H. Cavalcante, Serter Atabay, "Hydrodynamic modeling of Sharjah lagoons under climate changes, United Arab Emirates (UAE)." Regional Studies in Marine Science,Volume 63, 2023.

Geórgenes H. Cavalcante, Björn Kjerfve, David A. Feary, "Examination of residence time and its relevance to water quality within a coastal mega-structure: The Palm Jumeirah Lagoon." Journal of Hydrology, Volumes 468–469, (2012), Pag 111-119.

Geórgenes H. Cavalcante, Björn Kjerfve, David A. Feary, Andrew G. Bauman, Paolo Usseglio "Water Currents and Water Budget in a Coastal Megastructure, Palm Jumeirah Lagoon, Dubai, UAE," Journal of Coastal Research, 27(2), (2011) Pag 384-393.

Beth Polidoro, et al, "The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern." PLOS ONE 5(4): (2010).

Barry P. Tomlinson, "The Botany of Mangroves." 2nd ed. Cambridge: Cambridge University Press, 2016.

Ilka C Feller et al. "Biocomplexity in mangrove ecosystems." Annual review of marine science vol. 2 (2010): 395-417.

Katherine C. Ewel, Robert R. Twilley, and Jin Eong Ong. "Different Kinds of Mangrove Forests Provide Different Goods and Services." Global Ecology and Biogeography Letters 7, no. 1 (1998): 83–94.

Dubai Industrial Strategy 2030 and e Dubai 2040 Urban Master Plan. the latter marked by a vision of sustainable urban development of the city. http://dubai2040.ae/en/dubai-2040-urban-master-plan/ (accessed May 21, 2024)

Emirates News Agency, "Mohammed bin Rashid approves Dubai Countryside and Rural Areas Development Master Plan," https://www.wam.ae/en/details/1395303106040 (accessed May 21, 2024)

John P. Rafferty, "urban sprawl". Encyclopedia Britannica, 22 Mar. 2024, https://www.britannica.com/topic/urban-sprawl. (accessed 27 May 2024)

Cristiano Luchetti, Mondaini Gianluigi, and Francesco Chiacchiera, "Margham (UAE): A sustainable Desert Community" Ananke' 96-98, (2021) Pag.86-92 edited by Altralinea Edizioni

Georgia Daleure, "Holistic Sustainability' Policies: Preserving Local Cultural Identity in the UAE in the Face of Globalisation," Indian Journal of Public Administration, 65(3), (2019) Pag 749-768.

Dubai Industrial Strategy 2030 and e Dubai 2040 Urban Master Plan.

Sabrina Joseph, “Farming the Desert: Agriculture in the Oil Frontier, the Case of the United Arab Emirates, 1940s to 1990s.” British Journal of Middle Eastern Studies 45, no. 5 (2018): 678–94.

Shirley Kay, Emirates archaeological heritage. Motivate Publishing. 1987.

Joseph, 2018.

National Food Security Strategy 2051. https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/environment-and-energy/national-food-security-strategy-2051 (accessed 27 May 2024)

Emirates News Agency – WAM. Dubai Municipality opens "Grow Your Food" campaign with FAO participation. http://www.wam.ae/en/details/1395300435488 (accessed 27 May 2024)

Dubai Future Foundation. https://www.dubaifuture.ae/initiatives/future-design-and-acceleration/dubai-future-accelerators/how-it-works (accessed 3 May 2024)

ICBA https://www.biosaline.org/about-icba/vision-and-mission (accessed 3 May 2024)

Government of Dubai. http://www.moccae.gov.ae/en/knowledge-and-statistics/agritourism.aspx (accessed 3 May 2024)

Stephen J. Ramos, “The Blueprint: a history of Dubai’s Spatial Development through Oil Discovery.” Working Paper, Dubai Initiative, Belfer Center for Science and International Affairs, Harvard Kennedy School, 2009.

Pernilla Ouis, “Greening the Emirates: the modern construction of nature in the United Arab Emirates,” Cultural Geographies, 9(3), (2002): 334-347.

Dubai Conservation reserve website, https://www.ddcr.org/en/index.aspx

Kay, 1987.

David Pearlmutter, “Patterns of sustainability in desert architecture,” Arid Lands Newletter, no. 47, May 2000. https://ag.arizona.edu/oals/ALN/aln47/pearlmutter.html (accessed May 14,2024)

Krystyna Januszkiewicz and Jakub Golebieski, “Water Sensitive City. Within City as A Strategy for Activate Polluted Urban Areas,” IOP Conf. Ser.: Mater. Sci. Eng. 471 102043, 2019.

## BIOGRAPHICAL NOTE AUTHOR

Dr. Cristiano Luchetti is an architect, researcher, and educator with over 25 years of experience in both professional practice and academia. He obtained his PhD in architecture and urban design from the Universita' Politecnica delle Marche in Italy. After many years of professional work in Asia, Dr. Luchetti has been teaching and conducting research in architectural and urban design at universities in the UAE since 2012. Currently, he is an Associate Professor at the American University of Ras Al Khaimah in the UAE, where he teaches architectural design and theory courses. In his professional work, Dr. Luchetti provides consultancy for large-scale projects in the residential, commercial, and hospitality sectors of the Middle East. He also serves as the Associate Editor of Middle East for Compasses Architecture & Design and regularly contributes articles on the architecture and urbanism of the Arabian Gulf. In 2018, he co-curated the Egyptian pavilion at the Architecture Venice Biennale, and in 2021, he co-authored the book "Desert:Space - Architecture for Emptiness." Additionally, he frequently acts as a juror for major international competitions and awards.

# UNLOCKING ROAD SPACE: DESEALING AS A STRATEGY FOR URBAN SUSTAINABILITY

Gregorio Pezzoli
University of Bergamo
*gregorio.pezzoli@unibg.it*

## ABSTRACT

Desealing defined as the process of removing impermeable layers from the ground with the aim of restoring soil permeability and its ecosystem functions, is becoming increasingly central in urban environments worldwide. The desealing process can offer multiple benefits: it enhances biodiversity, reduces urban heat, improves stormwater management, and creates accessible spaces for social interaction and recreation. The desealing process is primarily promoted by the public administration on public land. It is inevitable that road space, which is typically dedicated to mobility, is affected. This has the potential to result in conflicts between the mobility needs and the increasing pressures that climate change exerts on urban systems and infrastructure. This contribution emphasizes the need to integrate a novel urban mobility paradigm to free road space for desealing processes. The methodology involves an analysis of the spaces dedicated to mobility in urban environments in the main cities of the Lombardy region, using Geographic Information Systems (GIS). The analysis is expected to reveal how much urban space is currently allocated to private cars, highlighting imbalances in the distribution of public space and underlining opportunities to create more equitable and inclusive urban environments through desealing processes. Integrating sustainable and active mobility with desealing strategies offers a pathway to more equitable and resilient urban environments, contributing to both the adaptation and mitigation of climate change, while demonstrating how urban design interventions can effectively reconcile mobility, social space, and sustainability.

KEYWORDS: Desealing; Mobility space; GIS analysis; Urban Resilience

## 1. INTRODUCTION

In recent years, urban expansion has caused progressive land consumption, defined as the expansion of urban areas or the increase in settlements at the expense of natural, semi-natural, and

agricultural land (EC, 2011; EC, 2012; Marquard et al., 2020). Urban expansion has negative impacts on biotopes, global warming, flood risk, and food production (Peroni et al., 2022). One possible remedy, which has gained increasing importance in the environmental policies of the European Union and its member countries (EC, 2012), is the desealing process, which consists of removing the artificial surface and converting the area to a new (mostly) undeveloped land use (Tobias et al., 2018). The benefits of such intervention are manifold: restoration of soil functions, mitigation of the urban heat islands, improved stormwater management, and increased livability of cities (EC, 2012). Despite the growing importance of such interventions, most of them remain fragmented and small-scale when compared to the overall extent of impervious urban soil (Muñoz & Duarte, 2025). This inconsistency highlights a fundamental issue: although desealing is widely recognized as a technical and ecological challenge, the spatial conditions that limit its implementation are less well understood. The issue is not only about the methodology of applying desealing, but also its location. A significant part of urban soil sealing is attributable to urban mobility systems.

These spaces are not considered neutral, but rather the result of a mobility paradigm that has prioritized private motorized transport, shaping public space, particularly road space (Jones, 2014). At the same time, political and academic debates are increasingly calling for a reorganization of mobility space as a means of supporting more resilient urban environments (Creutzig et al., 2020). In this context, road infrastructure is being rethought as green infrastructure, i.e., as multifunctional socio-ecological infrastructure. The relationship between urban mobility systems and soil desealing is profound: they are often presented as complementary, but their interdependence remains unclear. This paper is based on the assumption that large-scale soil desealing is structurally limited by the car-oriented mobility system and cannot be promoted significantly without a change in the management of urban mobility space. The research adopts a theoretical and empirical approach: how much urban space is constrained by mobility uses and to what extent is this space dedicated to private motorized transport? The research therefore contributes to the current debate on urban sustainability and soil restoration, helping to define desealing as a challenge linked to the political and spatial reconfiguration of urban mobility systems. The issue is addressed through a GIS quantification of urban space linked to mobility in the main cities of Lombardy, one of the most urbanized and impervious regions in Italy (SNPA, 2024). By measuring the extent of urban land devoted to mobility and analyzing its internal distribution between motorized and non-motorized uses, the analysis provides empirical evidence of the spatial conditions that enable or limit the implementation of desealing strategies.

## 2. THEORETICAL BACKGROUND

The soil desealing process can be defined as a technical-ecological intervention aimed at restoring soil permeability and mitigating the negative impacts of impervious surfaces. This practice can have beneficial effects, including reducing rainwater infiltration, decreasing urban heat, and supporting ecosystem services (Raimondi et al., 2021; Morel et al., 2025). This approach considers desealing through a technical lens, neglecting its role as a process situated in space and society. The process of desealing does not occur on abstract surfaces, but on land already integrated into urban uses and power dynamics.

The feasibility of desealing is determined not only by technical criteria, but also by the structural organization of urban space (Muñoz and Duarte, 2025).

Desealing should be understood as a form of socio-ecological repair that involves a redistribution of space, part of a broader debate on urban transformation. Contemporary urban mobility systems in many cities are the result of a planning paradigm that has favored private motorized transport. This car-focused mobility regime has not only shaped travel behaviors but has also exerted a significant influence on urban morphology. Cars require a much larger area per user than other modes of transport, both when moving and when stationary (Kirschner, 2021). Urban planning has therefore created environments in which a significant portion of public space is devoted to roads and parking lots, neglecting other types of mobility and contributing to the fragmentation of public spaces and a reduction in the share of soft mobility.

Streets play a unique role within urban systems, serving as both mobility infrastructure and public spaces. Furthermore, recent discourses on urban resilience and public space frame streets as potential multifunctional socio-ecological infrastructures, capable of supporting mobility, social interaction, and environmental functions within a single spatial framework (Wan et al., 2021; Holy-Hasted & Burchell, 2022). This conceptualization is subject to inherent challenges. The reallocation of street space often encounters resistance from a range of actors: the transformation of streets is not just a matter of design innovation. This phenomenon is a source of conflict, as it implies a redistribution of rights and priorities within the urban space (Brovarone et al., 2023). For this reason, the desealing process of road infrastructure should be conceived as a redefinition of the very role of roads, placing ecological functions on an equal footing with those of mobility. However, this perspective is incompatible with a road system designed around the needs of private motorized transport. A change in approach is therefore necessary. Instead of starting from the idea of integrating desealing processes into existing mobility systems, this research argues that a change in the mobility paradigm is a prerequisite and necessary condition for large-scale urban desealing. The shift to mobility models focused on active and shared mobility has the potential to free up urban spaces currently allocated to cars. In this way, desealing can go beyond symbolic interventions and become a process that is relevant both for climate change adaptation and for the quality of urban life.

This theoretical framework forms the basis for the empirical analysis presented in the following sections. Through quantitative analysis of the extent and distribution of urban space allocated to mobility, the study aims to provide tangible evidence of the structural constraints imposed by current mobility regimes, demonstrating the need to rethink the concept of mobility to effectively implement desealing strategies.

## 3. METHODOLOGY

The research, starting from the assumption that large-scale soil desealing interventions is structurally limited by the car-oriented mobility system, aims to verify this hypothesis by quantifying the share of road space dedicated to various forms of mobility. The analysis focuses on 12 provincial capitals in the Lombardy region. Lombardy has the highest percentage of impervious land among Italian regions. For this reason, the context under consideration is relevant for analyzing the relationship between mobility systems and the feasibility of soil desealing. The selected cities include metropolitan, medium-sized, and small urban contexts, allowing for comparison between different urban morphologies while maintaining

consistency in regional planning frameworks and data sources. The analysis is conducted within municipal boundaries and limited to urbanized areas, excluding agricultural land, which is already permeable. The analysis integrates regional and international spatial data to quantify the extent and distribution of urban space related to mobility.

Mobility infrastructure data was obtained mainly from the Lombardy Regional Topographic Database (Database Topografico Regionale, DBT), which provides vector information on road surfaces, dividing them into carriageways, sidewalks, and bike paths. The dataset in question allows for the differentiated identification of mobility-related surfaces within the urban fabric. The analysis of urban land use was conducted using the CORINE Land Cover dataset, with a specific focus on the category of anthropogenic land use. The two datasets were harmonized in a common spatial reference system and processed using QGIS software.

Urban space related to mobility is defined as the set of surfaces intended for the circulation of people and vehicles, as well as for their storage. This category includes infrastructure such as roads, parking areas, sidewalks, bicycle infrastructure, and pedestrian paths. The application of DBT allowed the extraction and intersection of mobility areas with CORINE urban land use boundaries in order to exclude non-urban segments. The resulting dataset represents the total impervious area associated with mobility within each city. To answer the research question, mobility space was further classified into two distinct categories: space dedicated primarily to private motorized transport, i.e., roads and parking areas, and space dedicated to non-motorized mobility, which includes sidewalks, pedestrian areas, and cycling infrastructure. The following indicators were calculated for each city:

- Urban mobility area: the geographical element representing the portion of land occupied by spaces intended for mobility within the urban area.
- The percentage of urban mobility area allocated to private motorized transport.
- The percentage of urban mobility area allocated to non-motorized uses.

The results obtained are expressed both in absolute terms and as a percentage, allowing for comparison between cities of different sizes.

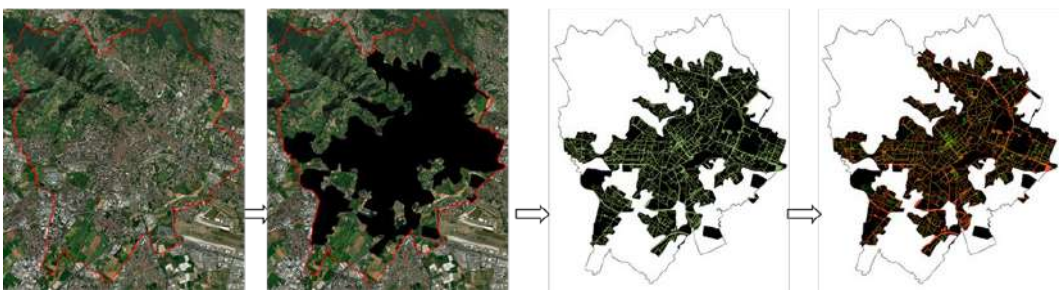


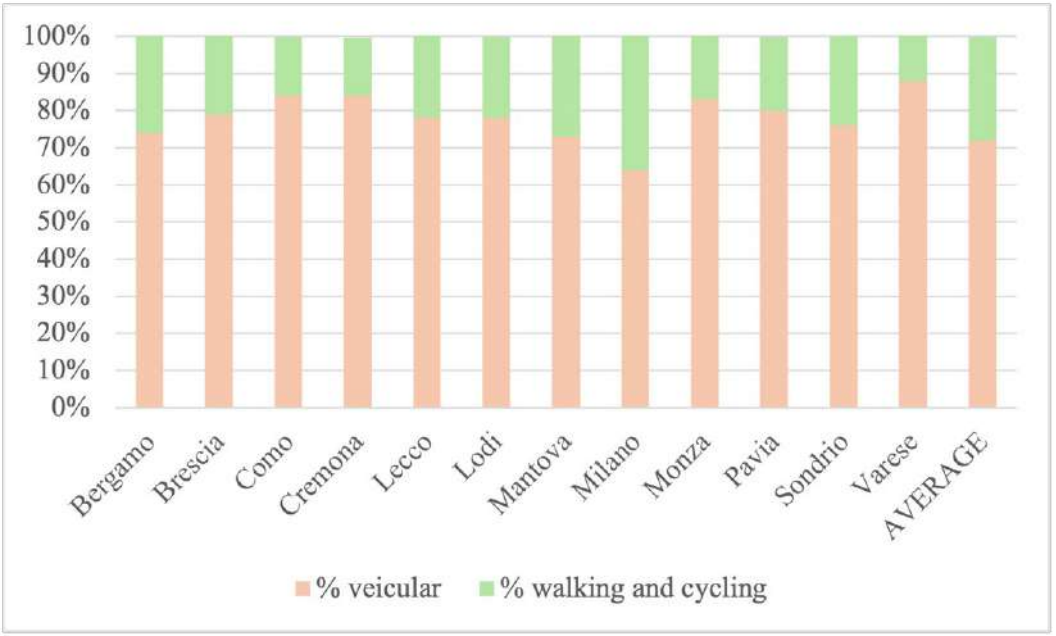
Figure 1: The process of calculating urban areas. Within municipal boundaries (red line), anthropized areas (black) are highlighted, within which mobility spaces (green lines) are isolated. The last step divides areas dedicated to cars (red) from those dedicated to other forms of mobility (green). Source: author's elaboration.

## 4. RESULTS

The analysis conducted shows that mobility infrastructure occupies a significant percentage of urbanized land in all the cities examined, with an average of 19% of the urban area. The highest value is recorded in the city of Milan (23%). This result is significant: discussions on desealing must explicitly address the issue of space dedicated to mobility in order not to limit their scope. Despite differences in size, urban morphology, and number of inhabitants, the percentage of land dedicated to mobility in the 12 cities shows a relatively stable trend. Analysis of the internal composition of the space dedicated to mobility reveals that, in all the cities examined, most of this space is allocated to private motorized transport, with an average of 72%. Among the cities with the highest share are Varese (88%), Como, and Cremona (84%). Comparative analysis between the selected cities reveals variations in absolute values but significant consistency in terms of percentages. Regardless of the size, density, or functional profile of the city, private motorized transport continues to dominate the space dedicated to mobility. This suggests that spatial organization is not only the result of local design decisions, but the expression of a more broadly rooted planning and mobility model. The results suggest that the limits to desealing are not technical or financial in nature, but rather structural and systemic, rooted in the long-term spatial allocation of urban land to mobility functions. Analysis of the extent and internal distribution of space dedicated to mobility reveals that transport infrastructure accounts for a significant proportion of impervious urban land. The dominance of private motorized transport over this space is excessive and materially limits the potential for large-scale desealing.

Table 1: Urban area, share of mobility area, and division of the two categories studied for the 12 provincial capitals in the Lombardy Region. Source: Author's elaboration.

| City | Urban area | Mobility surface in urban area | % bike/ped. | % car |
|---|---|---|---|---|
| Bergamo | 50% | 19% | 26% | 74% |
| Brescia | 50% | 17% | 21% | 79% |
| Como | 44% | 15% | 16% | 84% |
| Cremona | 29% | 16% | 16% | 84% |
| Lecco | 21% | 19% | 22% | 78% |
| Lodi | 20% | 19% | 22% | 78% |
| Mantova | 31% | 14% | 27% | 73% |
| Milano | 77% | 23% | 36% | 64% |
| Monza | 81% | 18% | 17% | 83% |
| Pavia | 24% | 19% | 20% | 80% |
| Sondrio | 18% | 19% | 24% | 76% |
| Varese | 44% | 14% | 12% | 88% |
| AVERAGE | 47% | 19% | 28% | 72% |




Graph 1: Percentage of surface area dedicated to vehicles and pedestrian and bicycle mobility for the 12 provincial capitals in the Lombardy Region. Source: author's elaboration.

## 5. DISCUSSION

The results obtained confirm the initial hypothesis of the research: large-scale urban desealing is structurally limited by the current configuration of mobility systems, and in particular by the spatial dominance of private motorized transport. The analysis conducted using a geographic information system (GIS) on the provincial capitals of Lombardy shows that almost one-fifth of the urbanized area is occupied by mobility infrastructure, of which more than two-thirds is dedicated to private motorized mobility. These data allow the discussion on desealing to be transferred from a purely technical or design perspective to a spatial and political dimension. A first element of discussion concerns the quantitative dimension. The share of urban space dedicated to mobility is not a residual component of the urban fabric but is one of its main structural elements. This implies that any desealing strategy that does not directly address space dedicated to mobility risks remaining confined to isolated and experimental interventions. The results obtained show that areas that are politically 'easy' to deseal, i.e. pedestrian areas, constitute only a minority of the total impervious land. In this perspective, the research makes a significant contribution to understanding an issue that is often taken for granted in policy documents and consensus-building deliberations: the spatial availability necessary for the widespread implementation of desealing and green infrastructure is not a given, but rather the result of specific space allocation choices that reflect particular mobility patterns. The results of the analysis show that, in the cities examined, these patterns are still strongly oriented towards car use,

despite the growing rhetoric in favor of sustainable mobility and urban resilience. A second element of considerable relevance concerns the stability of the results in heterogeneous urban contexts. The analysis highlights how, despite significant differences in terms of surface area and number of inhabitants, Lombardy's cities show surprising consistency in the proportional distribution of space allocated to mobility. This suggests that the predominance of private motorized transport is not attributable exclusively to contingent local choices but is the expression of a consolidated planning and mobility regime at the regional, if not national, level. The regime in question operates as a spatial lock-in mechanism, making it difficult to implement changes that could challenge the centrality of the car. This evidence consolidates the theoretical interpretation proposed in the conceptual context: car-based mobility is not only a transport system, but a spatial regime that structures urban land use in the long term. Infrastructure, such as roads and parking lots, is designed for significant longevity, giving it an inherent resistance to incremental transformation processes. From a desealing perspective, this implies that most impervious land is tied to functions that prevent its ecological conversion without a redefinition of mobility priorities. A further aspect for discussion concerns the relationship between these empirical findings and contemporary discourses on green streets and the multifunctionality of street space. Numerous planning strategies promote the integration of green elements and stormwater management solutions within existing road infrastructure, often without considering the overall amount of space allocated to vehicles. The research findings suggest that this approach could potentially overestimate the transformative potential of interventions that, while improving local environmental quality, do not address the structural causes of soil sealing. This statement is not intended to diminish the intrinsic effectiveness of desealing and green infrastructure, but rather to emphasize that their real effectiveness depends on their ability to reduce the space allocated to private motorized transport. In the absence of a significant reallocation of road space, desealing remains limited to marginal sections that are unlikely to produce significant effects on an urban scale.

## 6. CONCLUSION

This article examines the relationship between urban mobility systems and desealing, postulating that large-scale desealing is structurally limited by the current predominance of private motorized transport in urban spaces. Through a GIS-based quantification of mobility space in the provincial capitals of Lombardy, the research provided empirical evidence to support this hypothesis. The results show that mobility infrastructure occupies a significant portion of urbanized land and that, within this space, the most common means of individual transport is the car. This configuration materially limits the availability of surfaces that can be desealed without compromising existing mobility functions. Consequently, desealing strategies that do not explicitly address the issue of road space reallocation are bound to remain partial and ineffective. The research highlights that the feasibility of desealing is closely related to the mobility patterns that have helped shape urban space and continue to govern its use. From this perspective, the transition to a new mobility paradigm is not a secondary effect of desealing, but rather an indispensable prerequisite for this process. It is essential to recognize the inherent limitations of the research.

The analysis is based on static spatial data and does not consider the temporal dynamics of road space use, nor the legal, economic, or social dimensions that influence decision-making processes.

Furthermore, the research focuses on a specific regional context, although it is characterized by conditions that make the results relevant to other European urban contexts as well. Finally, it is assumed that the behavior of pedestrians and motorists is consistent with the space allocated to them, without considering, for example, any irregular parking. Despite the above limitations, the results of the tests provide a solid basis for reframing the debate on urban desealing. Instead of multiplying isolated desealing interventions, urban policies could benefit from an approach that directly addresses the redistribution of mobility space, recognizing the central role of road infrastructure in the production of impervious soil. The study under consideration suggests that urban desealing cannot be effectively pursued without a structural transformation of mobility systems. Analyzing this issue implies accepting that desealing is not only an environmental problem, but a process involving political decisions and conflicts that lead to a reorganization of priorities in the use of urban space.

## REFERENCES

Brovarone, E., Staricco, L., & Verlinghieri, E. (2023). Whose is this street? Actors and conflicts in the governance of pedestrianisation processes. Journal of Transport Geography, 107, 103528. https://doi.org/10.1016/j.jtrangeo.2022.103528

Creutzig, F., Javaid, A., Soomauroo, Z., Lohrey, S., Milojevic-Dupont, N., Ramakrishnan, A., Sethi, M., Liu, L., Niamir, L., Bren d'Amour, C., Weddige, U., Lenzi, D., Kowarsch, M., Arndt, L., Baumann, L., Betzien, J., Fonkwa, L., Huber, B., Mendez, E., … Zausch, J. M. (2020). Fair street space allocation: Ethical principles and empirical insights. Transport Reviews, 40(6), 711–733. https://doi.org/10.1080/01441647.2020.1762795

EC (European Commission. Directorate General for the Environment) (2011). Overview of best practices for limiting soil sealing or mitigating its effects in EU-27: Final report. Publications Office. https://data.europa.eu/doi/10.2779/15146

EC (European Commission. Directorate General for the Environment) (2012). Guidelines on best practice to limit, mitigate or compensate soil sealing. Publications Office. https://data.europa.eu/doi/10.2779/75498

Holy-Hasted, W., & Burchell, B. (2022). Does public space have to be green to improve well-being? An analysis of public space across Greater London and its association to subjective well-being. Cities, 125, 103569. https://doi.org/10.1016/j.cities.2022.103569

Jones, P. (2014). The evolution of urban mobility: The interplay of academic and policy perspectives. IATSS Research, 38(1), 7–13. https://doi.org/10.1016/j.iatssr.2014.06.001

Kirschner, F. (2021). Parking and competition for space in urban neighborhoods: Residents' perceptions of traffic and parking-related conflicts. Journal of Transport and Land Use, 14(1), 603–623. https://doi.org/10.5198/jtlu.2021.1870

Marquard, E., Bartke, S., Gifreu I Font, J., Humer, A., Jonkman, A., Jürgenson, E., Marot, N., Poelmans, L., Repe, B., Rybski, R., Schröter-Schlaack, C., Sobocká, J., Tophøj Sørensen, M., Vejchodská, E., Yiannakou, A., & Bovet, J. (2020). Land Consumption and Land Take: Enhancing Conceptual Clarity for

Evaluating Spatial Governance in the EU Context. Sustainability, 12(19), 8269. https://doi.org/10.3390/su12198269

Morel, A., Vidal-Beaudet, L., Brialix, L., Lemesle, D., Bulot, A., & Herpin, S. (2025). Evolution of microclimate following small patch de-sealing and revegetation in urban context. Urban Climate, 61, 102371. https://doi.org/10.1016/j.uclim.2025.102371

Muñoz, L. S., & Duarte, D. H. S. (2025). Green infrastructure as a planning tool: A comprehensive systematization of urban redesign strategies to increase vegetation within public places. Cities, 156, 105551. https://doi.org/10.1016/j.cities.2024.105551

Peroni, F., Pappalardo, S. E., Facchinelli, F., Crescini, E., Munafò, M., Hodgson, M. E., & De Marchi, M. (2022). How to map soil sealing, land take and impervious surfaces? A systematic review. Environmental Research Letters, 17(5), 053005. https://doi.org/10.1088/1748-9326/ac6887

Raimondi, F., Marchioni, M. L., Dresti, C., Kian, D., Mambretti, S., & Becciu, G. (2021). Urban Flood Risk Management: Impact of Combined Strategies. International Journal of Environmental Impacts: Management, Mitigation and Recovery, 4(3), 219–230. https://doi.org/10.2495/EI-V4-N3-219-230

SNPA (2024). Consumo di suolo, dinamiche territoriali e servizi ecosistemici. Edizione 2024, Report ambientali SNPA, 43/2024.

Tobias, S., Conen, F., Duss, A., Wenzel, L. M., Buser, C., & Alewell, C. (2018). Soil sealing and unsealing: State of the art and examples. Land Degradation & Development, 29(6), 2015–2024. https://doi.org/10.1002/ldr.2919

Wan, C., Shen, G. Q., & Choi, S. (2021). Underlying relationships between public urban green spaces and social cohesion: A systematic literature review. City, Culture and Society, 24, 100383. https://doi.org/10.1016/j.ccs.2021.100383

# URBAN TRANSFORMATION OF A SOCIALIST SILICA BRICK MULTIFAMILY HOUSING NEIGHBOURHOOD IN POST-SOCIALIST TIRANA

**Dr. Edmond Manahasa, MSc. Ermela Palla**
EPOKA University, Department of Architecture
Rr. Tiranë-Rinas, Km. 12, 1032 Vorë, Tirana, Albania
emanahasa@epoka.edu.al, epalla19@epoka.edu.al

## ABSTRACT

This research focuses on the urban transformation of a socialist period silica-brick multifamily housing in Tirana. The selected case study is a neighbourhood called "Blloku Partizani", which is located along "Muhamet Gjollesha" Street and was constructed in the 1970s. The research aims to document the urban transformation of the built environments of the "Blloku Partizani" neighbourhood, including both housing blocks and outdoor spaces. The methodology used for this research consists of archival data collection, plan redrawing, mapping and visual analysis of the changes/modifications realized during the post-socialist period.

The study measures the transformation of the neighbourhood by examining its housing blocks and common outdoor spaces. The transformation of the housing blocks is observed into two forms: formal/informal additions to the existing blocks and the construction of the new, taller apartment blocks. As for the outdoor common spaces, there is an observed reduction in green spaces, which is caused by the construction of new buildings at the expense of the common public spaces, the transformation of the ground floors into commercial activities and the increasing car parking spaces at the expense of public spaces.

**KEYWORDS**: Socialist Period Housing, Urban Transformation, Housing Additions, Tall Apartment Blocks, Green Spaces, Reduction

## 1. INTRODUCTION ON SOCIALIST PERIOD HOUSING AND URBAN TRANSFORMATION IN POST-SOCIALIST TIRANA

Housing development in Albania, similar to other communist states, was a component of a major urban planning policy that sought to create an egalitarian society (Aliaj, 2003). Using collective multifamily housing, this strategy was implemented on considerable scale in Tirana, except for housing blocks in the city centre and "Bllok" neighbourhood that were allocated for high-ranking officials and Politburo members (Misja and Misja, 2004). Thus, in other parts of the city, there was no distinction between working class and managerial personnel. As such, in the same apartment block, there could leave the director of a state enterprise and the company's workers. (Dervishi, 2014; Fuga; 2014; Manahasa, 2017).

Particularly in Tirana, the political conjecture of Albania has influenced very much also the housing models developed during the socialist period (Aliaj, 2003; Manahasa et al., 2025). In the 1950s Albania used models from the Soviet Union that were implemented in the form of large housing estates, such as in the case of the "Shallvaret", "Agimi" or "1 Maji" housing complexes (Misja and Misja, 2004). In the 1970s Albania broke the relations with the Soviet Union, and developed closer relations with China, which helped Albania with loans and technical/technological assistance particularly related to heavy industry. Apart from that, the Chinese influence impacted the evolution of two housing typologies in socialist period Tirana: i. low quality multifamily housing implemented by voluntary work; and ii. prefabricated panel housing (Bleta, 2010). The construction of the first typology was interesting because people from the same state company voluntarily worked during their after-work free time to obtain an apartment upon the accomplishment. This idea relied on the concept of the "New Socialist Man", which transferred from the Chinese Cultural Revolution. The built multifamily housings were implemented with low quality, generally non-plastered. The prefabricated panel-housing technology was also imported from China (Pojani & Baar, 2006), and once that the factory was established in Tirana, it could produce up to 2000 apartments per year (Islami & Veizaj, 2014). The neighbourhoods that were constructed using prefabricated housing were in the peri-urban zones of the city, outside the socialist city ring.

Another aspect that featured the socialist period multifamily housing neighbourhoods was that they were named based on the socialist ideology, such as "Partizani" housing block, the "Dinamo" housing block, or names of the WWII heroes such as the "Vasil Shanto" housing block or the "Ali Demi" housing block (Abitz, 2006). Since the communist political system was a highly centralised system, housing allocation was strictly controlled by the Labour Party, and people could relocate to other towns or cities only by special permission (Tashi, Dhrami, & Tola, 2015). Among the others in certain multifamily housing blocks, instead of red brick mainly for precision reasons, silica brick material was used, producing a better masonry stereotomy.

The collapse of the socialist regime and the transition to the liberal market economy caught the state companies unable to operate in the new system, thus causing unemployment, which, in a chain effect, generated immigration to foreign countries and within the country (Hysaj et al. 2021). Related to immigration within the country, Tirana took the lion's share (Durmishi, 2008). The impact of immigration combined with incapacities and ineffectiveness in urban management policies from local authorities (Misja & Misja, 2004) caused informal settlements in the periphery of Tirana (Dino & Grifith, 2023), while in the socialist city

neighbourhoods, were seen in the form of informal additions to apartment blocks and the "invasion" of public and green spaces by the construction of mid/high rise apartment blocks that obtained legal permissions through the so-called "partial plans" (Manahasa & Özsoy, 2020). Such developments have impacted negatively both physical and social aspects of socialist-period neighbourhoods (Pojani & Buka, 2015).

This research focuses on the documentation of the post-socialist period's transformation of a neighbourhood called "Blloku Partizani", built during the socialist period in Tirana. The study analyses the transformations which evolved during the post-socialist period in the apartment blocks and those that are related to the common public space of the neighbourhood.

## 2. CASE STUDY OF "PARTIZANI" NEIGHBOURHOOD AND THE URBAN TRANSFORMATIONS DURING THE POST-SOCIALIST PERIOD

This neighbourhood's housing blocks are constructed with silica-brick material, and it is located within the western edge of Tirana Middle Ring zone (based on French Plan), which was the city during the socialist period. The neighbourhood is about 1.2km from the city centre and approximately 300m from the "Karl Topia" square, also known as "Zogu i zi". The area stretches linearly from "Naim Frasheri" street as far as "Frederik Shiroka" street and roughly corresponds to the western part of the middle ring of Tirana.

The housing neighbourhood was designed by chief architect Koço Miho and architects Maks Velo and Femi Dishnica (AQTN). It was constructed in the 1970s and the choice in material was made due to the higher precision of the silica brick compared to the typical red brick (Vaso, 2017). As mentioned by one of the architects Velo (2019) this technology is used also in other parts of the city. This neighbourhood reflects the socialist period ideology in its name, "Partizani"

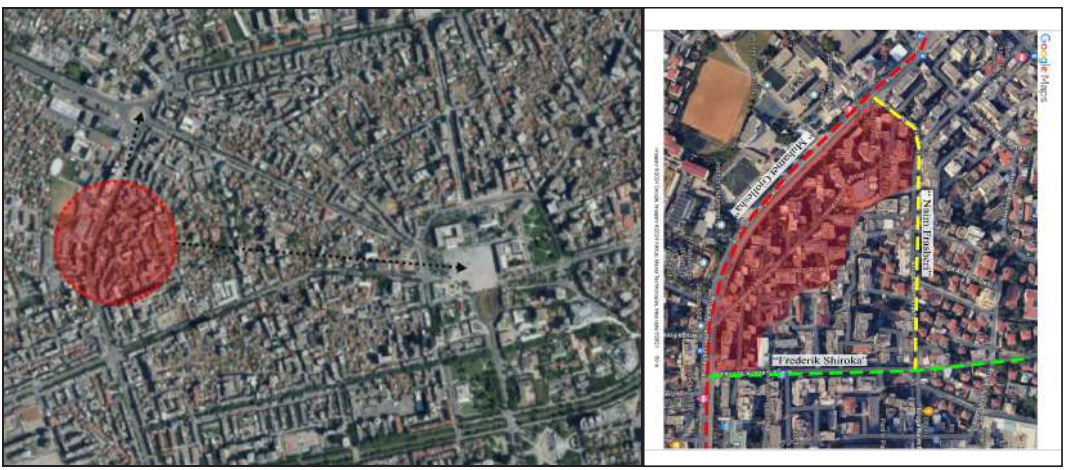



Figure 1. Location of study area according to city centre (left) and (right) study area highlighted (Source: Google maps)

The site plan of the neighbourhood is organised on both flanking sides of a diagonal main circulation artery, that in fact, goes in parallel with “Muhamed Gjollesha” Street. There are four apartment block types used in the “Partizani” neighbourhood regarding their geometrical shape (Manahasa, Özsoy, & Manahasa, 2021). In fact, these four apartment block types are achieved by the combination of 5 modules. Two consist of linear rectangular modules which are displaced back and forth. One of these typologies is placed parallel with the “Muhamet Gjollesha” street. The other used housing block consists of three main volumes, two of which are placed perpendicular to the larger middle volume (Figure 3). Apart from others, one apartment block located in the corner between Frederik Shiroka and Muhamed Gjollesha Street is larger, although its shape is achieved by the shift of one module diagonally, horizontally, and vertically (Figure 4).

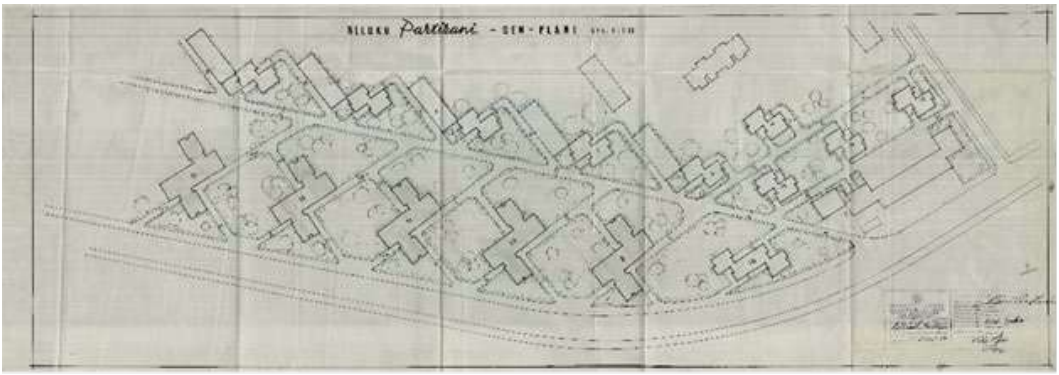



Figure 2. Original site plan of the “Blloku Partizani” (Source: AQTN).

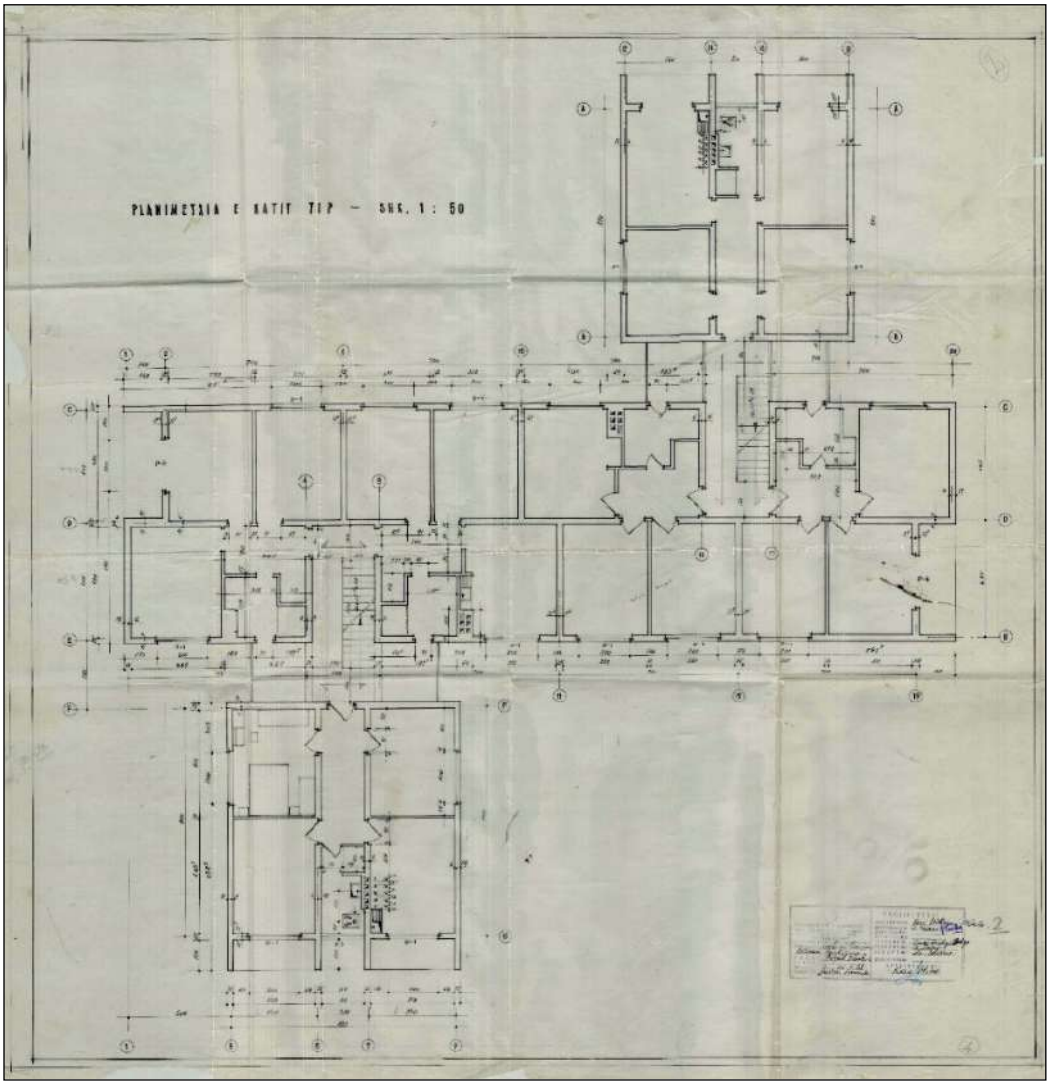



Figure 3: Original normal floor plan of apartment block Type 1 (Source: AQTN)

The silica brick mass housing offered accommodation to different social classes, including low-social class or high-social class families, propagating the socialist ideals of equality. This was achieved by offering three apartment types, including 1+1, 2+1 and 3+1 layouts. Even the presence of a balcony was alternated between the modules to give a greater variety of apartments.

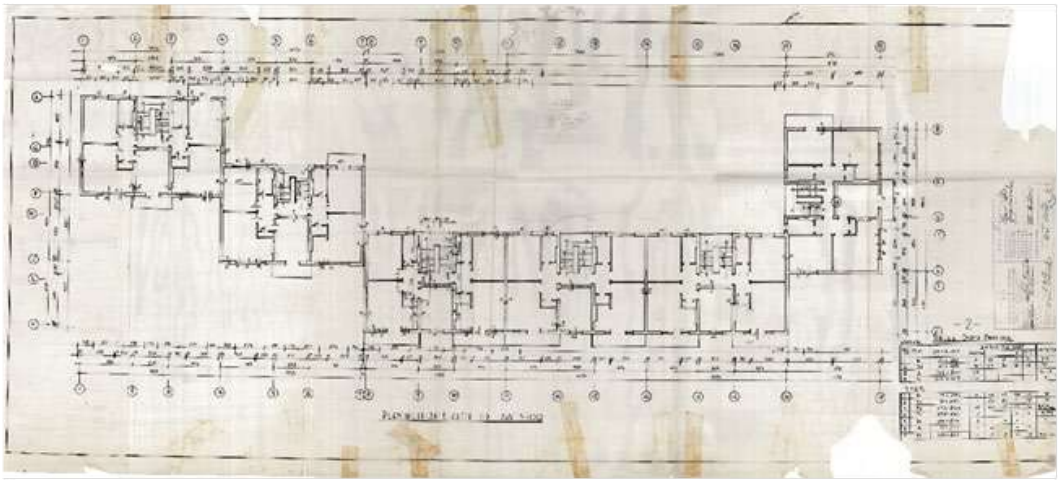


Figure 4. Original normal floor plan of apartment Type 2 (Source: AQTN).

In this research we will analyse the transformation that evolved during the post-socialist period of this neighbourhood by specifically focusing on its two components: the housing blocks and common public space. This research considers the transformation conducted between years 1994 and 2024, which is roughly a period of 30 years.

## 2.1. TRANSFORMATION OF COMMON OUTDOOR SPACES

Aerial images of the neighbourhood show a continuous reduction of green spaces due to the construction of high-rise apartment blocks and additions of new building volumes to the existing the socialist-period housing blocks. Another aspect that reduces the public green spaces is the transformation of the ground floor function from housing to commercial activities such as shops and cafes. The transformation of the common outdoor spaces shows certain differences between those located inside the neighbourhood and those located at the side of “Muhamet Gjollesha” Street.

The common outdoor green spaces located inside the neighbourhood were originally planned to be evenly distributed to create open common spaces in between buildings serving as small park areas. Even though in the current condition there can be detected many empty spaces remaining, these spaces are not entirely green. The differences between the green spaces as planned and the current conditions are visible in the comparative analysis represented in Figure 5. Most of these outdoor spaces currently are occupied by parking spots and furthermore, are left unkept (Figures 6 & 7). Particularly the construction of the high buildings in the original green spaces has increased the construction density in the area and suffocated the remaining spaces (Figures 8 & 9). Also, in many cases there are constructed coffee shops, which usurp the common green spaces as well, and covering them with tents to utilise them as outdoor spaces for their coffee shops. The green spaces that are located alongside “Muhamet Gjollesha” Street have been occupied

by shops and coffee shops, and lounges are being expanded on the ground floor, and very few exist as small courtyards of the apartment blocks (Figure 6).

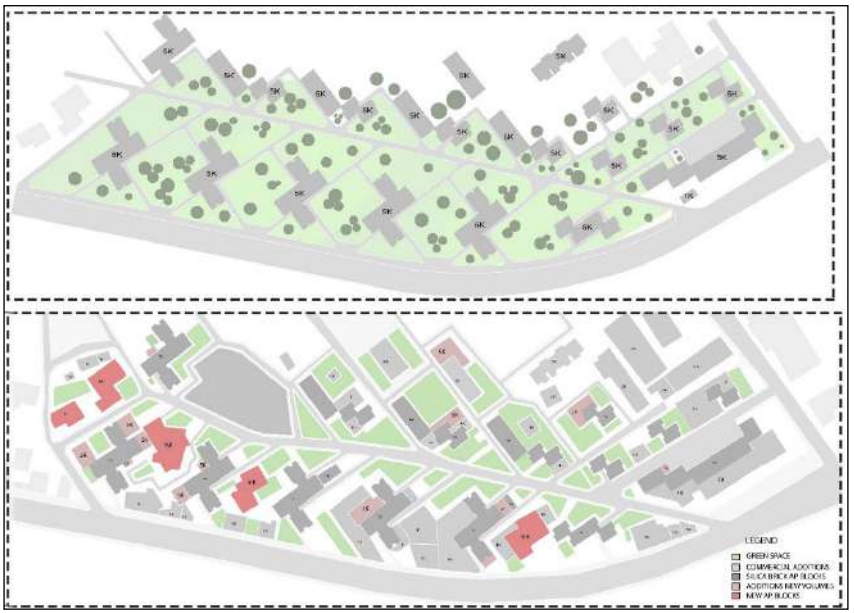



Figure 5. Comparative analysis of the original site plan (top-©Ermela Palla) and (bottom) the current situation of "Partizani" neighbourhood outdoor spaces

Figure 6. Image of coffee shops alongside Muhamet Gjollesha Street taken in May 2024 (Google Maps).

Figure 7. Image of the transformed common outdoor spaces within the neighbourhood in May 2024 (Google Maps).

Figure 8. Current images from the neighbourhood's upper part common outdoor spaces (Authors).

Figure 9. Current images from the neighbourhood's lower part common outdoor spaces (Authors).

## 2.2. TRANSFORMATION OF EXISTING SOCIALIST HOUSING BLOCKS AND NEW HOUSING PATTERNS

The current conditions of the neighbourhood nowadays are different compared to the original site plan. The first change from the original site plan is that one of the apartment blocks on the second row of buildings is missing. This is because during the construction process in 1972, the ruins of an Early Christian Basilica, including a mosaic, were discovered on the site (Tirana Mosaic, 2023). Such a discovery made it impossible to implement the original site plan. The other changes are related to the transformation that the "Partizani" neighbourhood has been undergoing during the post-socialist period.

The transformation of housing patterns can be grouped into three features:

i. The transformation of ground floors for commercial functions.
ii. Addition of new housing volumes to the existing socialist period silica-brick housing blocks.

iii. Construction of new mid/high-rise apartment blocks in between the green public spaces of the ex-socialist neighbourhood (Figure 6).

Regarding the post-socialist period transformations of ground floors, they consist of the removal of walls and substitution with large transparent glass panels. While in most the ground floors are transformed into coffee shops, in some cases such spaces are adapted for shops (Figure 10).

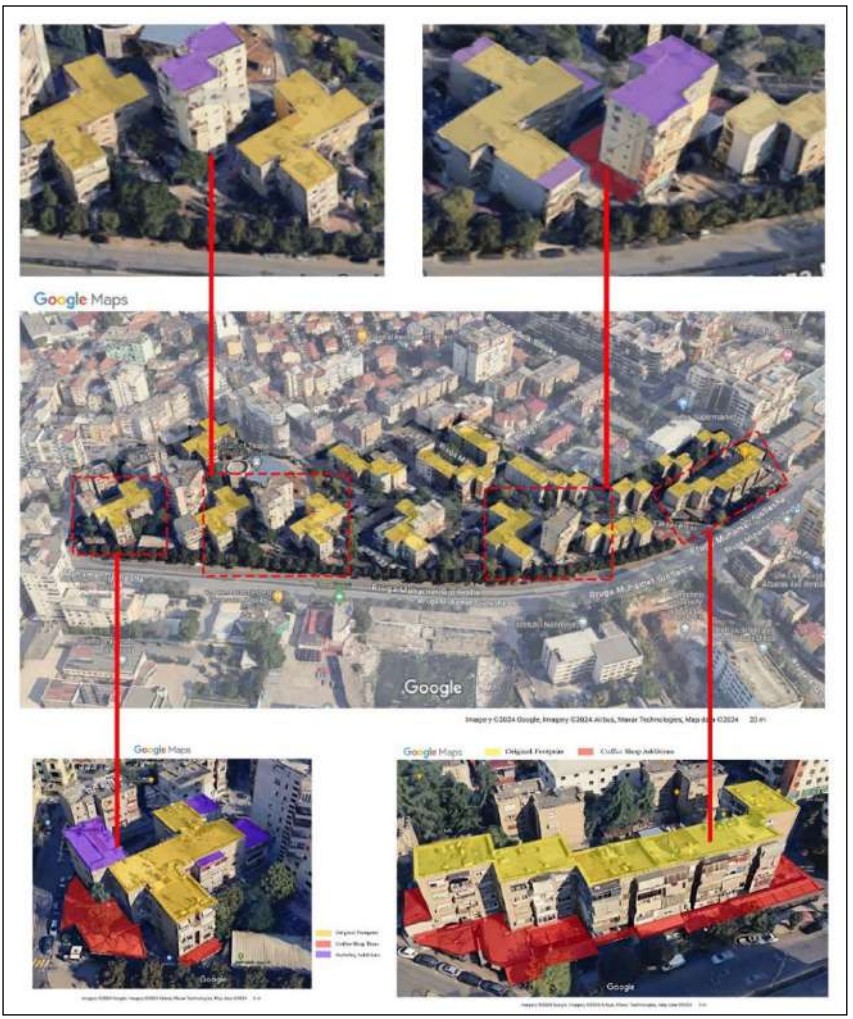



Figure 10. Aerial view of the neighbourhood in 2024 showing the original housing block footprints in yellow (top) and apartment blocks Type 1 (bottom-left) and Type 2 (bottom-right) showing additions in purple and coffee shops in red colour.

The addition of new housing volumes can be subcategorised at least into two forms. The first form includes newly constructed volumes that are integrated with the existing plan scheme of the existing building. In general, such additions are constructed with legal permission or, at the worst were legalised letter. The second form includes enclosure of balconies or extension of balconies for more space. While the central state agencies (Balkanweb, 2015) such as "ALUIZNI" (Agency for Legalisation, Urbanisation and Integration of Informal Areas and Buildings) have legalised such extensions ("shtesa" in Albania) in different periods, in certain cases they might not be legalised and be still illegal.

Regarding the construction of mid/high-rise blocks the analysis conducted in this neighbourhood reveals that there are three housing blocks, each 9 floors tall. Due to the height, they are perceived as tower-like apartment blocks. In addition, their outer appearance is in disharmony with the socialist period silica-brick apartment blocks. These apartment blocks are constructed between the years 1994 and 2001, as it is confirmed from the aerial views secured from Google Maps.

## 3. CONCLUDING REMARKS

To conclude, it can be said that the urban transformations of the socialist period silica-brick "Partizani" neighbourhood reflect certain features which are peculiar to the Albanian post-socialist developmental context, such as issues of local/central urban management and informal urban development. The study revealed that the common outdoor green spaces of this neighbourhood are reduced considerably. The reason for such reduction is related to the construction of new mid/high-rise apartment blocks on the original green spaces, additions of housing volumes in the existing socialist period housing blocks and commercialisation of the existing apartment block's ground floor, mainly transforming them into coffee shops. Such developments have produced a denser built environment. Furthermore, the common green spaces have also been worsened due to the presence of an increased number of automobiles in the neighbourhood that, in many times, apart from the streets, are parked within adapted parking spaces that usurp the older green spaces.

The transformation of the housing patterns developed during the post-socialist period is featured by the addition of new housing volumes to the existing socialist period silica-brick housing blocks and the construction of new mid/high-rise apartment blocks in between the green public spaces. The construction of such new additional volumes and new apartment blocks has caused a disproportional architectural and urban composition and a quite cacophonic and hybrid-built environment. On the other hand, particularly since the positioning of the post-socialist period apartment blocks is developed in the form of the infill, not respecting legal distances causes issues regarding privacy and visual comfort. Further studies regarding such an ex-socialist neighbourhood can be conducted to measure different aspects of dwelling quality and comfort.

## REFERENCES

Abitz, J. (2006). Post-socialist city development in Tirana. (Master Thesis), Roskilde University, Roskilde, Denmark

Aliaj, B. (2003). Albania: a short history of housing and urban development models during 1945–1990. Making Cities Work, 24-45.

Bleta, I. (2010). Influences of political regime shifts on the urban scene of a capital city case study: Tiran (Master's thesis, Middle East Technical University (Turkey)).

Dino, B., & Griffiths, S. (2023). Tirana: Its History and a Post-Socialist Perspective on Urban Growth and Transformation between 1991–2016. DOI, 10, 3-4.

Durmishi, O. (2008). Competing urban visions for the capital of Albania: international projects for Tirana city centre (Master's thesis, Middle East Technical University (Turkey)).

Hysa, A., Manahasa, O. D., Naselli, F., Manahasa, E., Yunitsyna, A., & Dervishi, S. (2021). Introducing the architectural, urban, and landscape challenges of Albania. In Current challenges in architecture and urbanism in Albania (pp. 1-15). Cham: Springer International Publishing.

Islami, G., & Veizaj, D. (2014). Comfort Conditions and Energy Consumption in Prefabricated. Proceedings of the 2nd ICAUD International Conference in Architecture and Urban Design, (p. 8). Tirana.

Manahasa, E., Demiraj, K., Manahasa, O., & Hysa, A. (2025). Effect of privacy in place attachment: how does a residential complex design in Tirana influence attachment to home, neighbourhood, and city? Journal of Housing and the Built Environment, 40 (2), 819-844.

Manahasa, E., & Özsoy, A. (2020). Place attachment to a larger through a smaller scale: attachment to city through housing typologies in Tirana. Journal of Housing and the Built Environment, 35(1), 265-286.

Manahasa, E. (2017). Place attachment as a tool in examining place identity: A multilayered evaluation through housing in Tirana (Doctoral dissertation, PhD dissertation, Istanbul Technical University).

Pojani, D., & Baar, K. (2016). Multi-family housing management in post-socialist countries: The Albanian experience. Journal of Housing and the Built Environment, 31(4), 743-760.

Pojani, D., & Buka, M. (2015). From camaraderie to detachment: The effect of changing built environment forms on neighborhood relations in a post-communist context. Cities, 49, 66-75.

Misja, V., & Misja, A. (2004). Veshtrim mbi situaten e banesave ne Shqiperi: analize krahasuese. Tirane: Akademia e Shkencave e Shqiperise, Instituti i Ekonomise.

Tashi, P., Dhrami, K., & Tola, A. (2015). The Transformation of the Urban Block in the City. International Journal of Science and Research (IJSR), 5.

https://www.balkanweb.com/legalizimi-i-shtesave-per-30-dite-miratohen-procedurat/#gsc.tab=0

Dervishi, Z. (2014). Zyhdi Dervishi personal communication. In E. Manahasa (Ed.).

Fuga, A. (2014). Artan Fuga Personal Communication. In E. Manahasa (Ed.).

Vaso, P. (2007). Pirro Vaso a Personal Communication. In E. Manahasa (Ed.).

AQTN- Arkivi Qendror Teknik i Ndertimit (Central Technical Archive of Construction of Albania).

# VIA APPIA AS ARIADNE'S THREAD: LINKING LANDSCAPE, COMMUNITY, MEMORY, AND DESIGN

Francesco Rotondo, Angelo Campo
Università politecnica delle Marche
f.rotondo@staff.univpm.it; info@angelocampo.it

## ABSTRACT

In 2024 via Appia, the ancient Roman road connecting Rome to Brindisi, was inscribed on the UNESCO World Heritage List. Historical research indicates that the Municipality of Carosino (Taranto, Southern Italy) encompasses a section of this ancient route. Within the Preliminary Programming Document (DPP) for the new General Urban Plan (PUG), drafted between 2021 and 2022, via Appia had a crucial role in defining an alternative model of self-sustained local development. This model aligns with the Regional Territorial Landscape Plan of Puglia (PPTR, 2015), which promotes the acknowledgement of territorial heritage as a fundamental tool for landscape protection and its enhancement. The aim of the document was to come up with innovative planning strategies based on two identity elements: the historical presence of via Appia and the local viticultural vocation. This experimental process prioritized participatory planning, embracing the active role of inhabitants in constructing the "sense of place" as a founding principle. The landscape is seen as a dynamic system of relationships and as an identity-based heritage in constant transformation. The project put via Appia as a symbolic and infrastructural key element- a common thread linking historical memory with contemporary design - while testing participatory tools based on active listening and the co-production of shared territorial visions. Carosino, part of "Albania Tarentina," owns a cohesive social fabric and widespread community activism, creating a "laboratory of complexity" where implicit participatory culture becomes a strategic resource. As a consequence, via Appia has the role of an identity-driven topos and of an infrastructural device interconnecting places, memories, and communities. It becomes an "Ariadne's thread" leading territorial regeneration rooted in identity, landscape, and shared vision.

KEYWORDS: Appia; landscape; community; memory; participation; urban planning; territorial identity.

## 1. INTRODUCTION

Today, landscape represents a central category for understanding and designing the territory. As highlighted by Turri (Turri, 1998), it serves as a "mirror of society"—a visible manifestation of its cultural structures and collective values. In the perspective of contemporary planning, the landscape can no longer be understood merely as an object of protection, but as a dynamic construction resulting from the continuous interaction between communities, resources, and transformation processes (Magnaghi, 2010). Within this context lies the research experience conducted in Carosino, a small town in the Province of Taranto covering approximately 11 sq km (see Figure 1).

Figure 1: Carosino along the Via Appia

Here, the via Appia has been interpreted as a symbolic and territorial axis capable of connecting history, identity, and the future. Developed in alignment with the Apulian PPTR (Regione Puglia, 2015), this initiative aimed to promote an integrated and participatory planning model capable of activating regeneration processes based on local landscape identity and the valorization of the community's relational capital. The general objective was to verify how participatory planning can become a tool for the collective construction of the landscape, fostering new forms of cooperation between citizens and institutions. Carosino was selected due to its compact yet strongly identity-driven territorial dimension, characterized by a rooted agricultural tradition and a cohesive social fabric, where civic participation represented a latent resource not yet fully activated in formal processes.

## 2. THEORETICAL AND METHODOLOGICAL FRAMEWORK

The theoretical foundation of this research is based on the conception of landscape as a "social construction" (Cosgrove, 1984; Olwig, 1996), resulting from the intertwining of collective perceptions, practices, and representations. This vision, consistent with the territorialist approach (Magnaghi, 2010), recognizes local projects as instruments for reactivating the bonds between inhabitants and territory. Such an approach orients transformations toward sustainable development rooted in a "consciousness of place" through the construction of scenarios rather than mere forecasts (Secchi, 2003; Magnaghi, 2007; Gabellini, 2007).

As Sabina Lenoci (2005) explains, constructing scenarios is distinct from making forecasts; while the latter relies on the predictable trend of variables, a scenario is configured as a "representation of ongoing trends" or an allusive vision of societal demands—an "argued and suggested path" investigating potential outcomes. In parallel, participatory planning served as the operative framework, understood as a deliberative and inclusive process for building shared visions (Healey, 2003; Forester, 1999). In this perspective, the experiential knowledge of inhabitants becomes an integral part of design expertise, generating "territorial intelligence" that integrates technical skills and local knowledge (Governa, 2015).

The methodology rested on three principles:

- Knowledge Integration: Historical, environmental, and social reconstruction as the basis for strategy.
- Active Participation: Direct community involvement in exploration and design.
- Identity Resonance: Recognition of collective memory and symbolic values as resources.

This structure took the form of a "double helix" process, where analysis and design intertwined through public debate and co-production activities.

## 3. THE TERRITORIAL CONTEXT OF CAROSINO

Carosino, situated in the eastern heart of the Province of Taranto, developed along the ancient via Appia. Its landscape, defined by dry stone walls, farmhouses, olive groves and viticulture, represents a cultural sedimentation that reflects the stratification of Greeks, Romans, Byzantines and Albanians (see Figure 2).

Figure 2: Walking on via Appia in the agricultural territory

For Carosino, the via Appia constitutes not only an infrastructural axis of memory but a true "Ariadne's thread" capable of stitching back the territorial fabric, reconnecting urban, agricultural, and symbolic fragments (see Figure 3).

Figure 3: Walking on via Appia in the agricultural territory

Valorizing this element has allowed for the construction of a shared narrative and design device, acting as a catalyst for local cooperation. The via Appia thus emerges as an identity-driven narrative topos; a symbolic and infrastructural device connecting places, memories, and communities (Simmel, 1913; Kubler, 1962; Coda, 2021; Oliva, 2022). It is a real cultural territorial system (Rotondo et al., 2016).

The understanding of the territory revealed additional pillars for self-sustained development: quality viticultural contexts, social wineries, and disused historical masserie. The presence of the via Appia Antica is not merely a historical asset but a linear axis for renewed identity awareness. The "vineyard system" has become the focal point for economic hypotheses, aiming to leverage these assets as an alternative to the pressure of invasive renewable energy plants, which have encroached upon rural contexts due to low land costs (Rotondo, 2022).

## 4. METHODOLOGIES AND PARTICIPATORY PROCESSES

The participatory process implemented within the DPP of the Carosino PUG was structured through a sequence of direct engagement actions:

- Exploratory walks along the via Appia, designed as tools for "territorial listening." Walking assumed a pedagogical value, allowing for the collective reworking of local memory through perception.
- Narrative workshops aimed at collecting stories and representations, subsequently translated into community maps and design proposals.
- Public events and thematic workshops where technicians, administrators, and citizens discussed territorial development visions.

These practices generated a shared "narrative mass" (Oliva, 2022)—an intangible archive of meanings that provided a legitimate basis for design choices. Participation was understood here as a "collective learning device" (Friedmann, 1993), capable of producing situated knowledge and shared responsibility.

## 5. RESULTS AND REFLECTIONS

The effects of the participatory process in Carosino (see Figure 4 and 5) are observed on three interconnected levels:

- Social Level: The project triggered a strengthening of relational capital, favoring horizontal and inclusive governance (Healey, 2006) and overcoming the distance between institutions and inhabitants.
- Cultural Level: The rediscovery of the via Appia as "cultural infrastructure" (Uggeri, 1987) redefined the collective imagination, transforming memory into an active resource for innovation.
- Territorial Level: The experimentation highlighted how reconnecting city and countryside can generate sustainable development.

The city-countryside path guided the formulation of ecological regeneration strategies based on environmental continuity. Integrating technical tools with participatory practices produces planning attuned to lived reality, combining efficiency with meaning to generate "public value" (Mazza, 2009).

Figure 4: The participatory process

Figure 5: The participatory process

## 6. CONCLUSIONS

The case of Carosino demonstrates that participatory planning anchored to landscape identity constitutes an effective tool for territorial regeneration. The via Appia, from a historical trace, becomes a cultural infrastructure for the future, guiding transformations by connecting memory and design. This

confirms that building the landscape is, fundamentally, a cultural process: a mediation between visible and invisible elements, and between daily practices and collective visions (Simmel, 1913). Furthermore, the research emphasizes the role of small municipalities as "laboratories of territorial innovation," where reduced scale allows for greater permeability between types of knowledge and faster experimentation.

The territorial project thus becomes a bridge between future and past, establishing interpretative and normative relationships between what could be, what is, and what has been (Gabellini, 2007). Finally, the experimentation strengthens the perspective of planning oriented toward "consciousness of place" (Magnaghi, 2010). The via Appia, as Ariadne's thread, remains a metaphor for a regeneration path weaving together memory, roots, and community.

## REFERENCES

Cosgrove, D. (1984). Social Formation and Symbolic Landscape. Madison: University of Wisconsin Press;

Forester, J. (1999). The Deliberative Practitioner: Encouraging Participatory Planning Processes. Cambridge, MA: MIT Press;

Forman, R.T.T. (1995). Land Mosaics: The Ecology of Landscapes and Regions. Cambridge: Cambridge University Press;

Friedmann, J. (1993). Toward a Non-Euclidian Mode of Planning. Journal of the American Planning Association, 59(4), 482–485;

Governa, F. (2015). Territorio e governance. Roma: Carocci;

Healey, P. (2003). Collaborative Planning in Perspective. Planning Theory, 2(2), 101–123;

Healey, P. (2006). Collaborative Planning: Shaping Places in Fragmented Societies. London: Palgrave;

Lenoci, S. (2005). Tra arte, ecologia e urbanistica, Roma: Meltemi;

Magnaghi, A. (2010). Il progetto locale. Verso la coscienza di luogo. Torino: Bollati Boringhieri;

Mazza, L. (2009). Pianificazione come discorso e come azione. Roma: Carocci;

Oliva, F. (2022). Il progetto del vuoto. Spazi aperti e rigenerazione urbana. Milano: FrancoAngeli;

Olwig, K. (1996). Recovering the Substantive Nature of Landscape. Annals of the Association of American Geographers, 86(4), 630–653;

Regione Puglia. (2015). Piano Paesaggistico Territoriale Regionale (PPTR). Bari: Regione Puglia;

Rotondo F. (2022), Urbanistica e paesaggio per promuovere il sistema territoriale culturale della via Appia: un caso di studio in area tarantina. In: Quilici, S., Oliva L. (a cura di) Still Appia. Roma: Gangemi Editore;

Secchi, B. (2003). "Scenari", in "Diario di un Urbanista", Planum, European journal of planning on line, http://www.planum.net/diary-06-scenarios-bernardo-secchi (visited: 12/12/2025);

Simmel, G. (1913). Philosophische Kultur. Leipzig: Alfred Kröner Verlag;

Turri, E. (1998). Il paesaggio come teatro: dal territorio vissuto al territorio rappresentato. Venezia: Marsilio;

Uggeri, G. (1987). La via Appia: itinerario romano da Roma a Brindisi. Roma: L'Erma di Bretschneider;.

ROTONDO F., Selicato F, Marin V, Lopez Galdeano J (eds., 2016). Cultural Territorial Systems. Landscape and Cultural Heritage as a Key to Sustainable and Local Development in Eastern Europe. Cham: Springer.

# A PROPOSAL FOR RURAL DEVELOPMENT: THE CASE OF LLËNGË VILLAGE IN POGRADEC

**Kristjan Collaku, Egin Zeka**
EPOKA University, Department of Architecture
Rr. Tiranë-Rinas, Km. 12, 1032 Vorë, Tirana, Albania
*kcollaku19@epoka.edu.al ; ezeka@epoka.edu.al*

## ABSTRACT

The preservation and revitalization of detached and abandoned villages present unique challenges, particularly in areas where accessibility, accommodation, and service provision are often inadequate. This thesis addresses these challenges by developing a comprehensive strategy and development model for the rehabilitation of detached sacred-heritage sites, with a specific focus on the remote village of Llëngë, in Pogradec, located in the Upper Mokra region of southeastern Albania. The study begins by assessing the current conditions of the village, examining infrastructure, economic status, population trends, and cultural and historical significance. A key component of the strategy involves improving the surrounding rural area to enhance accessibility and integrating community-driven approaches to ensure sustainable development. Through a detailed analysis of the region's physical and cultural elements, this research identifies potential interventions aimed at conservation, reusage, and the sustainable development of local economies. The findings highlight the importance of considering social phenomena and the roles of various stakeholders in the rehabilitation process. By showcasing the case of Shen Marene, the thesis demonstrates how targeted interventions can preserve cultural heritage while fostering economic and social revitalization in rural areas.

**KEYWORDS**: Sacred heritage, rural context, evaluation, rural development model, reusage, conservation strategies, Shen Marene.

## 1. INTRODUCTION

Rural abandonment is a worldwide phenomenon, and especially in second world countries like Albania this phenomenon is more prevalent than ever. This has led to the rapid depopulation of remote mountain villages, followed by a weakened infrastructure, and the deterioration of cultural and natural heritage

threaten both local identity and the continuity of traditional landscapes. Llëngë—an Aromanian settlement in Upper Mokra, a region generally affected by this phenomenon, —reflects this wider national and international trend. Once a vibrant community characterized by stone houses, terraced fields, and deep-rooted spiritual traditions, it now faces depopulation, followed by a limited economic activity, and insufficient conservation or heritage study efforts.

Heritage, and particularly sacred heritage, provides an opportunity for revitalization and for a pass on of traditions and other cultural elements into the next generations. Sacred sites act as cultural and social anchors, connecting communities to their past while offering potential for future socio-economic growth through responsible tourism and community-driven initiatives. By strengthening heritage preservation, improving accessibility, and reactivating local resources, villages like Llëngë can be repositioned within regional development strategies.

## 2. RESEARCH BACKGROUND

Detached sacred-heritage sites in rural areas represent important cultural, spiritual, and historical assets, functioning as links between communities and their collective past. These sites preserve rituals, beliefs, and social practices that have shaped local identities over centuries, while also contributing to the wider cultural landscape (An, 2020). Their relative isolation often enhances their authenticity and symbolic value, but simultaneously exposes them to risks related to abandonment, neglect, and limited accessibility.

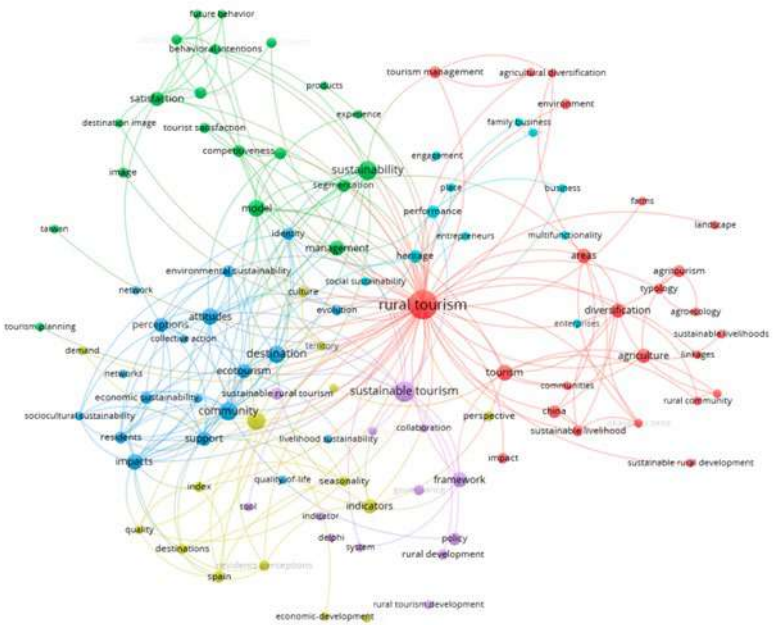


Figure 1: Co-occurrence map for articles related to sustainable rural tourism from 2009 to 2019. (An, 2020)

The literature identifies several challenges associated with the rehabilitation of rural sacred-heritage sites, including insufficient infrastructure, lack of financial resources, limited technical expertise, and reduced local populations (Elsorady, 2012). Effective rehabilitation therefore requires approaches that extend beyond physical conservation to include social, cultural, and economic considerations. Community participation and stakeholder engagement are consistently emphasized as essential components, ensuring that conservation strategies reflect local values and lived traditions (Wijijayanti, 2020; Landorf, 2009). The integration of traditional knowledge and practices into rehabilitation processes further supports sustainability and strengthens local ownership (Negi, 2010).

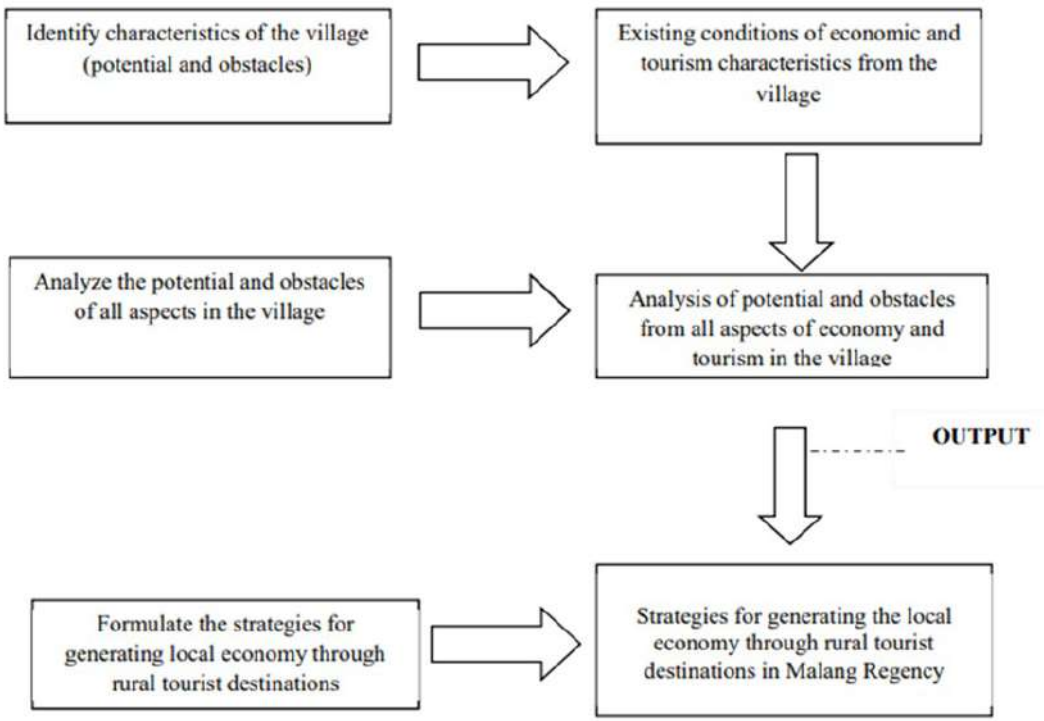



Figure 2: Development model outline. (Wijijayanti, 2020)

Pilgrimage and religious tourism are widely discussed as key drivers for the revitalization of detached sacred sites, while also presenting significant management challenges. Although pilgrims are often perceived as more respectful toward sacred landscapes, unregulated pilgrimage flows can still lead to

environmental degradation, congestion, and waste accumulation (Romanelli et al., 2021; Shinde & Olsen, 2022). Scholars highlight the importance of responsible tourism frameworks, environmental education, and visitor management strategies that protect the spiritual integrity of sacred places while supporting their continued use (Rutte, 2011). The concept of "pilgrim towns" further emphasizes the need to treat these settlements as living cultural and spiritual systems rather than purely touristic destinations (Shinde & Olsen, 2022).

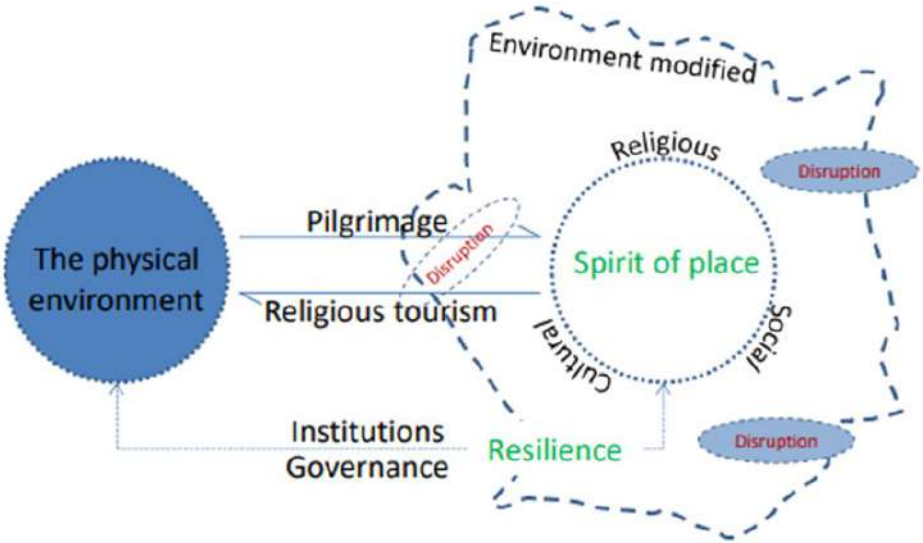



Figure 3: Revised model for understanding sustainability in sacred places (Shinde, 2022)

Preservation and management methods discussed in the literature include cultural mapping, interpretive signage, visitor centers, and community-based tourism initiatives (Aulet & Vidal, 2018). Collaboration between government authorities, religious institutions, heritage organizations, and local communities is considered fundamental to balancing conservation goals with economic development. Religious institutions, in particular, are recognized for their resilience and capacity to preserve spiritual meaning even in the face of physical transformation or increased visitor pressure (Leví & Kocher, 2012).

The Catalonia Sacra project in Spain examined over 300 religious heritage sites, demonstrating the importance of integrating architectural conservation with continued religious use (Aulet & Vidal, 2018). Rather than treating sacred buildings as static monuments, the project emphasized their role as active spiritual and cultural spaces, ensuring that restoration efforts reinforced both physical integrity and religious function. This approach strengthened community engagement and enhanced the visitor experience without compromising sacred values.

Additional studies highlight the resilience of sacred places, noting that physical disruption does not necessarily diminish cultural imagination or sacred meaning (Mróz, 2019). Sacred natural sites, in particular, are shown to function as informal conservation areas, preserving biodiversity through culturally embedded

practices rather than formal environmental regulation (Rutte, 2011; Velander, 2011). Rehabilitation projects linked to pilgrimage and cultural tourism have been shown to generate employment, stimulate local businesses, and strengthen community identity (Bajec, 2016; Ishida et al., 2019). At the same time, scholars warn of gentrification risks, emphasizing inclusive planning, community-led tourism models, and multifunctional village strategies as tools to prevent displacement and cultural erosion (Khartishvili, 2019; Gai et al., 2020).

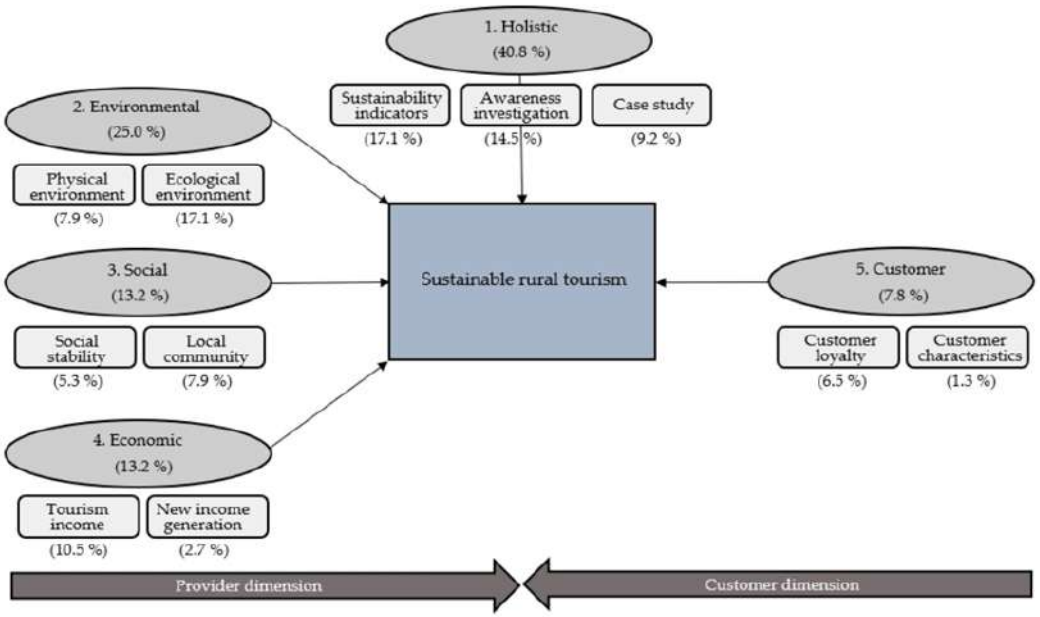



Figure 4: Dimensions of rural tourism (An, 2020)

## 3. METHODOLOGY

In order to have an entire understanding of the given subject we propose a step by step approach which will help us to identify the problems of the site analyse similar cases and develop around them a model sustainable for the continuous growth of the study area and also give options for this model to be used in other cases.

Firstly, what we must do is the literature gathering. This part can be redistributed in 2 other parts, one relating with the literature relevant to identification and course of action responding to different problems to these types of areas, and the study of medieval churches located in the area of Balkans, the other one being the gathering of different case studies in a local and international level to assess different effects of interventions in rural areas and how we can deal with such effects.

The second step consists of data gathering. We begin this stage by first determining the actors affective on and off site. After its determination we create different methods to approach each group and involve them in the development of this project. For the inhabitants of the area, it will be a questionnaire to gather collective data on their opinions. An important part of this step will also be the measuring and physical on-site observations to have a total overview of the area and understanding its current condition. This will assist in a more concise observation from both my viewpoint as an architect, the inhabitant viewpoint as users of the facilities, and as well a governmental or touristic viewpoint of the area.

The third step will be to create a contextual understanding of the site. Starting with a geographical analysis of its connections to the main cities nearby, in our case Pogradec, Gramsh and Perrenjas, and its regional importance related to the region of Mokër. Then a historical analysis of the village is to be done to create an even deeper understanding of the situation as well as the religious importance of the church and monastery relating to the region and further. This analysis will help us assess different factors which influence heavily the development of our site, as well as the usage of the area helping us to have a better decision making on future matters. The creation of cartels with information on the types of attractions located in the area, identify them, their national and regional importance, current conditions and opportunities on future development

The fourth step involves analysing and synthesizing the gathered information, then interpreting each point to create effective strategies and objectives. First, review all collected data, including research, observations, surveys, and interviews, to identify patterns and trends. Combine these insights to form a clear understanding and summarize the key points. Next, interpret these findings to understand their relevance and draw conclusions that inform the next steps. Develop broad intervention strategies to address the main issues identified, considering all affecting aspects. Define specific, measurable objectives to guide implementation.

The final step is the mixing of these interpretations with discussions and then devising final intervention and deciding critical sites and decisions around the area, be it in touristic interventions, structural interventions, service interventions or historical interventions. This part will be the last of the project and will create the model and then its implementation on the selected site while assessing expected effects it will have in the lives of the different actors and the effects it might create on a regional scale.

## 4. RESULTS

### 4.1. DESCRIPTION AND STUDY OF THE AREA

Upper Mokra, is located in southeastern Albania within the Municipality of Pogradec. It is composed of five administrative units: Dardhas, Trebinje, Proptisht, Velçan, and Çërravë. Though near main Albanian cities like Pogradec, Përrenjas, and Gramsh, access to these areas has long been difficult due to rough terrain and damaged infrastructure. Which are expected to improve with the completion of the Qukës–Qafë Plloç highway.

Situated at 1,040 meters above sea level, Upper Mokra is characterized by dramatic mountains, lush valleys, and a Mediterranean mountain climate with snowy winters and hot summers. Rich natural features include excessive grassland which is ideal for animal husbandry, dense beech and oak forests, and the Shkumbin River, which has shaped habitation in the area.

Culturally, the region hosts both Albanian and Aromanian villages, which maintain a long-standing, harmonious coexistence despite linguistic and cultural differences. Many villages remain undeveloped, preserving a traditional old-schooled way of life.

Upper Mokra has been inhabited since the Neolithic era, with archaeological traces from the Stone, Bronze, and Iron Ages, as well as remains from Illyrian, Roman, Byzantine, and medieval periods. Roman bridges and numerous archaeological sites testify to its historical importance. The people of Mokra were known for their bravery, including participation in Skanderbeg's campaigns. Medieval fortresses still stand throughout the landscape.

Under Ottoman rule, Upper Mokra became part of the Sanjak of Ohrid and later the Kaza of Starova within the Vilayet of Manastir. Over centuries, the region has maintained strong religious harmony among Orthodox Christians, Sunni Muslims, and Bektashi communities.

Combining natural beauty, deep history, and rich cultural traditions, Upper Mokra stands as a powerful expression of Albanian heritage—inviting visitors to explore its landscapes, discover its archaeological treasures, and connect with its timeless spirit.

There is a total of 31 villages in the region, in which we can see clearly the huge rate of abandonment as seen in the Table 1, where some villages barely have inhabitants at all. The figures shown are information gathered from official files from the Municipality of Pogradec, which indicates that this is most probable not the current situation as many families might have migrated elsewhere which makes these statistics even scarier.

## 4.2. MAIN REGIONAL ATTRACTIONS

Table 1: Cultural-Architectural attractions in the area

| Name | Location | Protection | Heritage Value | Current State | Possible use | Seasonality |
|---|---|---|---|---|---|---|
| Bridge of Nice | Nice (Dardhas) | 1st cat. | Part of Via Egnatia | Heavily damaged | Village-ruins connection | Year-round, small exceptions |
| Church of Saint Mary | Nice (Dardhas) | 1st cat. | Unique orthodox church | Heavily Damaged | Religious use, galleries | Year-round |
| Bridge of Terzi | Bishnice (Velcan) | 1st cat. | Part of Via Egnatia | Good | Cultural itinerary | Year-round |
| Saint Marene Church | Llenge (Trebinje) | 1st cat. | Unique orthodox church | Damaged | Pilgrimage-monastery | Year-round |

Table 2: Natural attractions in the area

| Name | Location | Type | Key Characteristics | Main Activities | Seasonality |
|---|---|---|---|---|---|
| Cave of the Bear | Bishnice (Velcan) | Cave | Natural stone formations | Cave Exploration | Year-round, small exceptions |
| Glacial Lakes of Lukova | Bishnice (Velcan) | Lakes | Forrest-surrounded glacial lakes | Hiking-Camping | Year-round |
| Canyons of Llenge | Llenge (Trebinje) | Canyon | Via Egnatia Landscape | Hiking-Sightseeing | Year-round |
| Lakes of Mujazda | Llenge (Trebinje) | Lakes | Light Vegetation surrounding | Hiking, water activities | Year-round (not winter) |

In Table 1 above we have listed the results of the cartels we have done for different attractions in the region which we have also mapped in Figure 6, showcasing the massive potential this region possesses to become a main hub of cultural and touristic activities.

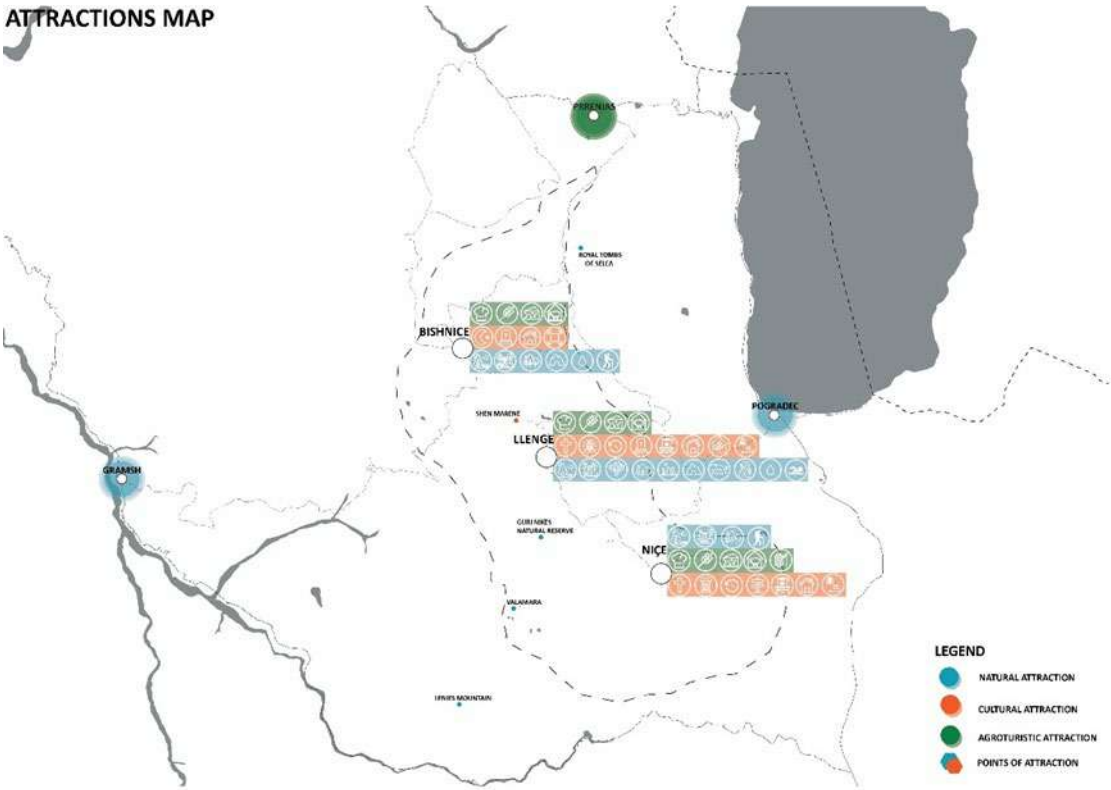



Figure 6: Map of attractions in the region

## 4.3. VILLAGE OF LLENGE

Llëngë village, officially recorded with 60 inhabitants and 13 families, in reality is home to only five permanent households, with a few additional families returning in rare occasions and for little to no time at all. Its economy is traditionally based on agriculture (60%) and animal husbandry (40%), yet both sectors are weakened by economic and social difficulties arisen in recent years, as well as the total abandonment of traditional handicraft such as metalwork and woodwork. Basic services remain critically underdeveloped: potable water and electricity supply are unreliable, grey-water management is inadequate, and the village lacks public buildings, educational facilities, and medical services. The nearest school and health center are several kilometers away and inaccessible due to the absence of public transport and poorly maintained roads, particularly in winter.

Large portions of land remain uncultivated as a result of infrastructural neglect and population decline. Existing agricultural activity is limited to small-scale self-sufficient crops and tree plantations. Residential structures suffer from significant physical decay, mirroring the general depopulation trend and lack of investment.

Despite these challenges, Llëngë possesses substantial development potential. The village hosts significant religious heritage sites—including the cave and monastery of Saint Marene and the monastery of Saint George—as well as diverse natural attractions such as the Llëngë Canyons and the lakes of Mujazda. These assets offer opportunities for tourism, pilgrimage routes, cultural revitalization, and eco-recreational activities. Combined with the presence of welcoming locals, existing festivals, and numerous abandoned or historic buildings suitable for adaptive reuse, Llëngë holds promise for sustainable rural development if supported by improved infrastructure, services, and regional cooperation.

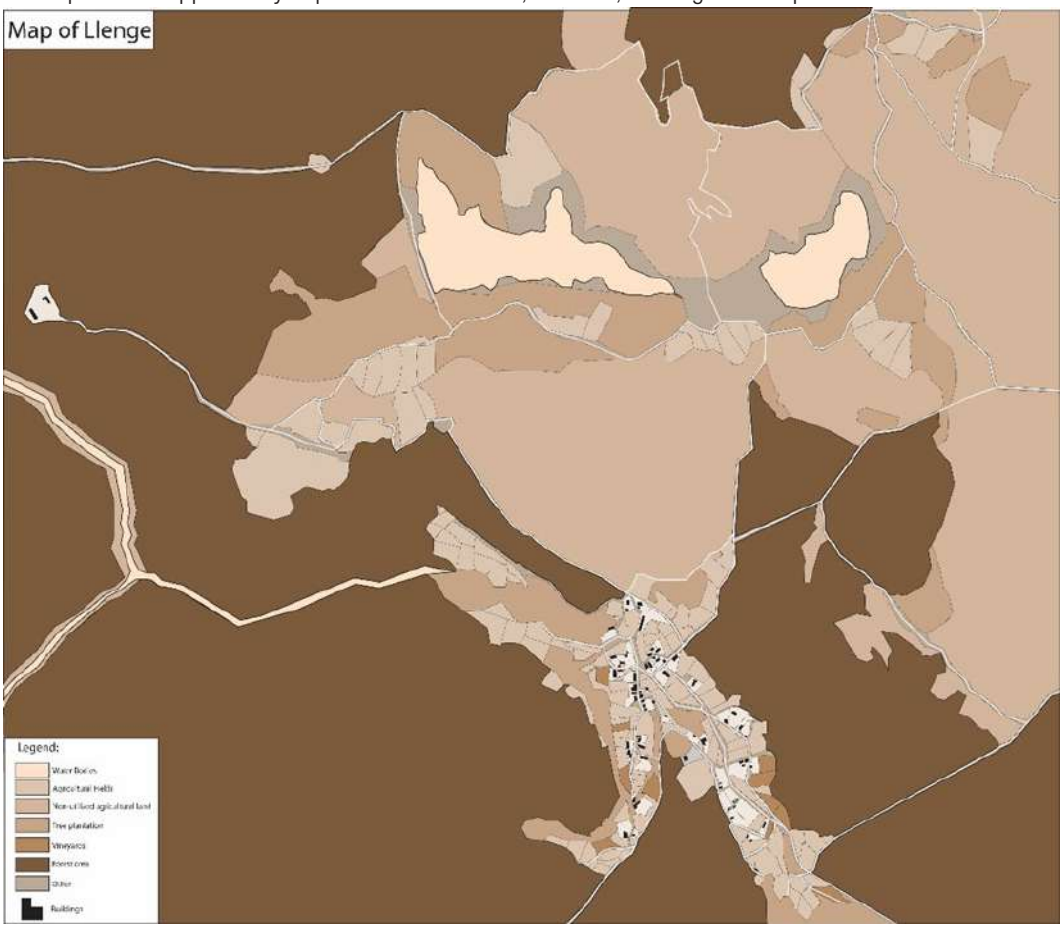



Figure 7: Map of Llenga with Land use

## 4.4. DEVELOPMENT MODEL

The development approach for Lliëngë is structured around the assessment of regional potentials and existing constraints, forming a framework for defining targets and a phased development model. The first phase focuses on foundational interventions, improving infrastructure, restoring essential services, and enabling basic economic and social functions. A key objective is repopulation, which is critical for reviving the local workforce as well as reintroducing traditional craftsmanship skills once practiced in the village. Encouraging investment from former residents with available capital is also crucial to completing this initial stage.

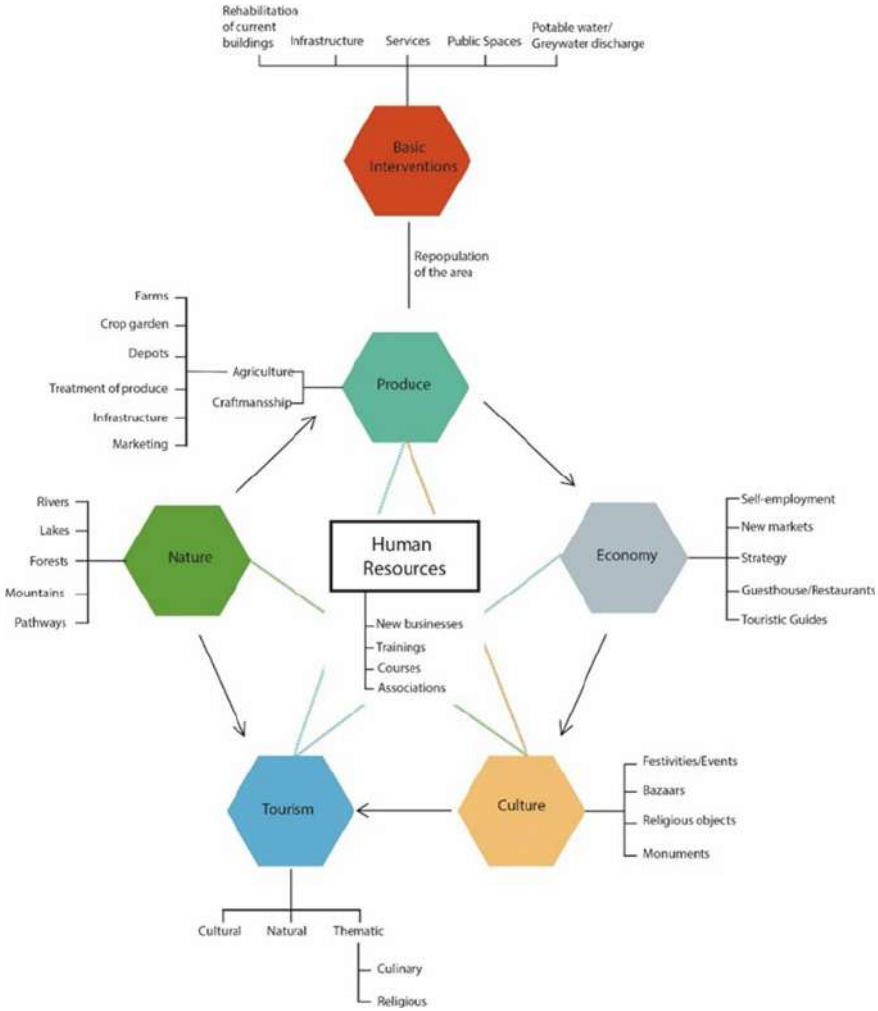



Figure 8: Second Development Phase

Upon establishing these basic conditions, the second phase focuses in the sectoral development measures aimed at boosting local production and creating more economical opportunities. Increased output is expected across agriculture, animal husbandry, and traditional crafts, creating opportunities for new markets, small businesses, and self-employment, such as guesthouses and restaurants. This growth is envisioned to support improved living conditions, controlled building restoration, and strengthened cultural identity while enhancing multiple forms of tourism, cultural, natural, culinary, and religious.

Agricultural development focuses on activating the region's extensive farmland through improved irrigation, drainage, and access roads, alongside the establishment of facilities for storage and processing of produce. A local farmers' association, supported by experts, is proposed to guide the adoption of new technologies and coherent cultivation strategies.

Tourism development helps existing cultural and natural assets. Plans include creating a village museum, restoring religious sites crucial to the pilgrimage network, and establishing agritourist complexes to reconnect visitors with local landscapes and culinary traditions. The diverse natural environment supports a range of activities, from water-based activities to mountain climbing, broadening the tourism offer and contributing to sustainable regional revitalization.

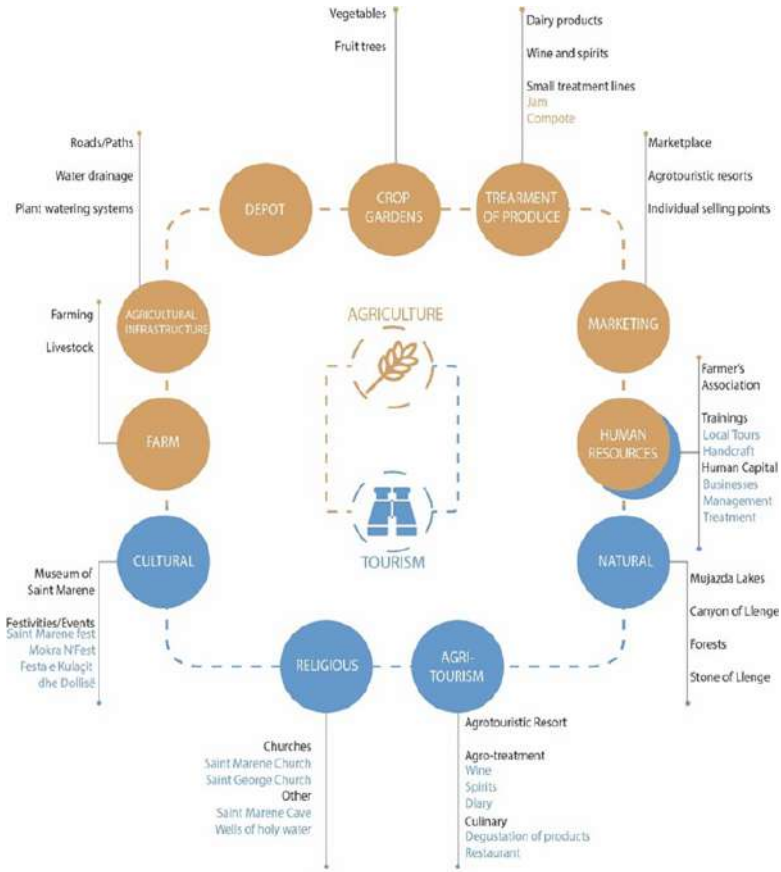



Figure 9: Detailed thematic development model

## 4.5. PROJECT PROPOSALS

The development framework for Llëngë is centered on developing regional connectivity, restoring essential services, and activating the area's cultural, agricultural, and natural assets to assist long-term rural revitalization. Strengthening transportation links is identified as a foundational intervention. A new system of upgraded roads connecting Proptisht, Somotinë, Bishnicë, and Llëngë—while also passing through Slabinjë, Losnik, Lushkë, Jollë, and Zgallo—significantly increases accessibility between villages. Equally important is the direct link between Llëngë and Niçë, the only two Aromanian villages in the region, which further connects the area to the Qukës–Qaf Plloç highway, aiding access to Pogradec, Përrenjas, Maliq, and Korçë. These improved connections are expected to support mobility, market access, administrative integration, and visitor circulation throughout Upper Mokra.

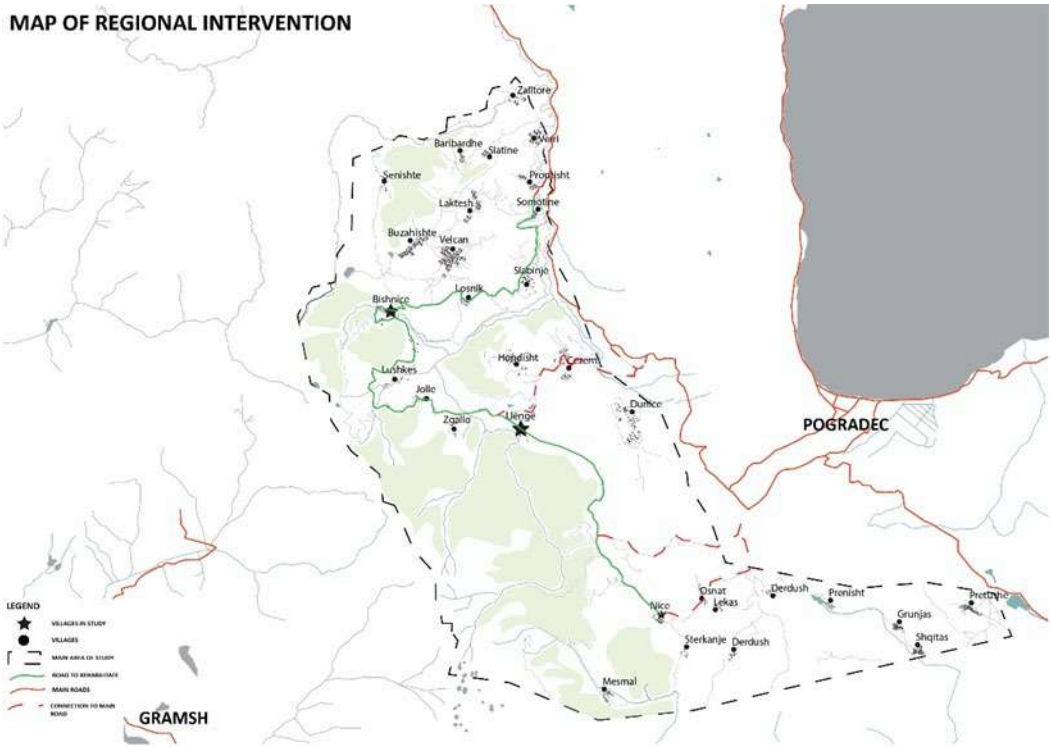



Figure 10: Map of Regional Interventions

Within the village itself, several critical issues require intervention, including damaged roads, lack of public lighting, insufficient potable water supply, and outdated or absent sanitation systems. Our proposal focuses on making the village accessible year-round, improving living conditions for current and future inhabitants, and laying the basis for future economic growth. Additional interventions include the installation of irrigation networks to support agriculture, the creation of a locally owned marketplace promoting regional produce, and the creation of a functional village centre equipped with essential services such as a pharmacy, an information point, public transport facilities, basic financial services, and communal spaces for residents and visitors.

A series of strategic development projects to further explain the long-term vision for the village. The Agricultural Complex, located in the area with the largest unused farmland, is designed as a multifunctional production and training hub. It incorporates a farmers' association headquarters, treatment centers for different agricultural products, as well as a restaurant dedicated to regional culinary traditions. This complex aims to raise agricultural productivity, introduce modern techniques to farmers, and support both local

livelihoods and rural tourism. Its phased implementation allows gradual adaptation by residents and sustained economic growth.

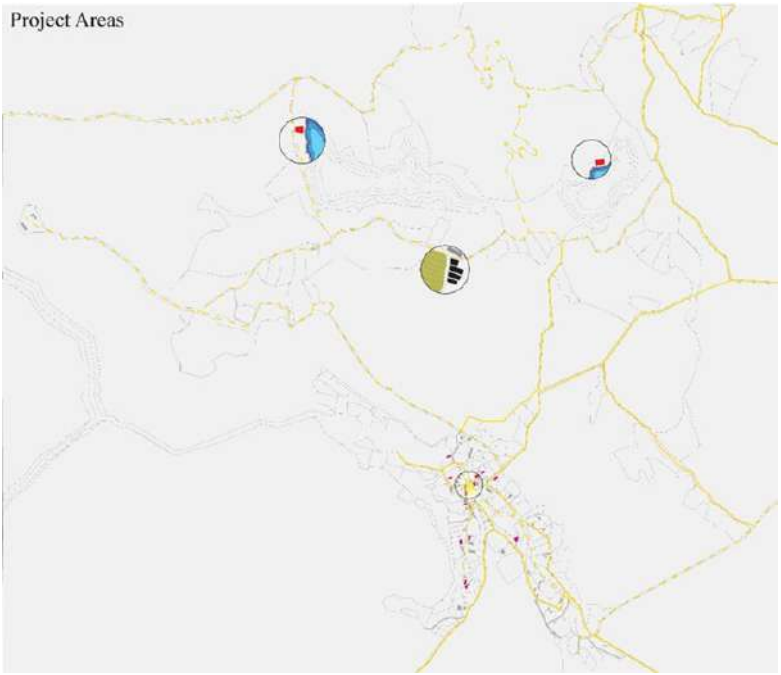



Figure 11: Project Areas

The Village Square Project seeks to re-establish a strong core by rehabilitating the school and medical centre, adding a transport terminal, parking areas, and essential services, as well as taking into consideration the creation of gathering and recreational spaces. This square is purposed to serve both inhabitants and tourists, acting as the starting point for guided tours and cultural activities, as well as the centre of all village activities. Parallel to this, the Guesthouse Conversion Program focuses on restoring abandoned or deteriorated traditional homes, transforming them into tourist accommodations that preserve local architectural character while offering immersive cultural experiences.

Complementary projects take a focus on the natural landscape and recreational capacity of the region. Near the lakes of Mujazda, new pedestrian infrastructure, seating areas, and sports facilities for water activities are proposed, creating an accessible and attractive outdoor recreation zone. The addition of clear orientation signage and maps is a response to the current absence of guidance elements, ensuring safer and more intuitive navigation for visitors.

A major cultural and spiritual component of the plan is the improvement of the pilgrimage network centered on the Saint Marene Monasteral Complex. The primary route begins in Llëngë and connects the village to the cave of Saint Marene an orthodox sacred site, before continuing to the monastery complex.

Traditional rites associated with the pilgrimage are to be preserved, while alternative routes, such as the path through the Llëngë Canyon, are proposed with a thought of future accessibility improvements. The recently reconstructed Saint George Monastery forms an additional pilgrimage destination, enriching the spiritual landscape.

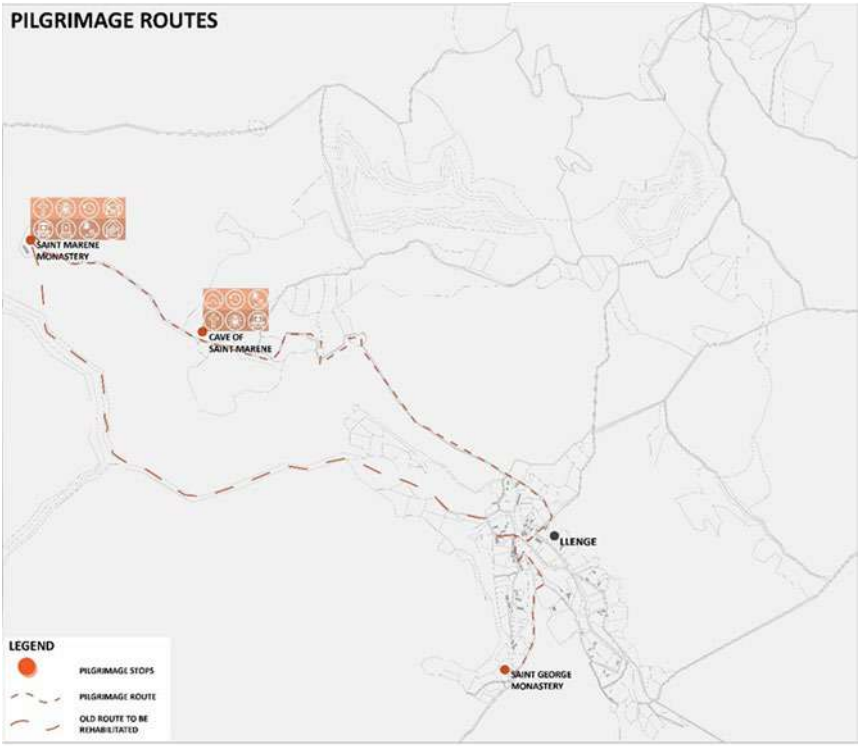



Figure 12: Pilgrimage Route

The most required heritage intervention is the Reorganization of the Saint Marene Monastery Complex, which includes phased documentation, restoration, and adaptive reuse of the site. Proposed additions include a sacred art gallery, renewed monastic living quarters, dedicated pilgrim accommodations, a visitor centre, and a gift shop. These enhancements aim to preserve the religious and cultural significance of the complex while enabling it to function as a year-round destination for pilgrims, researchers, and cultural tourists.

## 4.6. LLENGE VILLAGE OF TOMORROW

Touristic itineraries for Llëngë operate on both regional and local levels, supported by improved connectivity with nearby villages such as Niçë and Bishnicë. These itineraries, accessible by foot, bicycle,

or car due to favourable terrain, are organized into cultural, agricultural, and natural routes. The journey typically begins in Pogradec, leading visitors toward Llëngë through trails. Once in the village, visitors can explore traditional-styled guesthouses, cafés, artisan markets, and the Monastery of Saint George. Moving westward leads to the Canyons of Llëngë and the Stone of Llëngë, attracting nature lovers and climbing enthusiasts. Continuing northwest brings visitors to the pilgrimage site of Saint Marene's Cave and then to the Monastery of Saint Marene, which hosts a sacred art gallery, a visitor center, and natural springs. Further east, visitors reach the lakes of Mujazda, where they can enjoy water activities, nature walks, and panoramic views. South of the lakes lies the agritourist complex, which offers local cuisine while educating visitors about agricultural practices. The itinerary concludes with a return to the village centre or an extended forest hike surrounding the lakes.

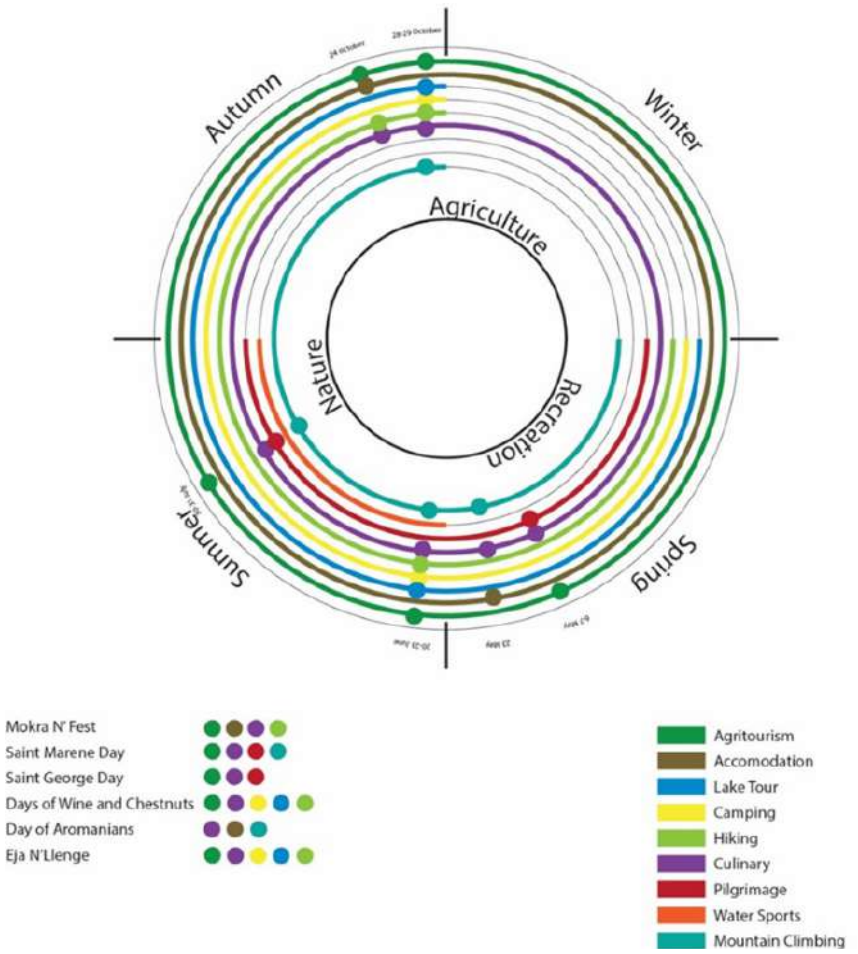



Figure 14: Yearly Calendar of activities

A two-day visit is proposed to structure the tourist experience.

Day 1 includes arrival and accommodation in local guesthouses, followed by visits to the Canyons, the Stone of Llëngë, the Mujazda lakes, the agritourism complex, and the Monastery of Saint George.

Day 2 begins with the pilgrimage site of Saint Marene's Cave, followed by a visit to the Monastery of Saint Marene, and ends with a forest hike and picnic.

The yearly calendar of activities supports seasonal tourism.

## 5. CONCLUSION

While analysing the area of Llenge, we identified key areas for intervention, such as improving infrastructure to enhance accessibility, integrating community-driven approaches for sustainable development, and promoting the conservation and reuse of heritage sites. The proposed development model emphasizes a holistic approach, considering both physical and cultural elements to ensure balanced and sustainable growth of the village. Key findings include:

- The need for improved infrastructure to make the village more accessible.
- The importance of community involvement in the development process to ensure that interventions are sustainable and culturally appropriate.
- The potential for cultural and religious tourism to boost the local economy.
- The necessity of preserving both the tangible and intangible cultural heritage of the village.

The proposed interventions include restoring and repurposing existing buildings, creating new economic opportunities through tourism, and organizing cultural events to attract visitors and engage the community. The case of Saint Marene demonstrates that with targeted efforts, it is possible to preserve cultural heritage while fostering economic and social revitalization in rural areas.

In conclusion, this thesis provides a strategic framework for the rehabilitation of detached sacred-heritage sites in rural areas. It underscores the importance of a collaborative approach involving local communities, government agencies, and other stakeholders. By focusing on both conservation and development, the proposed model aims to ensure the sustainability and vitality of Llëngë and similar villages in the region.

## REFERENCES

An, W. (2020). How Can Rural Tourism Be Sustainable? Madrid: MDPI.

Aulet, S. a. (2018). Tourism and religion: sacred spaces as transmitters of heritage values. Church Communication and Culture, 237-259.

Bajec, F. J. (2016). Cultural Heritage and the Role of Voluntary Associations in the Process of Achieving Sustainable Development in Rural Communities. Studia ethnologica Croatica, 21-45.

Chan, H. J. (2016). The role of self-gentrification in sustainable tourism: Indigenous entrepreneurship at Honghe Hani Rice Terraces World Heritage Site, China. Journal of Sustainable Tourism, 1-18.

Creative Industries Fund NL. (2014). Traveller and the Olive Grove. Rotterdam: Cityforster.

Delgado, G. J.-P.-G. (2020). Heritage, Tourism and Local Development in Peripheral Rural Spaces: Mértola (Baixo Alentejo, Portugal). Sustainability, 9157.

Elsorady, A. D. (2012). Heritage conservation in Rosetta (Rashid): A tool for community improvement and development. Cities 29, 379–388.

Gai, L. e. (2020). Research on the Development and Protection of Rural Culture from the Perspective of Multiple Plan- Take Panjia fen “Harmonious Family” Eco-Resort in Beijing Suburb as an Example. IOP Conference Series Earth and Environmental Scienc (pp. 012094-012094). -: Institute of Physics (IOP).

Giusca, M. (2020, May 1). Religious tourism and pilgrimage at Prislop Monastery,. Journal of Studies and Research in Human Geography, 1-19.

Hribar, Š. M. (2015). Sustainable Heritage Management: Social, Economic and Other Potentials of Culture in Local Development. Procedia - Social and Behavioral Sciences, 103-110.

Ishida, Y. e. (2019). Consideration of issues and solutions related to the coexistence of cultural properties and the real life of the neighborhood. Disaster Prevention and Management: An International Journal, 86-108.

Jia, Z. e. (2018). Sociocultural vitality versus regulation policy and tourism development in preservation of traditional rural landscape: a case from Guizhou, China. International Journal of Sustainable Development & World Ecology, 1-14.

Khartishvili, L. (2019). Rural Tourism in Georgia in Transition: Challenges for Regional Sustainability. Sustainability, 410.

Landorf, C. (2009). Managing for sustainable tourism: a review of six cultural World Heritage Sites. Journal of Sustainable Tourism , 53-70.

Leví, D. a. (2013). Perception of Sacredness at Heritage Religious Sites. Environment and Behavior, 912-930.

Lin, H. e. (2021). Research on the Development of Religious Tourism and the Sustainable Development of Rural Environment and Health. International Journal of Environmental Research and Public Health, 2731.

Ma, J. (2023). Religious Heritage Conservation and Community Engagement under the Threshold of Heritage Revitalisation in Ningxia. Frontiers in Humanities and Social Sciences, 1-6.

Minority Rights Group. (2024, February 25). Aromanians in Albania. London, London, England.

Mróz, F. (2019). Changes in Religious Tourism in Poland at the Beginning of the 21 st Century. Turyzm/Tourism, 95-103.

Negi, S. C. (2010). Traditional Culture and Biodiversity Conservation: Examples From Uttarakhand, Central Himalaya. Mountain Research and Development, 259-265.

Pogradec, M. o. (2017). Analiza dhe Vleresimi i Territorit. Pogradec: Municipality of Pogradec.

Romanelli, M. e. (2021). Towards a sustainability-oriented religious tourism. System research and behavioral science, 386-396.

Rutte, C. (2011). The sacred commons: Conflicts and solutions of resource management in sacred natural sites. Biological Conservation, 2387-2394.

Shinde, K. a. (2022). Reframing the Intersections of Pilgrimage, Religious Tourism and Sustainability. Sustainability 15, 461.

Soini, K. (2012). EXPLORING CULTURE IN SUSTAINABLE RURAL DEVELOPMENT . Jyväskylä: University of Jyväskylä.

Velander, K. (2011). Sacred Natural Sites: Conserving Nature and Culture. Mountain Research and Development, 276-276.

Velander, K. (2011). Sacred Natural Sites: Conserving Nature and Culture. Mountain Research and Development, 276-277.

Wijijayanti, T. (2020). Rural Tourism: A Local Economic Development . Australasian Accounting, Business, and Finance Journal , 1-14.

# HISTORY & HERITAGE

# THE REPRESENTATION OF STRUCTURE IN FRANK LLOYD WRIGHT AND MARION MAHONY'S WASMUTH PORTFOLIO

Carles Rosaleny-Gamón, Marcel·lí Rosaleny-Gamón, Ivan Cabrera-i-Fausto, Marina Sender-Contell,
Universitat Politècnica de València
Camí de Vera s/n, València, Spain
*carrogam@ega.upv.es; ivcabfau@mes-upv.es; mscontel@ega.upv.es; marrogam@ega.upv.es*

## ABSTRACT

The Wasmuth Portfolio constitutes a fundamental document for understanding the architecture of Frank Lloyd Wright and, in particular, his conception of structure as an order that generates form and space. Through the lithographs created together with Marion Mahony Griffin, structure is presented as an underlying system that organizes geometry, composition, and the relationship between architecture and its environment. Architectural drawing thus becomes an essential tool for thinking and transmitting the concept of structure.

The graphic language developed by Mahony plays a key role in this reading. Her ability to integrate architecture, landscape, and geometry within a single visual logic allows structure to be legible through alignment patterns, modulations, rhythms, and the continuity of horizontal planes. The use of negative space, the careful selection of viewpoints, and the consistent treatment of vegetation reinforce an organic conception of architecture, in which building and environment are part of the same system.

The analysis of the Winslow House and the Robie House confirms the consistency of this approach. Although they correspond to different stages of Wright's work, both manifest structure as an organizing principle, either through symmetry and modulation or through horizontality and cantilevers. Taken together, the Wasmuth Portfolio is established as a first-rate theoretical and graphic document for the study of modern architecture.

KEYWORDS: Frank Lloyd Wright, Marion Mahony Griffin, Wasmuth Portfolio, Graphic Representation, Structure, Architectural Drawing

## 1. INTRODUCTION

During the first decade of the twentieth century, the American architect Frank Lloyd Wright sought to present in Europe an architecture radically different from the dominant historicist languages, based on spatial continuity, integration with the surroundings, and an organic conception of buildings. To this end, together with the architect Marion Mahony Griffin, he developed what came to be known as the Wasmuth Portfolio: a carefully curated selection of projects, both built and unbuilt, which would become the principal instrument for the international dissemination of Frank Lloyd Wright's work. This set of lithographs, published in Berlin in 1911, marked a turning point in the reception of American architecture within the European context, since beyond the new formal and spatial qualities proposed by his architecture, the Wasmuth Portfolio made it possible to communicate a specific way of understanding structure as an organizing principle of the project.

Marion Mahony's exceptional system of graphic representation, which conceived drawings as artistic objects in their own right (Gray, 2022), endowed the collection with a visual coherence that went beyond the mere illustration of architecture. Her sensitivity to nature made the integration of the landscape one of the key elements of a carefully controlled composition and of extraordinary expressiveness. The plates conveyed a profound understanding of Wright's architecture, in which structure, form, space, and nature appeared inextricably linked. The choice of drawing over photography, together with such a personal graphic language, made possible the construction of a unified, coherent, and recognizable image of Wright's work.

Thus, although structure plays a fundamental role, it appears in an unusually implicit manner. In the plates of the Wasmuth Portfolio there are no diagrams, construction details, or technical indications regarding structural systems. Nevertheless, structure is constantly present as an underlying pattern (Xiong, 2019) that governs geometry, spatial modulation, and the relationship among the different elements of the project. The graphic manner in which structure is represented makes it possible to identify alignment patterns and rhythms that refer to an implicit structural logic, legible through the architectural drawing itself (Cantavella Franch, 2017). Moreover, it emphasizes those design concepts linked to architectural composition such as horizontality, spatial continuity, and cantilevers—features inherent to his work and which so deeply preoccupied Wright.

This way of understanding structure and manifesting it in the lithographs is part of a broader architectural conception developed by Wright, in which the building is conceived as a unitary system generated from simple geometric and spatial principles, repeated and modulated. Structure avoids manifesting itself as an independent skeleton and dissolves into the architectural space, organizing the plan, elevations, and the relationship with the surroundings. This idea, which runs through much of his work, finds one of its clearest expressions in the Wasmuth Portfolio, precisely because the representation dispenses with the technical in order to focus on conveying the internal order of the project (Beltrán, 2015).

The role of Marion Mahony in the Wasmuth Portfolio is essential, as she is credited with the vast majority of the plates. She carried out her professional activity during a period in which women were restricted to specific social and professional spheres, restrictions that she boldly transcended (Mortice, 2016). On some of the plates she incorporated her initials, identifying herself as the author and thereby breaking with practices normally attributed to women within a profession dominated by men (Gray, 2022).

Her childhood and youth experiences, her architectural education, and her graphic sensitivity—shaped by Japanese woodblock printing—enabled her to develop a representational language capable of integrating architecture, landscape, and geometry within a single visual logic (Gray, 2022). In her drawings, nature is treated as a necessary element of the compositional system, reinforcing the reading of architecture as part of a larger structural order. It is not understood as a decorative backdrop; rather, it communicates the appearance of the building and makes perceptible the structural logic that organizes it.

From this perspective, the Wasmuth Portfolio, in addition to being conceived as a means of international dissemination, can be understood as a genuine theoretical vestige. The more than ninety lithographs construct an architectural discourse in which structure appears as the invisible essence of form and space. Drawing thus becomes a tool for architectural thought, capable of transmitting a complex structural and compositional conception without resorting to technical explicitness.

On the basis of these considerations, the present study aims to analyze how structure appears in the Wasmuth Portfolio and how the graphic language developed by Mahony makes visible an underlying structural order. The study focuses on the analysis of the lithographs as graphic documents that articulate a specific understanding of architecture, placing representation at the center of the debate on the relationship between structure, form, and space in the work of Frank Lloyd Wright.

## 2. CONCEPTUAL FRAMEWORK

The present research is based on the idea that the Wasmuth Portfolio reflects, through its lithographic illustrations, how structure in the architecture of Frank Lloyd Wright constitutes a fundamental organizing principle. Far from being understood as a system independent from form, structure is conceived as a spatially generative order from which common characteristics of his architecture derive: simple geometries, the presence of horizontal lines, modulation, and the compositional articulation of the project that enables mastery of the free plan. In the essay “The Japanese Print: An Interpretation” (1912), Wright emphasizes the importance of the structural character of drawing, through which he reaches the essence of the object by means of geometry. This conception has been highlighted by various authors when analyzing Wright’s architecture, in which structure appears integrated into the very spatial logic of the building, conditioning both the plan and the relationship between interior and exterior.

This structural order manifests itself through simple and repeated geometries, organized by means of grids and alignment systems. Modular rhythm and the hierarchization of spaces respond to an internal logic that precedes the visible form of the building. Unlike his European contemporaries, Wright’s starting point in the development of a new conception of architecture stemmed from his education during the Chicago Renaissance, within a climate of experimentation with new materials and architectural forms (Ettinger, 2007). Numerous studies have linked this way of understanding structure to Wright’s early formative experiences, particularly the use of the pedagogical toys of the German educator Friedrich Froebel during his childhood. These experiences taught him to perceive architecture as the articulation of elementary geometric forms in space (Albert, 2015).

In the Wasmuth Portfolio, this structural conception is not explained through texts nor illustrated by means of construction diagrams. Wright and Mahony choose instead to express it graphically through drawing, so that structure becomes legible without being explicit. Thus, the notion of structure as an invisible order can also be read by observing the disposition of walls, the modulation of openings, and the continuity of horizontal planes.

In this regard, the contribution of Marion Mahony is especially relevant, as is her graphic language capable of integrating architecture, landscape, and perception within a single composition. Tools such as the use of negative space and the insistence on evidencing compositional continuity reinforce the reading of the represented architecture as an organic system, in which structure dissolves into form and extends into the natural surroundings.

Although the way in which Mahony represents and integrates nature in the illustrations inevitably constitutes a visual and aesthetic stimulus, what is exceptional is that this representation of nature often contributes to reinforcing the structural understanding of the building. By depicting vegetation, terrain, and architecture with a uniform graphic treatment, the plates suggest that all these elements form part of a single order. This visual strategy communicates a key conception in Wright's architecture: the building does not impose itself upon the site, but rather articulates itself with it through continuous geometric and spatial relationships. "Wright's Prairie Houses establish a harmonious relationship with the natural environment" (Ettinger, 2007) and take up the horizontality of the landscape in order to anchor themselves to the ground.

In this way, drawing becomes a tool for thought and transmission, in which each layer is capable of communicating the structural conception, how it is responsible for the character of the building, and how it responds to the environment in which it is constructed.

This conceptual framework constitutes the basis upon which the graphic analysis of the plates of the Wasmuth Portfolio is articulated. From it, it becomes possible to approach the study of the graphic expression of structure through a methodology that combines visual observation and theoretical reflection, understanding drawing as a means of accessing the structural thinking underlying Wright's architecture.

## 3. GRAPHIC EXPRESSION OF STRUCTURE

The analysis of the graphic expression of structure in the Wasmuth Portfolio makes it possible to understand architectural drawing as a fundamental instrument for the formulation and transmission of Frank Lloyd Wright's structural thinking. The plates that make up the portfolio function as a space of synthesis in which geometric, spatial, structural, and natural relationships are articulated. This dimension of drawing is essential for interpreting the work of the American architect, since structure is presented implicitly and becomes legible through the composition and the graphic tools employed throughout the collection.

The analytical methodology adopted in this study is based on a visual and compositional reading of the lithographs in the Wasmuth Portfolio, focusing on the identification of those elements and graphic resources that allow an underlying structural logic to be inferred. This approach relies on the systematic observation of patterns and on comparison between different representations, understanding drawing as a form of structural thinking and communication in itself. From this reading, three complementary levels of

interpretation are identified, which make it possible to break down the graphic expression of structure without fragmenting its unitary understanding.

- Geometric Order

The first level of analysis is based on the geometric order that organizes the plates through axes and proportions. Both in the plates of the Wasmuth Portfolio and in the buildings depicted in them, it is possible to identify regulating grids and frameworks that structure the arrangement of spaces and the relationships among the different elements. These patterns are not represented explicitly, but become visible through modular repetition, the correspondence between walls and openings and their rhythms, as well as the continuity of certain compositional axes (Cantavella Franch, 2017).

This geometric order responds to a structural conception in which geometry acts as the generative principle of the project. The organization of the different spaces, which adapt volumetrically to their function, is the result of proportional relationships and transverse modulations in plan, elevation, and section that ensure the coherence of the whole. This way of organizing the project through basic geometries refers to the idea of structure as an abstract system that precedes the visible form of the building.

It is in the elevations where the geometric order becomes most clearly evident, thanks to the rhythmic arrangement of openings and the hierarchization of volumes. The repetition of distances between openings and the alignment of constructive elements allow the reading of a latent structure that organizes the façade as a result of the spatial and functional logic of the interior spaces. In this way, graphic representation reveals the continuity between structure, form, and function.

- Structural Expression

The second level of analysis addresses structural expression. In the plates of the Wasmuth Portfolio, structure is manifested primarily through the superimposition of dashed lines over the drawings of the plans, the articulation of volumes, and the relationship between the shading of solids and voids. These graphic resources allow the behavior and structural design of the building to be intuited, particularly with regard to load transmission.

In various plans of the buildings represented, patterns of dashed lines are drawn that correspond to the joists of the floor slabs and that, on many occasions, coincide with decorative elements on the ceilings of the most representative rooms. This subtle representation contrasts with the forcefulness with which the elements to which these loads are transmitted are sectioned: walls and columns, which invariably appear shaded in black.

Horizontality plays a fundamental role in this structural expression. The extension of roofs, slabs, and terraced elements reinforces the reading of a structure that extends and is distributed through space. Horizontal planes act as organizers of space. This graphic strategy helps to dissolve the perception of structure as a set of isolated vertical supports, replacing it with the idea of a continuous system that articulates the building as a whole.

- Correspondence between Structure and Architectural Form

The third level of analysis focuses on the correspondence between structure and form, and on how this relationship manages to convey the balance between structure, function, form, and place. In Mahony's illustrations, structure is also transmitted through the structural character she is able to suggest in the building. The perspectives in the Wasmuth Portfolio are a clear example of this. Through the choice of

viewpoints in these drawings, the architect emphasizes the most significant structural elements, such as large horizontal planes or cantilevered volumes that give character to the building. Thus, the composition and framing of the scene contribute to constructing a structural reading of the building.

In this sense, the use of void as a compositional element also appears, contributing to the emphasis on the structural character of the buildings. Interstitial spaces, setbacks, and the shadows generated by cantilevers are represented meticulously and with great intentionality. They reinforce the perception of balance between mass and lightness, horizontality, and the impression of cantilevers. In this way, the drawing shows the appearance of the building while also suggesting how structure enables the opening of space, visual continuity between interior and exterior, and the pursuit of horizontality.

The incorporation of the natural environment and landscape in the representation also plays an essential role. Mahony places the representation of architecture and that of natural elements on the same level through a homogeneous and coherent graphic treatment. In this way, the lithographs suggest that both form part of a single architectural system and that the placement of each building is inseparable from its surroundings (Gray, 2022). This distinctive style, influenced by Japanese woodblock prints in which exuberant vegetation takes on a prominent role in the compositions, made the buildings appear “irresistibly romantic” (Bernstein, 2008). This visual strategy further reinforces and helps to communicate Wright’s organic conception of architecture—an architecture in which structure adapts to the site through formal and spatial relationships without imposing itself upon the environment.

This correspondence between structure and architectural form, constructed through graphic expression, is fundamental for understanding the Wasmuth Portfolio not only as a set of illustrations intended to promote the architect in Europe, but also as a historical and theoretical document of the new architecture and the principles advocated by Wright and Mahony.

## 4. CASE STUDIES

The analysis of the following case studies included in the Wasmuth Portfolio makes it possible to verify how the theoretical and graphic principles described in the previous sections are materialized in two specific projects. Through the comparative study of the Winslow House (1894) and the Robie House (1909), it is possible to identify constants in the way Wright and Mahony conceive and represent structure as an order that generates form and space. In this sense, the selected cases are approached as particular manifestations of a single structural and graphic logic.

- Winslow House (1894)

The Winslow House is one of Wright’s earliest residential projects. Through the study of this case, an initial stage is analyzed in which some of the principles that would characterize his later work are already evident. The influence of Louis Sullivan is still apparent in this project; however, the organization of the design anticipates a conception of structure as a principle of formal and spatial order.

The main façade of this house in River Forest is organized around an axis of symmetry and a modular rhythm that externalizes the order and function of the interior spaces. Structure thus appears as a regulating

element of the composition, establishing a direct correspondence between the interior spatial organization and the exterior expression of the building.

The Wasmuth Portfolio devotes its first plate to this project. It is a lithograph dominated by an exterior view of the house, in which many of the graphic tools previously described can be identified. The view reflects the main design strategies of the house, centered on the symmetrical composition of the façade and a clear differentiation between the ground floor and the first floor. This compositional order also has a functional correspondence, placing the main entrance on the central axis of the façade and zoning the daytime and nighttime areas on the ground and first floors respectively. The structural order is diluted within a composition that prioritizes exterior appearance, yet it can be glimpsed through the hierarchization of volumes and the geometric clarity of the composition.

Within this composition, the pitched roof acquires a singular prominence: it is the umbrella under which the house emerges, but also the drawing itself. Wright and Mahony emphasize this element in the lithograph, endowing it with a visual weight that reinforces its structural and symbolic role. The integration of vegetation, cascading down from the upper edge of the plate, establishes a visual analogy between the roof and natural elements, reinforcing Jennifer Gray's idea of an architecture conceived as part of a broader organic order.

Although the Winslow House, strongly influenced by Sullivan's legacy, presents a more closed and symmetrical organization that departs from the spatial continuity and organic character of later works, its representation in the Wasmuth Portfolio—both in plan and in perspective—already makes it possible to identify the importance that both Wright and Mahony attribute to structure. Axiality, modulation, geometric repetition, the centrality of the fireplace element, and the correspondence between structure and function anticipate the development of an architecture in which the structural language would be given particular care.

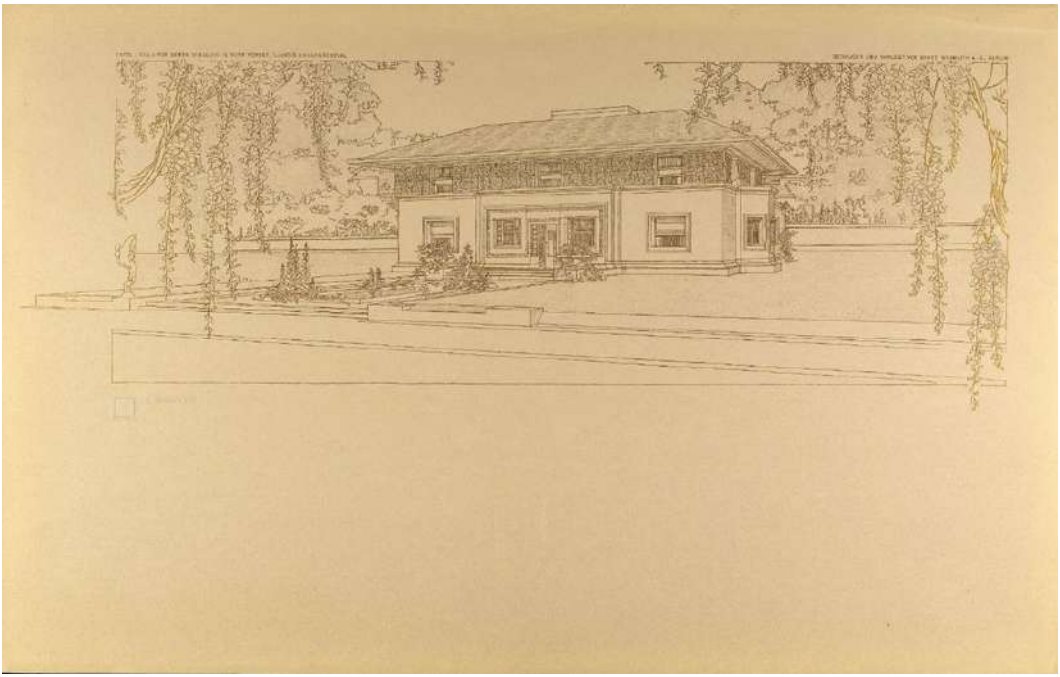


Fig. 1. Winslow House. Wasmuth Portfolio (1911). Marriott Library, 2001.

- Robie House (1909)

In the Robie House, Wright and Mahony demonstrate—after a process of formal refinement—the defining characteristics of this new American architecture. The breaking open of the architectural box in favor of spatial, visual, and functional fluidity coexists with the use of large cantilevers that emphasize the horizontal character of the house, thereby reinforcing the continuity between interior and exterior space. Thus, in the Robie House, horizontal planes generate and shape space while simultaneously dissolving the boundary between interior and exterior through the use of these cantilevers, which incorporate terraced elements. These aspects are closely linked to a structural conception based on horizontality and the extension of planes, which is clearly manifested both in the built work and in its graphic representation.

The large cantilevers play a decisive role in the configuration of space and in the expression of structure. They define the horizontal image of the building while also acting as structural mechanisms that allow the interior space to be freed and the continuity between the different areas of the house to be reinforced.

Wright and Mahony express this structure in the Wasmuth Portfolio—which devotes one lithograph (plate 37) to this house—through the superposition of horizontal planes that engage with negative space and define horizontal voids that emphasize the horizontality of the house. The plate includes an exterior perspective of the house together with the plan of the upper floor. As complementary material to the lithograph, some editions of the Portfolio incorporate the plans of the lower floors, printed on thinner paper and placed before the main plate (SteinerAG, s. f.).

In the case of the perspective drawing, the vegetation appearing on the terraced elements generates a contrast of horizontal solids and voids while also marking the structural and compositional rhythm of the façades. Thus, although the load-bearing elements are not explicitly drawn in the view, the geometric organization of the planes and the modulation of the openings reveal a clear structural logic that supports the cantilevers. This logic becomes especially evident in the plans, where the wall dissolves, transforming into a cadence of vertical supports governed by a pattern that orders the façades.

This rhythm is also expressed in the plans, where the drawing of the floor joists appears delineated in projection with dashed lines over the large living and dining space, thereby introducing a direct reference to the structure. In this way, in the plans, this logic becomes more explicit: the wall loses its continuous character and is transformed into a cadence of vertical supports that organize both space and façades. This dissolution of the traditional wall in favor of a more open structure is graphically represented through the rhythmic modulation of elements and the continuity of spatial axes. By eliminating the conception of space as enclosed by walls, Wright was able to generate spaces that were more permeable and visually connected to the exterior, while also increasing natural lighting and ventilation.

Once again, as in the Winslow House, Mahony employs strategies aimed at conveying a sense of horizontality and lightness in both the building and the plate. One of these strategies is the choice of the perspective viewpoint, which contributes decisively to the expression of structure. The slightly elevated viewpoint gives greater prominence to the horizontal roofs, thereby increasing the proportion of void in relation to the elements that are rendered with great precision. This graphic strategy visually reinforces the structural character of the building, making the cantilevers and horizontal planes the essence of the architecture.

Another of these strategies consists in placing the perspective in a slightly elevated position and shifted toward the upper edge of the plate's composition. The tension generated by this compositional choice helps the house to appear as if it were levitating above the ground, like its cantilevers, accentuating the sensation of lightness and horizontal continuity.

Overall, the representation of the Robie House in the Wasmuth Portfolio constitutes a clear example of how architectural drawing can convey the structural understanding of a building without resorting to specific plans or structural diagrams.

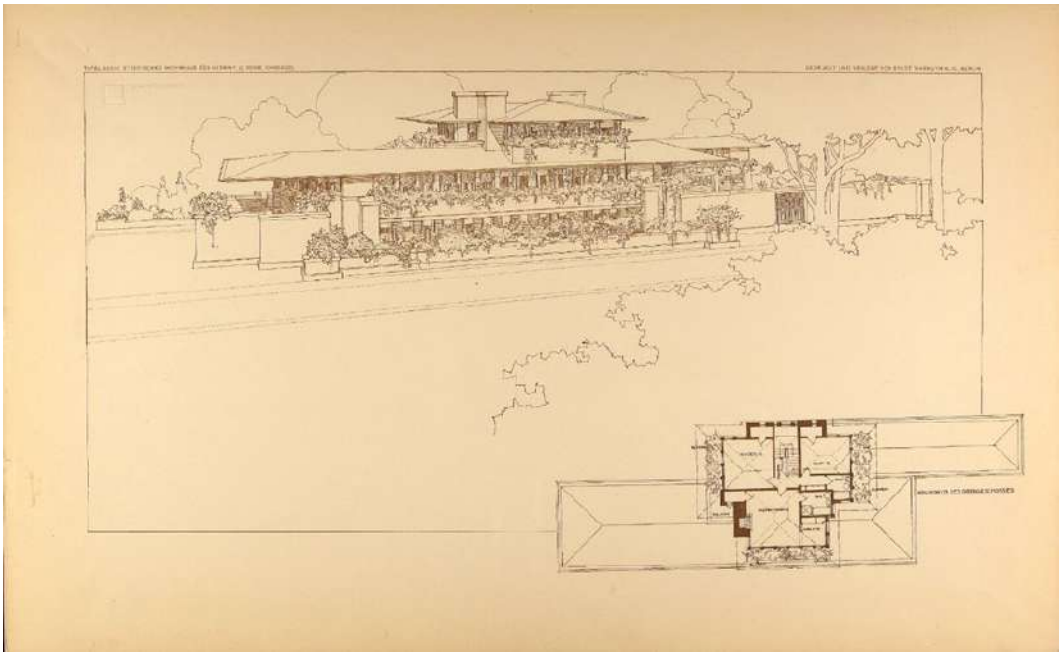


Fig. 2. Robie House.Wasmuth Portfolio (1911). Marriott Library, 2001.

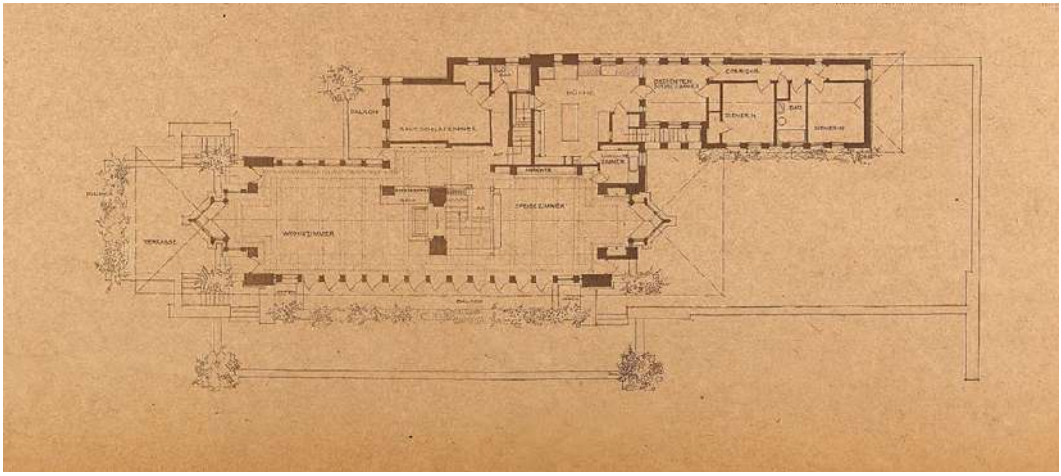


Fig. 3. Robie House.Wasmuth Portfolio (1911). Marriott Library, 2001.

## 5. CONCLUSIONS

From the analysis of the Wasmuth Portfolio, it can be concluded that in Frank Lloyd Wright's work, structure is conceived as an underlying order that organizes architecture from its very initial conception. The lithographs of the Portfolio, far from merely describing the buildings included within it, construct a coherent and sensitive visual narrative in which structure appears integrated into the overall composition of the project and can be intuitively perceived through the illustrations.

The graphic language developed by Marion Mahony adds to architectural drawing the capacity to become a fundamental tool for the transmission of structural thinking. The identification of geometric patterns, alignments, and modulations in plans, elevations, and perspectives makes it possible to infer the internal logic that articulates the projects, revealing an understanding of structure as a generative principle of form and space. Thus, the idea is reinforced that in the Wasmuth Portfolio, graphic representation, in addition to acting as a means of communication and transmission of concepts, becomes a space for architectural reflection and documentation within the legacy of architectural history.

In this way, Marion Mahony's contribution proves essential to understanding this dimension of the Portfolio. Her ability to integrate architecture and landscape within a single visual logic made it possible to construct representations in which structure is perceived as part of a broader organic system. The use of negative space, the value of line, the carefully considered choice of viewpoints, and the treatment of vegetation all contribute to reinforcing the structural reading of the buildings, placing architecture in harmony and dialogue with its surroundings and underscoring the coherence between form, function, and place. As a result, Mahony's captivating and recognizable style becomes a first-rate communication and marketing tool and provides Wright with a powerful brand identity for his studio (Gray, 2022).

The study of the cases of the Robie House and the Winslow House confirms the validity of this interpretation. In both examples, structure is graphically manifested as an organizing principle that regulates composition and spatial organization, although it does so through different strategies appropriate to each stage of Wright's work. Whereas in the Robie House structure is expressed through horizontality, cantilevers, and the dissolution of the wall, in the Winslow House it appears linked to symmetry, modulation, and the roof element.

Wright and Mahony anticipate modern reflections on the integration of structure, form, and environment, and they demonstrate the potential of architectural representation as a tool for thought. This reading reinforces the continued relevance of the Wasmuth Portfolio as a historical instrument of dissemination, but also as a fundamental source for the critical analysis of modern architecture and of the mechanisms through which structure becomes the invisible essence of the architectural project. In this sense, this set of lithographs can be understood as a theoretical document of the highest order, proposing a specific way of thinking about and representing architecture and documenting it for posterity.

## REFERENCES

Albert Hernández, N. (2015). Análisis de la estructura de la Casa de la Cascada (Fallingwater) [Trabajo de fin de grado, Universitat Politècnica de València].

Beltrán Fernández, M. Á., García Muñoz, J., & Dufrasnes, E. (2015). La casa Jacobs I de Frank Lloyd Wright: Un hito en la arquitectura bioclimática. En Actas del I Congreso (pp. 199–207).

Bernstein, F. A. (2008, febrero 21). Rediscovering a heroine of Chicago architecture. The New York Times.

Brooks, H. A. (1972). The Prairie School: Frank Lloyd Wright and his Midwest contemporaries.

Cantavella Franch, J. (2017). El grafismo de la estructura en el Wasmuth Portfolio de Frank Lloyd Wright.

Ettinger, C. (2007). Arquitectura orgánica: Historia de la teoría de la arquitectura.

Gray, J. (2022). A powerful brand: Marion Mahony's original form of graphic representation. Frank Lloyd Wright Quarterly.

Levine, N. (1996). The architecture of Frank Lloyd Wright.

Marcela Woodhull, C. (2020). Una aproximación morfológica: Formas de la pradera y su intencionalidad estética en el espacio interior y el objeto. Cuadernos del Centro de Estudios de Diseño y Comunicación, 21(81).

Pfeiffer, B. B. (1985). Frank Lloyd Wright drawings.

SteinerAG. (s. f.). The Wasmuth Portfolio. https://www.steinerag.com/flw/Books/a0087.htm

Wright, F. L. (1910). Ausgeführte Bauten und Entwürfe von Frank Lloyd Wright (Wasmuth).

Xiong, X. (2019). Invisible lines: Patterns of alignments in the renderings of Frank Lloyd Wright's Wasmuth Portfolio. The Journal of Architecture, 24(3), 408–429.

# MATERIAL PERSISTENCE, URBAN DISRUPTION: READING THE "DINE HOXHA" VILLA IN TIRANA ACROSS REGIMES

**Kejsi Veselagu**
POLIS University
Tirana, ALBANIA
*kejsi_veselagu@universitetipolis.edu.al*

## ABSTRACT

This paper investigates the trajectory of the 1930s villa “Dine Hoxha” in Tirana as a lens through which to examine the dynamics of continuity and disruption in urban models. Erected during the interwar period, the villa reflected the aspirations of an emerging bourgeoisie and the influence of Italian modernist domestic typologies. With its front yard overlooking the city’s main street, the house was conceived as both a private dwelling and a public statement of visibility, openness, and status. Its orientation and relationship to the street echoed broader urban patterns of the time, where architecture mediated between individual identity and the collective city.

The advent of the communist regime marked a profound rupture in this model where a row of residential blocks was strategically erected in front of the property. This intervention concealed the villa from the street and negated its symbolic role within the urban fabric. What had once embodied openness and bourgeois modernity was then transformed into an object of erasure, surviving materially yet deprived of its spatial and cultural presence.

Drawing on a recent digital survey of the villa’s facades conducted through drone photography and photogrammetry, complemented by historical research, the paper reflects on how such domestic architectures persist physically while their meaning and function are continuously redefined by political power and urban transformation. The inability to fully capture or photograph all sides of the villa further underscores the notion of partiality in documentation and memory, highlighting how architecture resists complete representation.

The case study illustrates how urban models are not fixed but subject to cycles of continuity and disruption, where domestic space becomes an arena for ideological contestation. In tracing the villa’s shifting status, the paper underscores how urban form embodies the tensions between persistence, suppression, and reinvention across time.

**KEYWORDS**: Disruption, Urban, Villa, Regimes

## 1. INTRODUCTION

Urban models are often discussed through the language of continuity: continuity of form, of function, of memory. Even when cities undergo radical political change, architecture is frequently treated as a stabilizing element, as a material anchor capable of carrying identity across time. This assumption echoes long-standing urban theories that privilege coherence and spatial legibility, even as they acknowledge fragmentation as a by-product of modernization (Brown, 1988). Within this framework, persistence is understood as survival, and survival is implicitly equated with endurance or resistance. Yet such readings risk overlooking a critical aspect of urban life: architecture does not persist by remaining intact, but by being repeatedly subjected to interruption, reinterpretation, and spatial violence.

While scholarship on urban transformation has extensively addressed processes of modernization, densification, and ideological restructuring (Le Gallou, 2025), less attention has been paid to the micro-scale mechanisms through which political regimes act upon domestic architecture. In particular, the spatial strategies through which buildings are made to disappear without being demolished but through obstruction, enclosure, or denial of visibility remain under-theorized. These forms of urban intervention operate not through destruction, but through displacement and suppression, allowing architecture to survive materially while stripping it of its representational role.

This gap becomes especially evident in cities marked by abrupt regime change, where architecture is repeatedly inherited by political systems that neither fully accept nor entirely erase what came before. In such contexts, domestic buildings occupy an ambiguous position. Neither monumental nor infrastructural, they are often excluded from dominant narratives of urban history, despite being deeply implicated in the negotiation of ideology, ownership, and visibility. Their persistence is therefore unstable, contingent, and frequently unacknowledged.

## 2. RESEARCH PROBLEMS AND METHODOLOGY

This paper is guided by a central research question: how does domestic architecture persist within the city when its original urban logic becomes politically incompatible? More specifically, what happens when a building is allowed to remain physically present, but is deliberately removed from the field of urban visibility? The working hypothesis of the study is that persistence in such cases does not operate through continuity of form or use, but through cycles of spatial disruption that actively redefine a building's relationship to the city. Rather than resisting change, architecture endures by being transformed, obstructed, and re-coded within successive urban models.

By approaching persistence as a spatial and ideological process rather than a material one, the paper proposes a shift in how urban continuity is understood. This position aligns with critical urban theory that frames space as a product of political negotiation and representational struggle, rather than a neutral container of social life (Lefebvre, 1991). It suggests that the survival of domestic architecture under changing political regimes is not a passive condition, but a negotiated outcome shaped by power, representation, and the politics of visibility.

Figure 1: Dine Hoxha Villa

The research adopts a qualitative, case-study-based methodology that combines historical cartographic analysis with contemporary digital survey techniques. The Villa of Dine Hoxha (Figure 1) is employed as a critical case through which broader questions of urban persistence and disruption can be examined at the scale of domestic architecture. Rather than treating the villa as a representative or typical example, the study approaches it as a strategically revealing case whose spatial trajectory makes visible mechanisms that often remain implicit within larger urban transformations.

The selection of this case is motivated by three interrelated factors. First, the villa was constructed during a clearly identifiable historical moment (the interwar period) when Tirana's urban model emphasized visibility, openness, and representational domesticity. Second, the building has survived successive political regimes without being demolished or radically rebuilt, allowing its persistence to be traced across distinct ideological frameworks. Third, despite its physical survival and its inclusion in official heritage listings, the villa has undergone a profound spatial marginalization, particularly through the obstruction of its relationship with the main street during the communist period. This combination of continuity and disruption makes the villa a productive site for methodological inquiry.

The first methodological component of the study consists of a comparative analysis of historical maps and archival cartographic material. Sources include a municipal sketch from 1930 associated with a property transaction, city maps from 1937 and 1958, and contemporary cadastral and urban maps. These documents were not used as static historical references, but were actively redrawn and reinterpreted through a process of cartographic reconstruction.

This redrawing process serves two purposes. On the one hand, it allows for the precise identification of transformations in plot configuration, building density, and access patterns surrounding the villa. On the

other hand, it functions as an analytical operation in itself, foregrounding what each urban model chose to project, preserve, or suppress. The comparison between the reconstructed maps reveals that the most consequential transformation affecting the villa was not internal modification, but the progressive reconfiguration of its surroundings.

The second methodological component involves the use of photogrammetry to document the villa's current condition. A digital survey of the building's façades was conducted using drone photography, generating a three-dimensional model through photogrammetric processing. Unlike conventional surveying methods such as total station measurement, photogrammetry depends on visibility, access, and light conditions. In the case of the Villa of Dine Hoxha, these conditions are severely constrained by the surrounding built fabric, altered terrain, and informal additions.

## 3. TIRANA AS A CITY OF IDEOLOGICAL RUPTURE

Tirana's urban development throughout the twentieth century is characterized by rapid transformation and discontinuity. Within a relatively short period, the city moved through monarchy, communism, and post-socialism, each regime imposing distinct spatial logics and architectural priorities. Rather than producing a coherent urban narrative, these successive interventions resulted in a fragmented fabric (Aliaj, 2003) composed of overlapping and often contradictory projections.

### 3.1. MONARCHY AND THE ARCHITECTURE OF VISIBILITY

During the interwar period, under the reign of King Zog, Tirana underwent its first systematic process of modernization. Urban planning became a tool for constructing a national image aligned with European models of governance and representation. Italian architects and planners such as Armando Brasini and Florestano Di Fausto introduced axial layouts, monumental compositions, and geometric street systems that reconfigured the former Ottoman town into a modern capital (Prifti, 2013).

These interventions were not merely technical. Urban space functioned as a stage for political visibility, where architecture articulated power, progress, and social hierarchy. The introduction of suburban villa districts along new infrastructural axes encouraged the emergence of a bourgeois domestic typology associated with education, wealth, and proximity to authority.

The villa, in this context, operated as a spatial projection of modernity. Its architectural language which is often neo-classical or rationalist, translated political aspiration into domestic form, rendering private status publicly legible.

### 3.2. COMMUNISM AND THE SUPPRESSION OF DOMESTIC INDIVIDUALITY

The communist regime enacted a radical rupture with this spatial logic. Architecture and urban planning were mobilized as instruments of ideological reprogramming aimed at dismantling bourgeois privilege and promoting collectivist values. Private property was abolished, and domestic individuality was actively discouraged. Standardized apartment blocks replaced villas as the dominant residential typology, expressing ideals of equality and uniformity (Pojani, 2014). Urban space was reorganized into functional zones, while architectural form became increasingly regulated and predictable. Visibility, previously associated with status, became a potential threat subject to control and surveillance.

Former villas were often subdivided, repurposed, or physically concealed by new construction. Their persistence was permitted only through suppression, transforming them into marginal or invisible elements within the urban fabric.

## 3.3. POST-SOCIALISM AND INFORMAL URBANISM

Following the collapse of communism, Tirana entered a period of intense urban transformation driven by market liberalization, migration, and weak regulatory frameworks. The city expanded through private initiatives, speculative development, and widespread informal construction.

In this context, historical buildings that lacked immediate economic value were frequently neglected or absorbed into denser developments. Older villas, including the Villa of Dine Hoxha, became vulnerable not to ideological erasure but to economic marginalization. Their persistence depended less on political symbolism than on chance, neglect, or heritage designation.

## 4. THE VILLA OF DINE HOXHA

The Villa of Dine Hoxha is located in the northwestern part of Tirana, near the intersection of Rruga e Durrësit and what is today Rruga e Ambasadave. Architectural analysis situates its construction in the late 1920s, aligning it with the Italian-influenced villa typologies of the interwar period. Its symmetrical composition, neo-classical ornamentation, and distinctive octagonal bow-window correspond to design features common in Italian rationalist and eclectic domestic architecture of the time.

The villa takes its name from Dine Hoxha, an advisor to King Zog remembered in contemporary accounts as an intellectual mediator and political strategist. Archival newspapers and memoirs describe him as a rhetorically skilled figure capable of navigating complex political situations. Anecdotal evidence links the villa to a known assassination attempt against King Zog in Vienna in 1931, reinforcing its association with political power during the monarchy.

Municipal records from 1930 confirm the villa's existence by that date, while a site plan (Figure 2) attached to a deed of sale (Figure 3) indicates that it originally occupied an open and prominent position along Rruga e Durrësit. This spatial visibility aligns with its symbolic function as a domestic projection of status and authority.

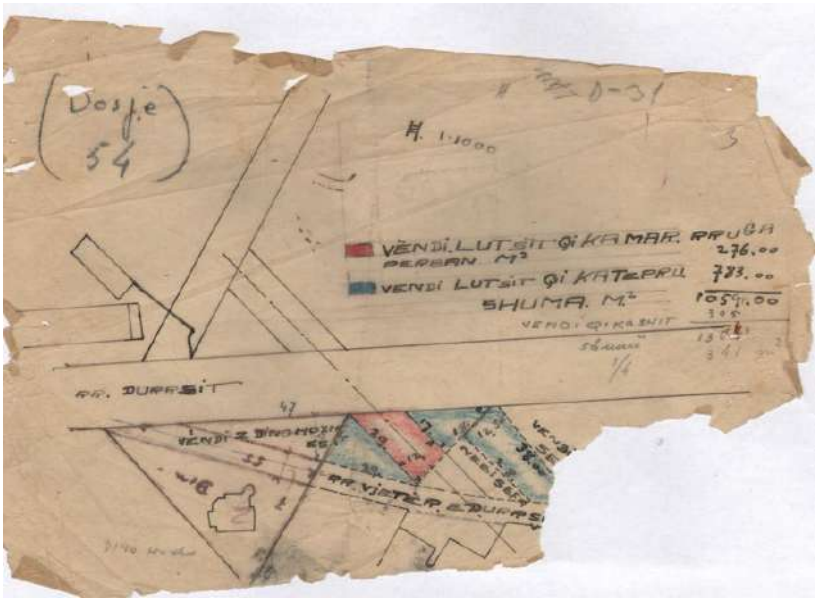



Figure 2: Dine Hoxha Villa's original site plan

Figure 3: Dine Hoxha Villa's deed of sale

## 4.1. URBAN DISPLACEMENT MADE VISIBLE

While archival documentation concerning the Villa of Dine Hoxha remains fragmentary, the transformation of its urban condition can be reconstructed with considerable precision through cartographic analysis (Figure 4). A central methodological contribution of this study lies in the production of three analytical drawings of the villa's surroundings, each corresponding to a distinct historical moment. These drawings are not merely illustrative; they function as interpretive instruments through which the shifting spatial status of the villa becomes legible.

Figure 4: Comparison of the villa's position on historic maps

The drawings are reconstructed from historical maps and archival sketches dating from the interwar period, the communist era, and the contemporary city. By redrawing these sources using a consistent graphic language and scale, the analysis isolates urban transformation as a spatial process rather than a stylistic or anecdotal one. What emerges is a clear visualization of how political regimes materialized themselves through the progressive reconfiguration of the villa's immediate surroundings.

The earliest drawing from the municipal archive sketch dated 1930 and supported by cartographic material from the late 1920s, depicts the villa within a markedly open urban condition. The property occupies a triangular plot whose longest side faces Rruga e Durrësit. At this stage, the villa's primary façade and front yard are fully exposed to the street, reinforcing its role as a visible domestic marker along a key infrastructural axis. The bow-window and entrance staircase are oriented toward the two extremities of the plot, engaging directly with the urban void rather than retreating into enclosure. No adjacent buildings obstruct the villa's frontage, and the spatial relationship between private residence and public street remains deliberate and legible.

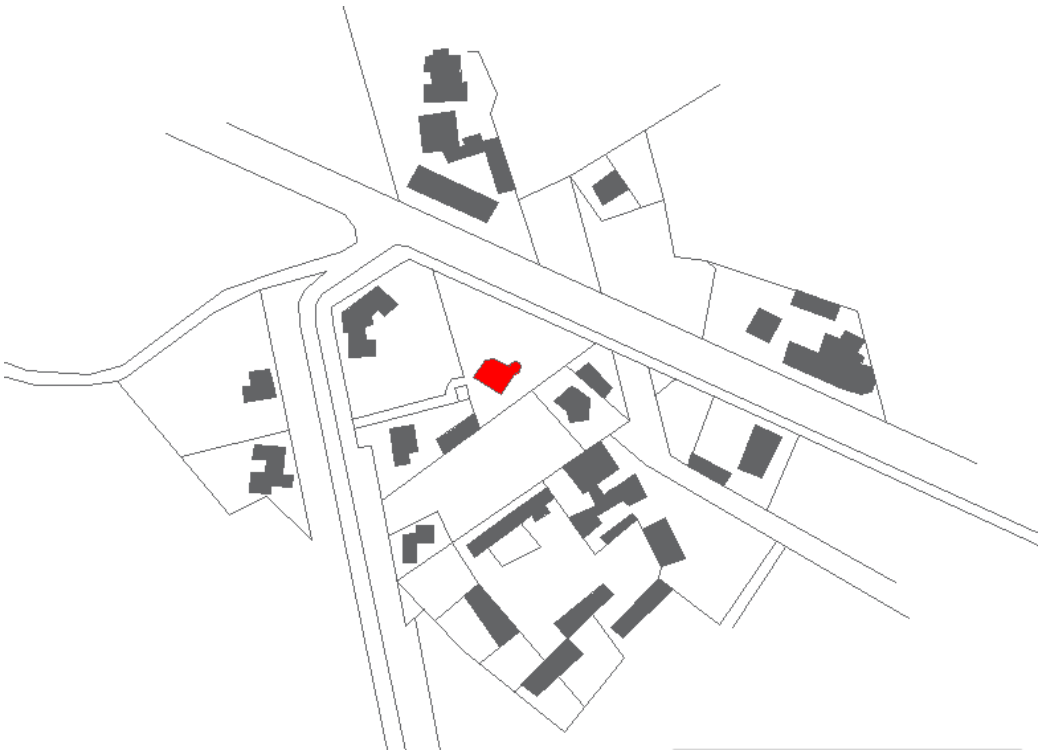


Figure 5: Drawing of the villa's urban condition in 1937

This spatial openness is not incidental. It corresponds directly to the ideological framework of the interwar monarchy, in which domestic architecture (particularly elite villas) functioned as an extension of public representation. The villa's front yard operates as a threshold space, mediating between private ownership and public visibility. The drawing makes evident that the villa was conceived not as an isolated object, but as a participant in the representational logic of the city.

The first drawing, reconstructed from a 1937 city map (Figure 5), already indicates the beginning of spatial pressure. While the triangular plot remains largely intact, new constructions begin to appear in the surrounding area. Importantly, however, the villa's frontal exposure toward Rruga e Durrësit is still preserved. The drawing suggests a transitional moment in which urban densification has begun, but without yet undermining the villa's spatial autonomy. A small access path appears on the southwest side, indicating early adjustments to circulation rather than ideological suppression.

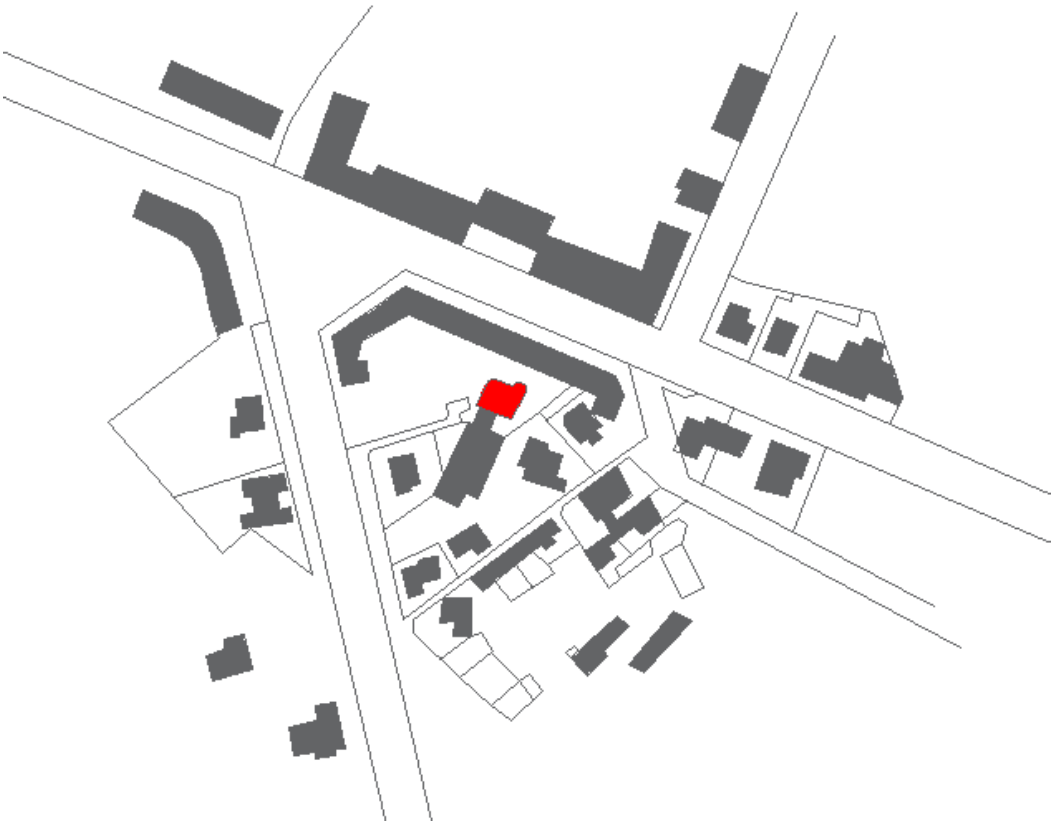


Figure 6: Drawing of the villa's urban condition in 1937

The most radical transformation becomes evident in the second drawing (Figure 6), based on cartographic material from 1958. Here, the communist reorganization of the city manifests itself with striking clarity. A continuous row of apartment blocks is constructed directly in front of the villa, entirely blocking its visual and spatial relationship with Rruga e Durrësit. What was once a front yard oriented toward the city becomes an enclosed residual space, stripped of representational function. The villa's façade, formerly designed for visibility, is rendered functionally blind.

This intervention is not simply a byproduct of densification. Its linearity, scale, and placement indicate a deliberate spatial logic consistent with socialist urban planning. The blocking of the villa's frontage can be read as a material act of ideological suppression, in which bourgeois domestic visibility is neutralized through collective housing. The drawing makes this argument explicit: the villa is no longer a projecting object within the city, but a contained remnant embedded within a new spatial order.

Figure 7: Drawing of the villa's urban condition in 2018

The final drawing presents the villa as it exists today (Figure 7). The original blockage persists, and the most significant change in the surrounding context is the increased densification of the area. This development has further isolated the villa, limiting both its spatial accessibility and its visibility within the urban fabric. Access to the building is highly restricted, and it no longer lies along the primary routes frequently used by residents, rendering it largely imperceptible within the everyday experience of the city.

A comparison between the three drawings reveals that the villa's persistence is not a matter of architectural continuity, but of spatial negotiation. The building itself remains largely unchanged in form, yet its meaning is fundamentally altered by the reconfiguration of its surroundings. What changes is not the villa, but its field of projection.

The contemporary condition, confirms the trajectory illustrated by the earlier maps. Post-socialist densification, informal constructions, and infrastructural adjustments have further reinforced the enclosure initiated during the communist period. The original triangular plot has been fragmented, leaving the villa with two small residual yards on opposing sides, connected by a narrow passage. Although the building is officially listed as a monument, its spatial marginalization persists, now driven less by ideology than by economic and regulatory neglect.

These drawings play a crucial epistemological role in the study. They demonstrate that the villa's transformation cannot be fully understood through stylistic analysis or textual description alone. The blocking of the front yard is not merely a loss of space; it represents the collapse of an entire regime of visibility. By reconstructing and comparing these urban conditions graphically, the study reveals how political ideology operates through spatial subtraction as much as through construction.

This cartographic comparison also establishes a critical link between urban history and representational methodology. Just as the villa's original projection toward the city has been obstructed, contemporary attempts to represent the building whether through surveying or photogrammetry are similarly interfered with by surrounding structures. The difficulty of capturing the villa today is not accidental; it is the direct consequence of the spatial transformations made visible in the drawings.

In this sense, the analytical images do more than document change. They expose the mechanisms through which architecture is made to persist by being deprived of its original conditions of appearance. The villa survives not as an intact object, but as a spatially displaced one: its persistence dependent on the very disruptions that have rendered it marginal.

## 5. REPRESENTATION AS DISRUPTION

A central methodological choice in this study beyond the cartographic approach was to employ photogrammetry as a primary tool for not only documenting the villa but extracting its incompleteness. Unlike conventional surveying methods such as total station measurements, which produce precise and authoritative representations of architecture, photogrammetry is inherently dependent on visibility, access, and environmental conditions. It is precisely this dependence that renders the act of representation vulnerable to interference, turning the methodological process itself into a lens for observing the villa's disrupted urban condition.

The villa's contemporary surroundings, densely built structures, altered terrain, and informal additions directly constrain the ability to capture its form fully. Some façades are partially or completely obscured by adjacent buildings, while the ground has been reshaped by successive urban interventions, restricting viewpoints and disrupting the original orientation of the villa (Figure 8). Certain walls lean into the camera's field, while informal structures interrupt the geometry of the original design. Shadows, gaps, and distortions appear throughout the three-dimensional model, not as flaws, but as traces of the villa's spatial marginalization.

Figure 8: Villa's photogrammetric facades

In this context, photogrammetry makes visible the villa's negotiated persistence, the tension between the original projection of the building and the urban forces that have contained, enclosed, and obstructed it. The very act of photographing the villa becomes a performative encounter with its environment: each missing angle, each distorted surface, testifies to the transformations that have shaped its visibility, accessibility, and symbolic presence. The villa's endurance is inseparable from the interruptions imposed upon it, and the photogrammetric survey, by reflecting these interruptions, mirrors the processes that have historically displaced it within the city.

The resulting images of the façades reveal not only architectural details, bow-windows, ornamental compositions, and spatial configurations, but also the conditions of obstruction that have come to define the villa's contemporary existence. Where once a front yard opened onto the street, the surrounding fabric now blocks most viewpoints; where symmetry once articulated visibility, shadows and occlusions fragment perception. These gaps and distortions operate as a material index of urban intervention, making the villa's history of concealment, marginalization, and partial erasure legible through representation itself.

## 6. CONCLUSION

Through the case of the Villa of Dine Hoxha, this paper has argued that architectural persistence is inseparable from disruption. Across monarchy, communism, and post-socialism, the villa survived not by remaining unchanged, but by being repeatedly re-signified, concealed, and displaced within the urban fabric.

The study demonstrates that urban models are cyclical rather than stable. Domestic architecture, in particular, functions as a sensitive arena where ideology, visibility, and ownership are negotiated. Persistence emerges not as continuity, but as an ongoing struggle over representation and meaning.

By foregrounding disruption as a constitutive condition of survival, the paper contributes to broader debates on urban transformation and architectural theory, offering a lens through which contested domestic spaces can be reinterpreted beyond narratives of decay or loss.

## REFERENCES

Aliaj, Lulo and Myftiu (2003). Tirana : the challenge of urban development. Tirana: Cetis.

Brown, R.F. (1988). FINDING LOST SPACE: THEORIES OF URBAN DESIGN. Landscape Journal, 7(1), pp.80–81. doi:https://doi.org/10.3368/lj.7.1.80.

Le Gallou, A. (2025). Ruins and the politics of disappearance: racial and social invisibilities in Detroit's abandonment tourism. Social & Cultural Geography, pp.1–20. doi:https://doi.org/10.1080/14649365.2025.2564642.

Lefebvre, H. (1991). The Production of Space. Translated by D. Nicholson-Smith. Oxford: Blackwell.

Pojani, D. (2014). Urban design, ideology, and power: use of the central square in Tirana during one century of political transformations. Planning Perspectives, 30(1), pp.67–94. doi:https://doi.org/10.1080/02665433.2014.896747.

Prifti, A. (2013). The Realization of the 'New Architecture'. The Italian Colonial Experience in Albania During the Years 1925-1943.. Academic Journal of Interdisciplinary Studies, 2(9). doi:https://doi.org/10.5901/ajis.2013.v2n9p648.

# "PROCESSUAL LEGACY" ARCHITECTURE AND HISTORY IN THE ROMAN SCHOOL OF URBAN MORPHOLOGY

**Giusi Ciotoli, Marco Falsetti**
Independent Researcher
Rome, Italy
*ciotoligiusi@gmail.com; marcofalsetti.arch@gmail.com*

## ABSTRACT

This paper aims to dwell on the exchange between architectural and historical disciplines within Saverio Muratori's Roman Type-Morphological School. Starting from Franco Purini's essay L'ammirazione che all'arte si deve (1989), the role of the Modenese architect has been re-evaluated and analyzed in the light of a "rightful critical distance" so as to contextualize his academic, theoretical and even didactic contribution. In addition to the realized works, in fact, what is striking is Muratori's theoretical legacy. Muratori, especially in the last years of his life – following the so-called "defense" at the Roxy Cinema in Rome – founded a School of typology and urban morphology. Probably this is the legacy to date most and obvious that we can attribute to Muratori, considering in fact that this School played a more than basic role in the international dissemination of a whole series of urban morphology researches (both within the scientific association ISUF international and within the Urban Morphology courses).

The paper intends to dwell, in particular, in the processual meaning of History given by Saverio Muratori and in the interpretative role of the Maps of Rome (made by Muratori with Guido Marinucci Bollati, Sergio and Renato Bollati) such as to illustrate the working history of the Italian Capital. Such drawings constitute the central fulcrum around which is centered, on the one hand, the Muratori's teaching of History (within which different degrees of typicality and transmissibility of characters are distinguished); on the other hand, Muratori's wholly singular vision, for which the relationship Architecture-History-Civilization is made explicit through a processual reconstruction, which takes place in stages, and which is always the result of an awareness of the memory (historical, social, economic, constructive ones) of a particular place.

**KEYWORDS**: Urban Morphology; Roman School Of Architecture; Maps; Saverio Muratori; Theoretical Legacy; Territory; Organism; Legacy

## 1. INTRODUCTION

"In recent times, having acquired the necessary critical distance, many people have begun to take a closer and more dispassionate look at the figure of Saverio Muratori. For years, he was the subject of prejudicial denigration or, conversely, unconditional exaltation" (Menghini and Palmieri, 2009, 27). This sentence by Anna Bruna Menghini and Valerio Palmieri (which echoes Franco Purini's suggestion in his famous 1989 essay L'ammirazione che all'arte si deve) (Purini, 1989) clearly expresses the duality of reactions that, even today – almost Sixty years after the events that culminated in the "defense" of the Roxy Cinema in Rome (Purini et al., 2004; Barizza and Falsetti, 2019) – have accompanied Muratori and, by extension, the theoretical thinking that founded his school of students. Before addressing Muratori's role within the Roman School of Architecture and analyzing the themes that made him central to academic research (in particular urban morphology), it is worth noting that his studies – although shared by a large international community through ISUF conferences, which will be discussed in the last paragraph, and other associations – still have a complex, often conflictual reception in Italy. This situation, which is currently fortunately confined to the academic world, had very heated repercussions in the 1960s, reflecting the broader tensions that led to the student movements of 1968. It is worth noting that Saverio Muratori is, in many ways, a unique figure within the Roman School (Giovannoni, 1932; Purini, 1988; Franchetti Pardo, 2001; D'Amato Guerrieri, 2017). To summarize his position in general terms, on the one hand, it can be argued that he was the last and most refined product of architects who worked on urban and architectural themes – such as Gustavo Giovannoni and Marcello Piacentini – and, on the other hand, that he enriched these same teachings with insights that gave rise to a new school (Muratori, 1980). In this sense, consider the concept of "operative history" and its implications (Caniggia, 1988), first defined in his urban studies on Venice (Muratori, 1960). At the same time, Muratori was also a prolific designer, with a unique professional career that began with total adherence to the Scandinavian modernism of Erik Gunnar Asplund (Muratori et al., 1990) and resulted in a language steeped in history that, on some occasions, was very close to historicism (Menghini and Palmieri, 2009). Although conceived from the outset as closely intertwined with theory and practice, Muratori's works show a discontinuity linked to the period around World War II, after which he shifted the focus of his research from a purely modernist language to a universe of symbols and meanings that were not exclusively architectural (Ieva, 2018).

Saverio Muratori's beginnings date back to the early 1930s, when, not yet a graduate, he designed the Student House in Rome's University City. The first Muratori worked in the years between the end of the War and the mid-1950s, while the second, more purely theoretical, matured in the following years, when he emphasized the didactic characteristics of his work. The 1950s, in particular, were occupied by the neighborhood reconstruction project, which several scholars point to as a turning point in his theoretical formulations. The following period, from 1957 to 1963 (the year of publication of Studi per una operante storia urbana di Roma and Architettura e civiltà in crisi), was characterized by a full understanding of the evolutionary phenomena of the city; but this was also a period in which political opposition to Muratori's teaching gradually increased, distancing him from the professional practice of design and progressively shifting his attention towards theoretical research tout court. In 1959, the year of the Barene di San Giuliano competition in Venice and the first prize for his project "Estuario III", Muratori's professional activity shifted

definitively toward the academic world. This brief introduction allows us to address the theme of processuality in Saverio Muratori's thinking and its legacy in the Roman School, a fundamental theme that must be addressed in order to understand its subsequent influence on what later became ISUF, the International Seminar on Urban Form.

## 2. THE "OPERATIONAL" ARCHITECTURE

According to Gianfranco Caniggia, Saverio Muratori "was a practicing architect: he designed and supervised the construction of buildings. He was also an architectural theorist and taught how to practice architecture. Three activities, therefore: it is essential to try to understand the correlation between these which, for Muratori (...) had periods of maturation, or at least periods of more or less intense activity, which were not exactly consistent (...). The uncertainty of the INA-Casa neighborhoods and the awareness of their inadequacy prompted Muratori to study the formative processes of the existing city and the continuity of building culture (...). In other words, the maturity and productivity of Muratori's theoretical work came after most of his design projects, particularly after the design of the neighborhoods of the 1950s" (Caniggia, 1984, 31).

In fact, there seems to be a temporal division between Muratori as a designer and Muratori as a theorist, particularly evident in his later works, in which the study of large-scale phenomena – capable of interpreting the processes of construction, modification, and transformation and associating them with specific timelines – seems to transcend the more concrete and design-oriented aspects. Muratori's cultural position is undoubtedly a product of his time, since, like most architects of his generation, he cannot help but take into account the teachings of modernism. It is worth noting that, starting in the second half of the 20th century, the formative and transformative processes of cities have been the subject of study not only in Rome but throughout Italy, through figures such as Giuseppe Samonà, Ernesto Nathan Rogers, Ludovico Quaroni, and later Vittorio Gregotti, Carlo Aymonino, and Aldo Rossi (Boeri, 2016). These are just a few of the names of those who have reestablished the centrality of the city in design culture[1] and in the transmission of political, civil, and ethical messages. The complexity of the urban form, in fact, had to be oriented towards new standards to improve the lives of citizens but, at the same time (especially in contexts stratified over the centuries), it had to dialogue with the forms inherited from history. Terms such as process, transformation, modification, organism, and morphology (Caniggia, 1981; Caniggia and Maffei, 2017) derive from this design culture in which attention is always focused on the difficult and delicate relationship between pre-existence and prefiguration. The "continuity" in the ancient-new dialogue – so important for

[1] According to Franco Purini: "In the 'first' post-war period, teachers of this type could be counted on the fingers of one hand. Muratori, Samonà, Libera, Quaroni, and Rogers embody the entire meaning of teaching and learning. If we stretched out our hand, we would understand that these five directions indicated by our fingers are still the paths we follow today", (Purini, 1989).

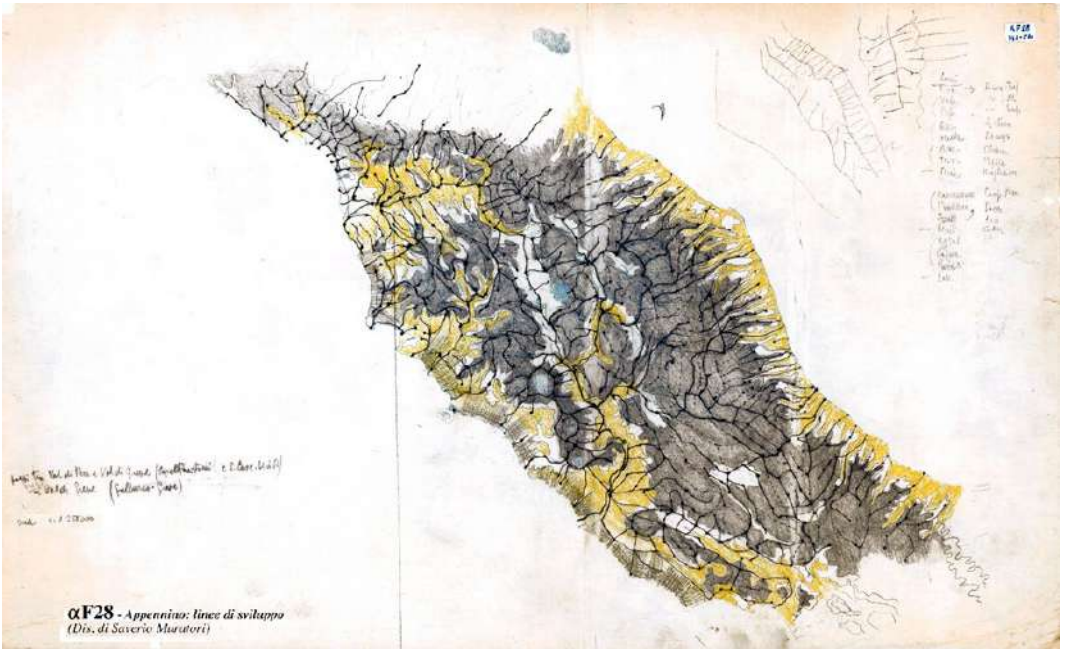
The volume Studi per una Operante Storia urbana del Territorio (1967-1973) was supposed to collect all these drawings, some of which were created in collaboration with architects Renato and Sergio Bollati, Guido Marinucci, and Alessandro Giannini. The work was interrupted by Muratori's death in 1973.

the entire Roman school – in Muratori is clearly influenced by Giovannoni's concept of "ambientism" (Simoncini, 2001; Stabile, 2017), whereby the morphological reading of the city must organically link the structural moment and its context of belonging. Muratori is assiduously engaged in the study of historical fabrics and the identification of typo-morphological characteristics: he seeks to interrogate places, analyzing their area of reference and identifying functional needs and formal aspects, so as to be able to establish the new in the project of the city and the territory, as if it were the last part of an organism that lives in history. The typical formative characteristics of a given area – as demonstrated by studies for Venice, in particular for the Barene, and for the historic center of Rome (Muratori, 1963b) – are examined within the categories of space and time.

Muratori's theoretical contributions are of extraordinary importance, above all for the foresight with which the Modena-based architect has managed to trace some key moments in the relationship between man and nature. On the one hand, he analyzes the relationship between Architecture, Civilization, and Crisis, offering a strangely topical interpretation of the very concept of crisis; on the other, he introduces the concept of territory as "(...) a concrete and tangible reality" (Muratori, 1967, 52) in relation to an international context characterized at the time by unconditional expansion, land consumption, and hyper-extension. As we will analyze in this paper, Crisis and Territory play a fundamental role in the hierarchical and a priori system established by Muratori, and are key ideas for studying and understanding the different phases of the relationship between man and nature. This cyclical nature, a characteristic aspect of this relationship, is the subject of study in both the text Architettura e civiltà in crisi (Muratori, 1963) and Civiltà e territorio (Muratori, 1967), while the drawings made for Studi per un'operante storia del territorio (the atlas never published, the drawings are now available for consultation in the Muratori Archive in Modena) summarize the expression of the great historical periods through graphics (Tagliazucchi, 2015; Ravagnati, 2012). Theory and drawing, like theory and design, are therefore indistinguishable, as they are different tools through which to achieve a common goal of knowledge.

The territory is not simply a concept, a corollary of a theoretical system, but rather unequivocal reality "in the sensitive relationship between man and nature common to all, open to promptly record every development real happened, but also to welcome every new development. It participates in the same dynamic plasticity of human thought and consciousness, but in the inexorable control of the relationship with natural and historical reality, it requires and affirms, like all functioning organisms, a discipline and a productive hierarchy of autonomous structures of the parts, but organic as a whole; in short, it reflects all the attitudes of man and society on the conditioning and concrete limits of physical reality" (Muratori, 1967, 52-53). The territory is therefore a natural organism, which lives and transforms itself through processual means. Precisely because it is an organism, it contains within itself a series of recurring aspects that can be shared by its inhabitants in cultural conditions that are clearly defined with respect to the categories of space/time (Caniggia and Maffei, 2017, 222-223). Among these, we can mention the ways of crossing and appropriating it, the specificities to make it productive, the possibilities of modifying its uses according to changing economic needs, etc. Unlike the definitions of urban and architectural organisms, a relationship is immediately established between use and economy, between property and yield, between function and realization. After all, settling, founding, building, etc. are primary actions that are constant in the way humans shape the territory; they do not change over time and interpret a sort of collective rituality, practiced by both

ancient and more modern civilizations. Primary operations take place in the territory and are therefore the most obvious manifestation of a cyclical nature of orderly actions that shape human beings and society over time. In this sense, rituality gives a unique meaning to the territory, as a place where all this can take shape (Ciotoli, 2024). There is therefore an inseparable relationship between the original moment and the territory, and Muratori seems to have succeeded in identifying it by examining the critical stages of the process of human settlement in the world, going back in time with respect to the historical, conceptual, and physical codification of the built world (Ciotoli, 2022). The territory is therefore the origin and, to paraphrase Karl Kraus, "the origin is the end" (Kraus, 1959, 59) of the studies conducted by Muratori in his later years. The territory as "origin as the temporal beginning of processes" (Strappa, 2023, 8) is also the answer to the meaning of the crisis and the way to overcome it. The crisis is not an exceptional phenomenon, but rather something that repeats itself as a typical aspect of human life. As Franco Purini observed in his essay L'ammirazione che all'arte si deve, "only the moment of 'catastrophe' seems to be controllable because in it theory and reality can overlap: but if this is true, it is even more true that it is precisely catastrophe that puts knowledge in crisis. All that remains, therefore, is to theorize further on the continuity of the critical moment, on its condition of normality" (Purini, 1989, 5). Confined within a concrete reality, the concept of crisis takes on a "positive" value, that is, it pushes the organism to adapt (Muratori, 1963, 15). The effort of adaptation noted by Muratori establishes a direct relationship between fracture (or moment of rupture between man and nature, space and society), transformation, and reality.



**αF28** - *Appennino: linee di sviluppo*
*(Dis. di Saverio Muratori)*

Figure 1: Apennines: lines of development. Drawing by Saverio Muratori on tracing paper. Source: Libraries of the Municipality of Modena, Saverio Muratori collection.

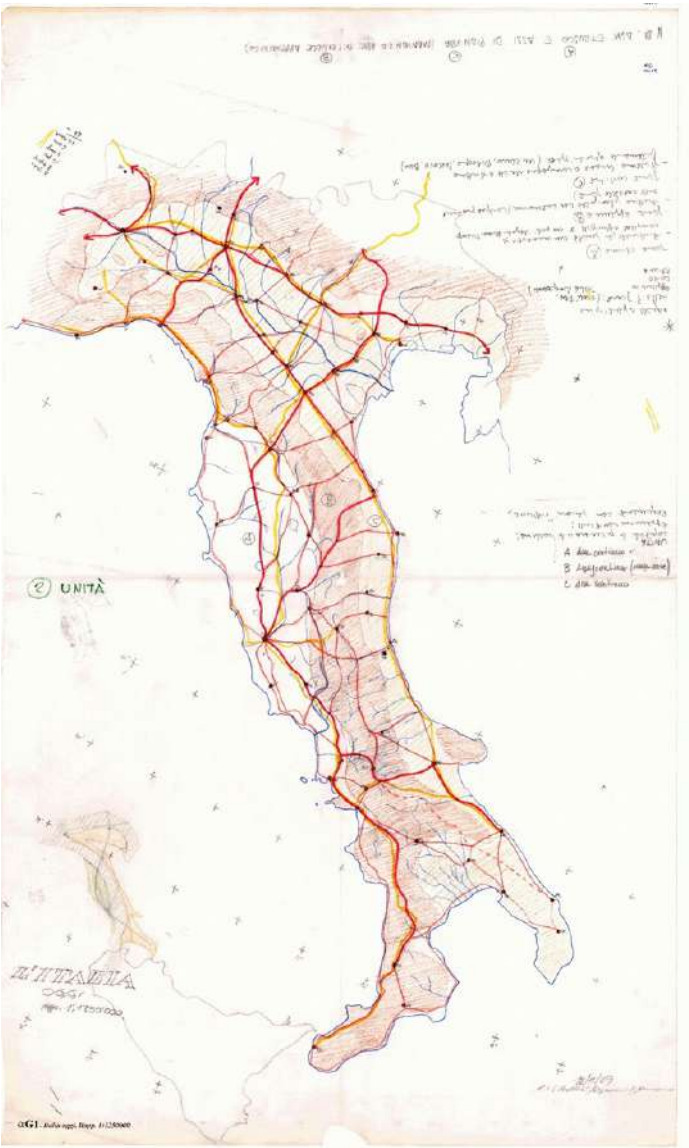



Figure 2: Italy today. Drawing by Saverio Muratori, Renato and Sergio Bollati, Guido Marinucci, and Alessandro Giannini on tracing paper. Source: Libraries of the Municipality of Modena, Saverio Muratori collection.

## 3. THE LEGACY OF MURATORI'S TEACHINGS AND ITS SPREAD ABROAD

While the complexity of Muratori's work and the depth of his thinking prevent us from addressing all aspects of his figure – from his teaching to the other critical texts he wrote – one important aspect to consider is certainly the abrupt break that affected him academically and conditioned his legacy. After the infamous conference at the Cinema Roxy (1963) (Vv. Aa., 1964) – a trial of his figure by other academics, primarily Bruno Zevi – Muratori suffered real ostracism and saw his influence in the Roman faculty diminish considerably (Purini et al., 2004). In the years that followed, his students experienced a veritable diaspora (Cataldi, 2013) scattering to various locations throughout Italy. It was a disorderly, uncoordinated dispersion, in which each of the pupils independently carried on Muratori's thinking with varying degrees of innovation. In these years, in particular, the figures of Gianfranco Caniggia, Paolo Maretto, Maria Grazia Corsini, Gian Luigi Maffei, Giancarlo Cataldi, and Giuseppe Strappa emerged, who carried out procedural urban studies within various Italian faculties, including Florence, Genoa, Siena, and, once again, Rome.

The 1980s saw a general reappraisal of Muratori's figure and thought, with his discovery/rediscovery by Italian scholars (Purini, D'Amato Guerrieri) but, above all, by foreign scholars (Malfroy and others). The interest of the latter aroused a feeling of unity among Muratori's followers, prompting them to look abroad – rather than at the narrow national scene – and to systematize the research conducted up to that point. In the summer of 1996, a group of scholars from England, France, Germany, Ireland, Switzerland, Japan, Australia, and the United States formalized the creation of the International Seminar on Urban Form (ISUF or SIFU, Séminaire International de la Forme Urbaine, International Seminar on Urban Form), at the conclusion of a series of meetings held in Lausanne over the previous two years. As it had not yet been formalized as an academic discipline tout court, the group brought together experts from various disciplines, including architecture, geography, history, and planning. Although the study of urban morphology (albeit included within other disciplines) was widespread in various countries and in different ways, the creation of ISUF highlighted the centrality of the studies of two figures in particular: the Anglo-German geographer Michael Robert Gunter Conzen (1907-2000) (Conzen, 1960) and Saverio Muratori.

Although different in background and fields of study, both were considered eccentric and nonconformist within their academic circles at the time. Recognizing common ground and similar scientific objectives, their followers understand the importance of not sacrificing the values transmitted by the history of places and the dynamics that shaped them to the idea of progress tout court. Geography, urban economics, stratification, and modification thus become central themes in the cultural palette that both Conzen and Muratori sought to highlight, albeit with different tools. Among Conzen's followers, Jeremy Whitehand was the main promoter in Great Britain, founding the Urban Morphology Research Group at the University of Birmingham in 1974 and institutionalizing the study of urban morphology. The Birmingham school produced key figures such as Peter Larkham and Karl Kropf, who further expanded the boundaries of the discipline, on the one hand by focusing on the teaching of urban morphology and, on the other, by integrating new technologies (GIS, CAD, etc.) into the study of cities (Barrett, 2023).

In 2019, the drawings created for Studi per una operante storia del territorio were studied by a group of researchers at MIT and included in a publication that aimed to analyze multiple visionary projects conceived since the 19th century. In this context, Muratori's macro-scale drawings find expression alongside

Arturo Soria y Mata's Linear City, Le Corbusier's Mundaneum, and even more recent utopias. The volume The World as an Architectural Project, edited by Hashim Sarkis, Roi Salgueiro Barrio, and Gabriel Kozlowski, is undoubtedly eccentric in terms of its editorial positioning compared to all those texts, essays, and doctoral theses that can be traced back to typological-morphological studies. However, it offers a very interesting external point of view that highlights the impact of Muratori's studies outside his school and the ISUF, in a much broader context. Muratori's cartographic project is identified in light of several themes such as geography, geo-visualization, human-earth system, and territorial gestalt, and finds a concise correspondence with the theoretical processes well illustrated in Civiltà e territorio. According to the authors, "The book's explicit theme, the 'planning of the world', reflects Muratori's attempt to find the conceptual and methodological support to intervene in a situation where civilization – his term for humanity's social and spatial organization – has found its dimensional limits (Muratori, 1963, 491). (…) The architectural and urban scales are insufficient to address world spatial organization. Territory, by contrast, refers precisely to the spatial intermingling between geography and culture that contemporary civilization needs to assume as a global condition (Muratori, 1963, 198)" (Sarkis et al., 2019, 321).

## 4. CONCLUSION

In conclusion, Saverio Muratori's work represents a fundamental and essential contribution to design culture, standing out for its ability to integrate theory, practice, and historical research within a method of investigating reality. In this sense, as Alessandro Giannini observed, Muratori can be counted "(...) among the greatest modern architects, not so much for what he did as for what he said and the lucidity with which he said it, for being the only one to say it, to make it clear in its entirety. He never abandoned architecture; rather, when he realized the gap between designing and building in today's architecture, he preferred to work in depth, to find the extreme limits of architecture, to demonstrate that they are also the extremes of the environment (…)» (Giannini, 1992).

The centrality of the relationship between urban organism, territory, and history, as well as his processual vision of urban history, opened up new interpretative perspectives that were received and developed internationally, especially through the founding of the School of Typology and Urban Morphology and the subsequent spread of ISUF. Muratori was thus able to identify the typical historical and environmental characteristics (Lombardini, 2017) shared by architectural and urban organisms, promoting an ethical and conscious approach to the relationship between man and nature. His idea of territory as a living organism, subject to cyclicality and transformation, has contributed to redefining the concept of crisis as an intrinsic and positive element of the evolutionary process of urban civilization. The legacy of Muratori's thinking is evident not only in academia, but also in design methodology and contemporary theories of global planning. This is demonstrated by recent international studies and publications on Muratori's Atlas drawings, which highlight the universal and still relevant scope of his ideas.

## REFERENCES

Boeri, S. 2016. La città scritta. Carlo Aymonino Vittorio Gregotti Aldo Rossi Bernardo Secchi Giancarlo De Carlo, Quodlibet, Macerata.

Barrett, H. 2023. British urban morphology: Time to take stock and regroup?, in "Serbian Architectural Journal", 15, pp. 162-185.

Barizza, E. and Falsetti, M. 2019. Rome and the Legacy of Louis I. Kahn, Routledge, New York-Abingdon on Thames.

Caniggia, G. 1981. Strutture dello spazio antropico. Studi e note, Alinea, Florence.

Caniggia, G. 1984. Saverio Muratori e il progetto di tessuto, in "Storia e Architettura", 1-2, pp. 31-38.

Caniggia, G. 1988. Saverio Muratori. La didattica e il pensiero, in Montuori, M. Dieci Maestri dell'architettura italiana. Lezioni di Progettazione, Electa, Milan, pp. 143-161.

Caniggia, G. and Maffei, G.L. 2017. Interpreting basic buildings. Alinea, Florence.

Cataldi, G. 2013. Saverio Muratori architetto (Modena 1910-Roma 1973). A cento anni dalla nascita. Atti del Convegno itinerante, Aión, Florence.

Conzen, M.R.G. 1960. Alnwick, Northumberland: A Study in Town Plan Analysis, Institute of British Geographers, London.

Ciotoli, G. 2022. Crisi e Critica nel pensiero di Saverio Muratori, in "Arc2Città", monographic issue edited by Purini, F. and Falsetti, M., 12, pp. 52-53.

Ciotoli, G. 2024. Faber. Processualità dell'architettura tra origine e fallimento, Silvana Editoriale, Cinisello Balsamo.

D'Amato Guerrieri, C. 2017. La Scuola di Architettura di Gustavo Giovannoni e la sua eredità oggi in Italia, in "Bollettino del Centro di Studi per la Storia dell'Architettura", 1, pp. 33-46.

Franchetti Pardo, V. 2001. La Facoltà di Architettura dell'Università di Roma La Sapienza dalle origini al Duemila, Gangemi, Rome.

Giannini, A. 1992. in A. Capelli, Saverio Muratori Architetto (Modena, 1910 -Roma, 1973). Sullo stato dell'architettura italiana verso la fine del secolo XX, Atti del Convegno, Modena 24/25 maggio 1991, Stamperia Comunale, Modena.

Giovannoni, G. 1932. La Scuola di Architettura di Roma, Paolo Cremonese, Rome.

Kraus, K. 1959. Du bliebst am Ursprung. Ursprung ist das Ziel, in Der sterbende Mensch, Worte in Versen, Munchen.

Ieva, M. 2018. Architettura come lingua, Franco Angeli, Milan.

Lombardini, G. 2017. L'ambiente come storia: una rilettura dell'ultimo Muratori, in "Scienze del territorio", 5, pp. 227-232.

Menghini, A.B. and Palmieri, V. 2009. Saverio Muratori. Didattica della Composizione architettonica nella Facoltà di Architettura di Roma 1954-1973, Poliba, Bari.

Muratori, S. 1960. Studi per una operante storia urbana di Venezia, Istituto Poligrafico dello Stato, Rome.

Muratori, S. 1963. Architettura e civiltà in crisi, CSSU, Rome.

Muratori, S. 1963b. Studi per una operante storia urbana di Roma, CSSU, Rome.

Muratori, S. 1967. Civiltà e territorio, CSSU, Rome.

Muratori, S. 1980. Saggi di critica e di metodo nello studio dell'architettura, CSSU, Rome.

Muratori, S., Cataldi, G. and Marinucci, G. 1990. Da Schinkel ad Asplund. Lezioni di architettura moderna, 1959-1960, Alinea, Florence.

Purini, F. 1988, La scuola romana dagli anni Sessanta agli anni Ottanta. Un'educazione sentimentale all'architettura, in Montuori, M. Dieci Maestri dell'architettura italiana. Lezioni di Progettazione, Electa, Milan, pp. 272-294.

Purini, F. 1989. L'ammirazione che all'arte si deve: impressioni, interpretazioni, riflessioni su Saverio Muratori, sulla sua opera interrotta, in "Phalaris", 0, pp. 5-7.

Purini, F. et al. 2004. Monographic issue of "Rassegna di Architettura e Urbanistica", 112-113-114.

Ravagnati, C. 2012. L'invenzione del territorio: l'atlante inedito di Saverio Muratori, Franco Angeli, Milan.

Sarkis, H., Barrio, R.S. and Kozlowski G. 2019. The World as an Architectural Project, The MIT Press, Cambridge.

Simoncini, G. 2001. Gustavo Giovannoni e la scuola superiore di architettura di Roma (1920-1935), in Franchetti Pardo, V. La Facoltà di Architettura dell'Università di Roma La Sapienza dalle origini al Duemila, Gangemi, Rome, pp. 45-53.

Stabile, F.R. 2017. Gustavo Giovannoni e la cultura dell'ambientismo, in "Bollettino del Centro di Studi per la Storia dell'Architettura", 1, pp. 135-14.

Strappa, G. 2023. Leggere il territorio. Prendersi cura del territorio. Reading the territory. Taking care of the territory, in "U+D Urban Form and Design", 20, pp. 8-11.

Tagliazucchi, S. 2015. Studi per un'operante storia del territorio. Il libro incompiuto di Saverio Muratori, PhD thesis, University of Bologna.

Vv. Aa. 1964. Convegno della Facoltà di Architettura di Roma, in "L'Architettura. Cronache e Storia", 99.

# URBAN EQUILIBRIUM

Klea Uruci, Kreshnik Merxhani
Epoka University, Department of Architecture,
Rruga Tiranë-Rinas, Km 12, 1039, Tirana/Albania
kuruci23@epoka.edu.al, kmerxhani@epoka.edu.al

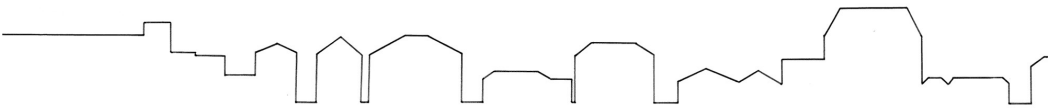
## ABSTRACT

This paper reconsiders the House+ project in the historic centre of Pogradec as an inquiry into urban equilibrium: how a contemporary intervention can re-energize a fragile historic fabric without becoming an object of contrast or spectacle. Rather than treating heritage as a fixed image to be copied, the project understands continuity as a balance between memory, daily life, spatial rhythm, and new cultural use. Drawing on Gustavo Giovannoni's concepts of diradamento, innesto, and ambientismo, and informed by Herzog & de Meuron's idea of a house that seems as if it had always been there, the paper frames design as a search for equilibrium across scales from the room and courtyard to the street, the block, and the city. Through a hybrid program combining dwelling, atelier, archive, and underground exhibition spaces dedicated to Misto Cici, the project proposes a modest but contemporary urban infill that restores attention, access, and cultural continuity within the historic centre.

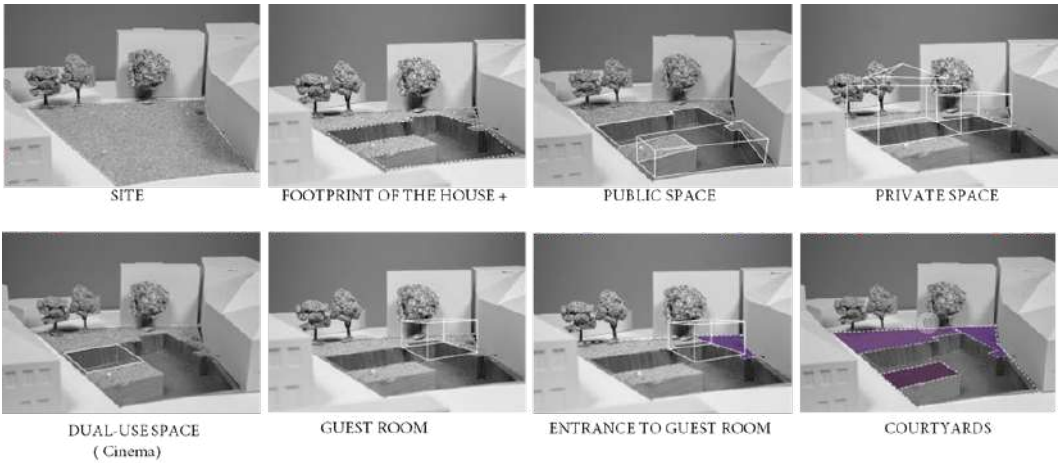
KEYWORDS: Urban Re-Energizing; Urban Equilibrium; Diradamento; Innesto; Historic Centers; Urban Infill; Contemporary Architecture

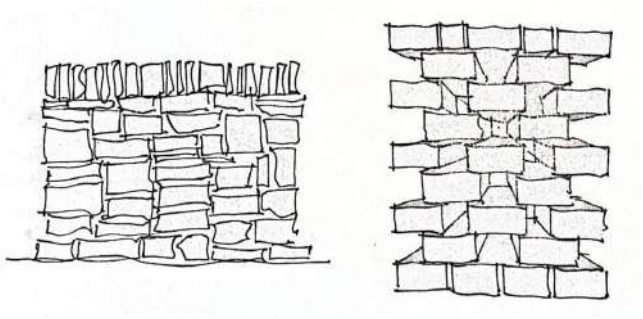
Historic centres are often caught between two opposite but equally damaging conditions: on the one hand, rigid protection can turn them into frozen fragments of the past; on the other, economic pressure and isolated contemporary insertions can weaken the delicate relations that once gave them coherence. The problem is therefore not simply whether one should build within a historic context, but how a new intervention may enter such a context without accelerating its loss of identity. This question defines the methodological starting point of the project. Before proposing form, the research identifies a series of tensions already present in the historic centre of Pogradec: the gradual atrophy of central areas, unequal access to cultural memory, the pressure to preserve without the means to sustain everyday life, and the risk that new architecture either imitates superficially or insists on contrast. Within this condition, the aim of the project was not to produce an immediate visual impact, but to find an equilibrium, an architectural presence that arrives naturally, without violence, and seems to belong because it has understood the measure of the place. For this reason, the theoretical frame turns first to Gustavo Giovannoni, whose reflections on the recovery of old urban nuclei remain strikingly relevant in a contemporary moment still marked by crisis and by the exhaustion of spectacle-driven and iconic architecture. His ideas on diradamento, innesto, and

ambientismo are not treated here as historical quotations but as operative tools: selective renewal rather than erasure, grafting rather than isolation, and respect for the atmospheric character of a place rather than formal mimicry. The project is also informed by Herzog & de Meuron's memorable formulation of 'a house that is as if it had always been there,' a phrase that is important not because of style, material, or image alone, but because it suggests an architecture that reaches equilibrium through necessity, restraint, and a deep reading of context. From this combined framework, the design process moved through site observation, urban and architectural analysis, precedent study, and repeated formal testing in order to understand where equilibrium already existed and how it could be extended.



Particular attention was given to the relationship with the street, to access from the public realm, to the rhythm of façades and openings, to the presence of greenery and gardens, and to the way domestic life in Pogradec has historically been organized through courtyards, layered thresholds, and modest spatial sequences. Instead of placing a new object against this fabric, the proposal works as an urban infill that completes and recalibrates it. Its volume follows the street line and the scale of the surrounding houses, while its internal organization introduces a hybrid program in which a family dwelling, an atelier, guest space, and an underground museum dedicated to the archive of Misto Cici coexist without confusion. The decision to touch the subsoil is crucial: the public cultural program is not imposed as an extroverted object, but inserted beneath the domestic realm, allowing the street continuity and the human scale of the neighbourhood to remain intact while expanding the civic role of the house. In this way, the project brings back into collective attention both a forgotten figure and a broader historical layer linked to the formation of these buildings in the 1920s and 1930s. Equilibrium here is therefore spatial, social, and urban: it concerns the balance between private and public, between memory and contemporary use, and between detached fragments and a more integrated neighbourhood condition. Materiality supports this intention. The project does not seek confusion between old and new, but neither does it dramatize their difference. A contemporary construction language potentially in composite concrete, brick, and carefully proportioned vertical elements is considered in relation to the textures, weights, and rhythms of the historic environment so that the new intervention can remain legible as a work of the twenty-first century while still participating in the calm continuity of the existing fabric. Small courtyards, filtered light, and the measured relation between solid and void help sustain this continuity at the level of atmosphere. The result is not a nostalgic reconstruction and not an iconic insertion, but a modest act of recomposition that tries to rebalance the historic centre by reconnecting architecture with ordinary life, local memory, and shared cultural access. Seen from the scale of the neighbourhood and then from the scale of the city, the project suggests that urban equilibrium is not a static condition but a process through which disconnected zones can gradually become integrated again. In this sense, House+ is proposed as an example of urban re-energizing: a contemporary intervention capable of entering a protected historic context with enough precision, restraint, and cultural awareness to appear not abrupt, but necessary.



## REFERENCES

Architekturzentrum Wien (ed.). (2001). Sturm der Ruhe: What is Architecture? Salzburg: Anton Pustet Verlag.

Benedetti, S. (2017). Gustavo Giovannoni e la cultura dell'ambientismo. Firenze Architettura, n.s. 1. Giovannoni, G. (1913/2023). Diradamento of the Urban Fabric in Old City Centers. In S. W. Semes, F. Siravo & J. Cody (eds.), Old Cities: Writings by Gustavo Giovannoni on Architectural and Urban Conservation. Los Angeles: Getty Conservation Institute.

Giovannoni, G. (1931/2023). Improvement of the Internal Nuclei: The Theory of Diradamento. In S. W. Semes, F. Siravo & J. Cody (eds.), Old Cities: Writings by Gustavo Giovannoni on Architectural and Urban Conservation. Los Angeles: Getty Conservation Institute.

Herzog, J., & de Meuron, P. (2001). A House that is Necessary. In Architekturzentrum Wien (ed.), Sturm der Ruhe: What is Architecture? Salzburg: Anton Pustet Verlag.

Kallamata, K., et al. (2018). Guidelines for the Built Heritage in and around Pogradec on the Albanian Side of Lake Ohrid. UNESCO / ICOMOS.

# BUILT ENVIRONMENT & PERFORMANCE

# EFFECTS OF EARTHQUAKE DEPTH IN A FRAME STRUCTURE CONSIDERING SOIL STRUCTURE INTERACTION DURING 2016 SEPTEMBER SKOPJE EARTHQUAKE

Kemal Edip, Vlatko Sheshov, Julijana Bojadjieva and Aleksandra Bogdanovic
Institute of Earthquake Engineering and Engineering Seismology, "Ss. Cyril and Methodius",
Skopje, Republic of N. Macedonia
*kemal@iziis.ukim.edu.mk*

## EXTENDED ABSTRACT

The Seismic excitation experienced by structures is a function of the earthquake source, travel path effects, local site effects and soil structure interaction whose results have been analysed in the last decades. On 11th of September 2016 at 13.10h UTC time an earthquake with magnitude of 5.2 hit the city of Skopje. Although moderate in magnitude, the earthquake was felt strongly in the city with moderate structural damages experienced in the reinforced concrete buldilngs. The earthquake was monitored by many local and regional stations in which the data for the depth of the hypocenter were given as 4km while USGS reported the depth of 10km. In this work the ground motion prediction equations according to Boore and Stewart [1] have been used in order to define the target spectra for both depths as given in Fig.1 below.

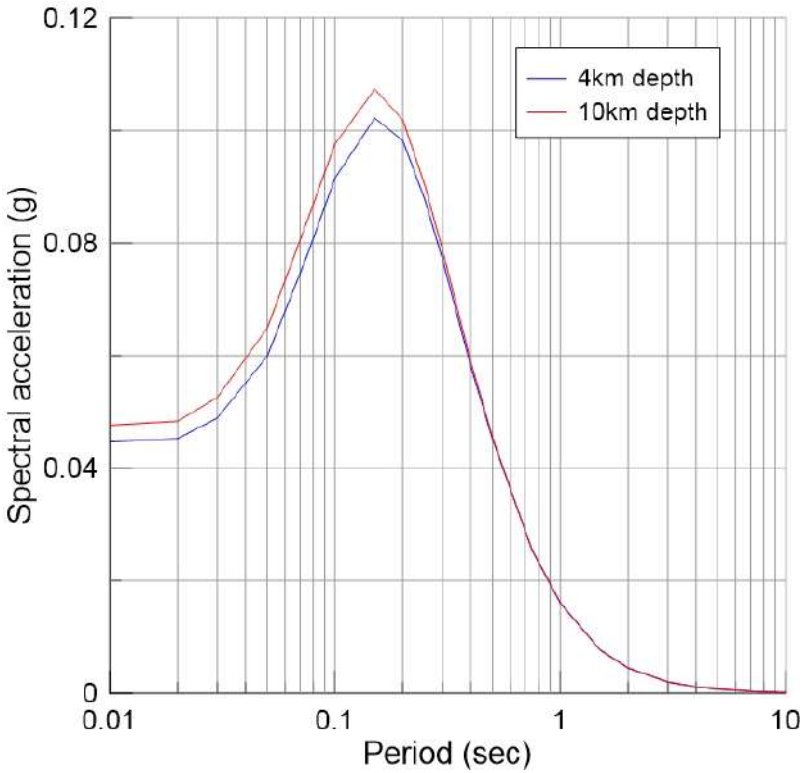



Fig. 1 Target spectra for different depths of rupture

The target spectra reveal significant differences between the two depth scenarios, particularly in the spectral acceleration values across various periods. The deeper hypocenter prediction generates slighthly higher spectral accelerations in the short-to-medium period range, which is critical for the response of low-to-mid-rise structures. These target spectra serve as the basis for generating spectrum-compatible artificial accelerograms that will be used in the subsequent dynamic analyses. Based on the target spectra, artificial earthquake records have been created in order to evaluate the effects of the earthquakes in the structural response of a three-storey frame structure as given in Fig.2 below.

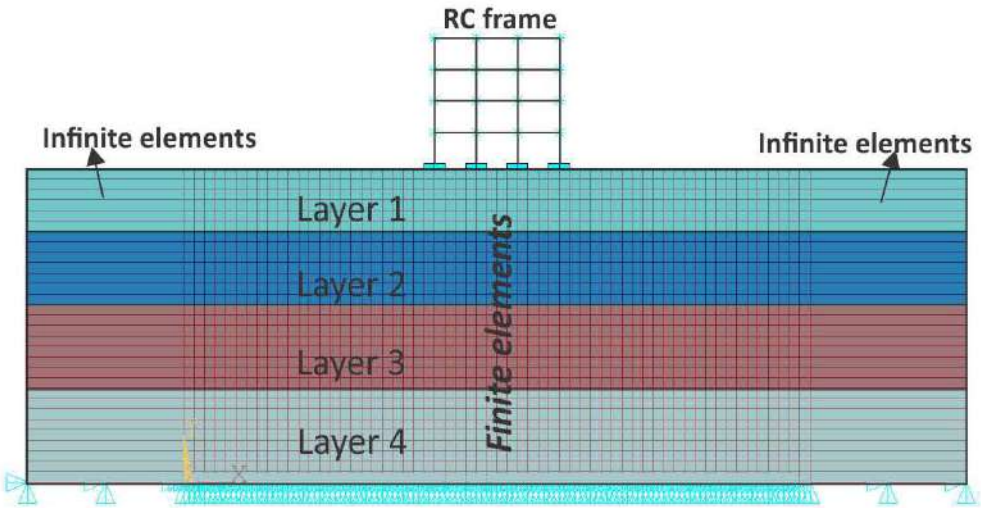



Figure 2. Numerical model of SSI

The numerical model incorporates both the superstructure and the surrounding soil medium to capture the complete soil-structure interaction effects. The three-storey reinforced concrete frame represents a typical building configuration found in Skopje's building stock. The foundation is modeled with appropriate contact elements, while the soil domain extends sufficiently in all directions to minimize boundary effects. Infinite elements are implemented at the outer boundaries to simulate the semi-infinite nature of the soil medium and prevent spurious wave reflections that could contaminate the structural response. The generated earthquake records have been gnerated by using the open source software Code Aster [2]. The generation of earthquakes for 4km and 10km depth is given below in Figure 3.

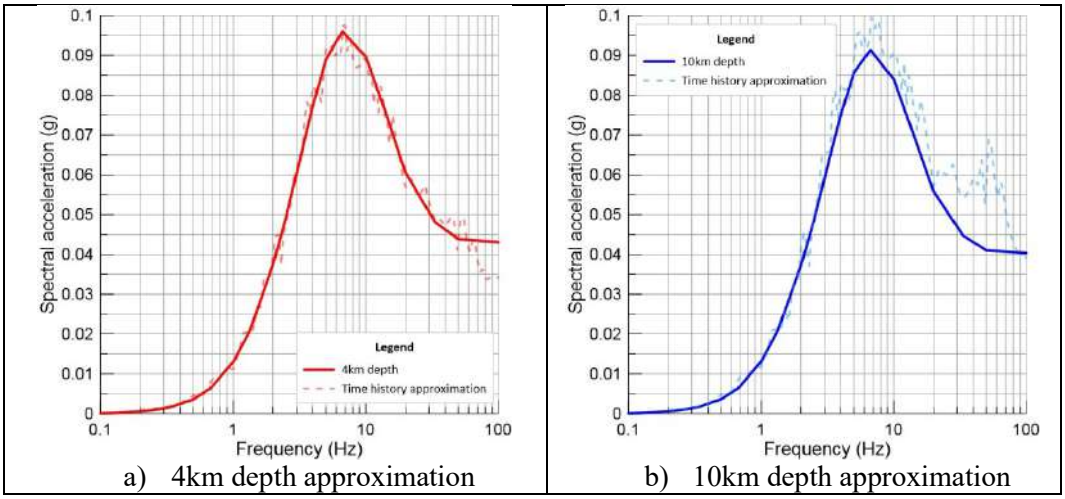



Figure 3: Comparison of artificial earthquakes with the spectra

As can be seen in the Figure 3 the results of spectra show better approximation in the lower frequencies which is used in our case. The artificial accelerograms demonstrate excellent agreement with their respective target spectra, particularly in the period range of 0.1 to 1.0 seconds, which governs the dynamic response of the analyzed frame structure. The spectral matching procedure ensures that the generated ground motions preserve the key characteristics of earthquakes occurring at different hypocentral depths while maintaining realistic time-domain properties. Minor deviations at higher frequencies have negligible impact on the structural response given the predominant periods of the structure under investigation. The obtained earthquakes relating to the spectra are shown next in Figure 4.

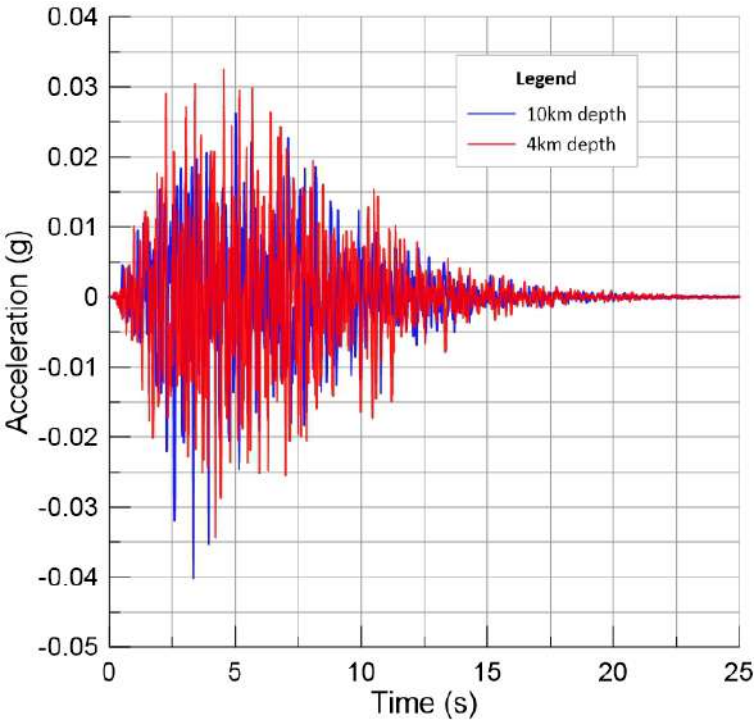



Figure 4: Earthquake time histories of 4 and 10 km depth

The soil medium is considered to be either dense or soft sandy material, which can be classified as Type B and Type C soils, respectively, according to Eurocode 8 classification. The simulation considers a nonlinear behavior with respect to the soil modelling [3]. All analysis are performed in ANSYS computer package in which user defined elements [4-6] are used for calculations. These analyses enable the performance of both the soil and the structure to be accurately modelled. Seismic evaluations and comparisons for all earthquakes are given in detail for earthquake time histories from the target spectra. The seismic behavior of the structure considers results considering deformations, structural moments at the top of the structure and acceleration at the ground level. Two soil conditions—dense and soft—are analyzed to assess the influence of soil stiffness on the structural response The results are summarized in the Table 1 below:

Table 1 Comparison of results

| Depth | Soil Medium | Max. displacement (cm) | Max. acceleration ($m/s^2$) | Max. moment (kNm) |
|---|---|---|---|---|
| 10km | Dense | 2.50 | 7.65 | 153.10 |
| | Soft | 2.37 | 3.87 | 56.43 |
| 4km | Dense | 2.57 | 8.03 | 168.41 |
| | Soft | 2.45 | 4.06 | 60.94 |

The results have demonstrated interesting outcomes showing the combined influence of earthquake depth and soil stiffness on the seismic response of the frame structure. For both soil conditions, the shallower earthquake scenario (4 km depth) consistently produces higher maximum displacements, accelerations and bending moments compared to the deeper event (10 km depth), indicating stronger near-source effects. Dense soil conditions lead to noticeably higher accelerations and internal moments than soft soil, while the differences in maximum displacement remain relatively small. In conclusion it can be stated that the soft soil significantly reduces acceleration and moment demands despite comparable displacement levels, illustrating the filtering effect of compliant soil and the importance of soil–structure interaction in modifying structural response. Last but not least, this work shows the critical influence of small differences in prediction of earthquake hypocenter depth on the structural demand parameters, emphasizing the need for accurate seismic source characterization in vulnerability assessments and design application.

KEYWORDS: Skopje Earthquake, Soil Structure Interaction, Numerical Modelling, Infinite Elements

## REFERENCES

Boore, D.M., J.P. Stewart, E. Seyhan, and G.M. Atkinson, NGA-West2 equations for predicting PGA, PGV, and 5% damped PSA for shallow crustal earthquakes. Earthquake Spectra, 2014. 30(3): p. 1057-1085.

Code-Aster. Fem Software, https://code-aster.org/. 2018.

Edip, K., V. Sheshov, J. BOJADJIEVA, T. KITANOVSKI, and J. CHANEVA, Numerical simulation of triaxial tests. ce/papers, 2018. 2(2-3): p. 621-626.

Edip, K., V. Sesov, C. Butenweg, and J. Bojadjieva, Development of coupled numerical model for simulation of multiphase soil. Computers and Geotechnics, 2017.

Edip, K., V. Sheshov, W. Wu, and J. Bojadjieva, Numerical modelling of saturated boundless media with infinite elements. Acta Geotechnica, 2021. 16(8): p. 2683-2692.

Edip, K., Development of three phase model with finite and infinite elements for dynamic analysis of soil media. 2013, Ss. Cyril and Methodius: Institute of Earthquake Engineering and Engineering Seismology.

# EVALUATING THE THERMAL PERFORMANCE AND ENERGY EFFICIENCY OF A VERNACULAR DWELLING IN TIRANA, ALBANIA

Ina Dervishi, Endrin Lasku, Sokol Dervishi
Department of Architecture, Epoka University
Rr. Tiranë-Rinas,Km. 12, Tirana, Albania
*iosmani@epoka.edu.al; elasku20@epoka.edu.al; sdervishi@epoka.edu.al*

## ABSTRACT

Vernacular architecture represents an important source of climate-responsive design knowledge developed through centuries of adaptation to local environmental conditions (Rapoport, 1969). Traditional buildings incorporate passive environmental strategies such as thermal mass, natural ventilation, solar orientation, and locally sourced construction materials to achieve indoor thermal comfort with minimal reliance on mechanical systems (Rudofsky, 1964; Fathy, 1986). These design principles are particularly relevant in Mediterranean climates, where seasonal variations require both cooling and heating solutions (Olgyay, 2015). This research investigates the thermal performance and energy efficiency of a vernacular dwelling located in Tirana, Albania, known as the Libohova Villa within the historic Toptani Saray complex. The study combines architectural documentation with building performance simulation using DesignBuilder and the EnergyPlus simulation engine. Climate data for Tirana were obtained using Meteonorm weather files. Two representative rooms with different orientations were analyzed to evaluate the influence of solar exposure, ventilation strategies, and building envelope characteristics on indoor thermal conditions. Several ventilation and retrofit scenarios were simulated to assess potential improvements in energy performance. The results demonstrate that natural ventilation strategies significantly reduce indoor temperatures during summer periods, while envelope optimization interventions reduce heating demand during winter. The most effective retrofit scenario achieved reductions of approximately 74% in heating demand and 28–29% in cooling demand compared to the base case scenario. The study highlights the potential of integrating vernacular architectural knowledge with modern building performance simulation tools to enhance energy efficiency while preserving historic architecture.

KEYWORDS: Vernacular architecture; Passive design strategies; Building energy simulation; Natural ventilation; Thermal performance; Energy efficiency

## 1. INTRODUCTION

Vernacular architecture provides valuable knowledge on climate-responsive design developed through long-term adaptation to local environmental conditions and materials (Rapoport, 1969). Traditional buildings often employ passive strategies such as thermal mass, natural ventilation, solar orientation, and locally sourced materials to regulate indoor thermal conditions with minimal mechanical systems (Rudofsky, 1964; Fathy, 1986; Coch, 1998). These principles remain particularly relevant in Mediterranean climates where buildings must respond to seasonal heating and cooling demands (Olgyay, 2015). The building sector accounts for approximately 36–40% of global energy consumption, making energy performance improvement a key objective of sustainability policies (Nejat et al., 2015; European Commission, 2021). As a significant portion of the European building stock consists of historic and vernacular buildings, retrofit strategies are required to improve energy efficiency while preserving architectural heritage (Stefanizzi et al., 2016). Advances in building performance simulation, using tools such as EnergyPlus and DesignBuilder, allow detailed evaluation of building thermal behavior under different environmental scenarios (Crawley et al., 2001). Research by Dervishi and collaborators has contributed to this field through studies on solar radiation modelling, environmental performance assessment, and simulation-based analysis (Mahdavi & Dervishi, 2010; Orehounig et al., 2011; Dervishi & Mahdavi, 2012; Orehounig et al., 2014). Recent studies have also investigated retrofit strategies and energy optimization in buildings, including glazing improvements, façade vegetation, adaptive reuse, and urban morphology effects on energy performance (Belba et al., 2022; Bano & Dervishi, 2021; Breçani & Dervishi, 2019; Breçani et al., 2019; Dervishi & Baçi, 2023; Merollari & Dervishi, 2024; Picari & Dervishi, 2019; Tafani et al., 2022; Ulliri & Dervishi, 2023; Dervishi et al., 2023). Within this context, the Libohova Villa, located in the historic Tirana Castle area, represents an example of Albanian vernacular residential architecture characterized by stone masonry walls and timber structural elements. This study evaluates its thermal performance and energy efficiency using building performance simulation, focusing on the impact of natural ventilation strategies and envelope retrofit interventions on indoor thermal conditions and annual energy demand.

## 2. METHODOLOGY

### 2.1. ARCHITECTURAL ANALYSIS

The Libohova Villa is located within the historic Tirana Castle area and forms part of the Toptani Saray complex, an important historic urban ensemble in Tirana. Built in the 1830s, the villa represents a significant example of traditional Albanian residential architecture. Its location within the historic urban fabric of Tirana is illustrated in Figure 1, which highlights the relationship between preserved historic structures and recent urban development in the city center. The spatial organization of the building was analyzed through architectural plans of both floors. As shown in Figure 2, the building follows a typical Albanian vernacular residential typology, consisting of two floors with different functional roles.

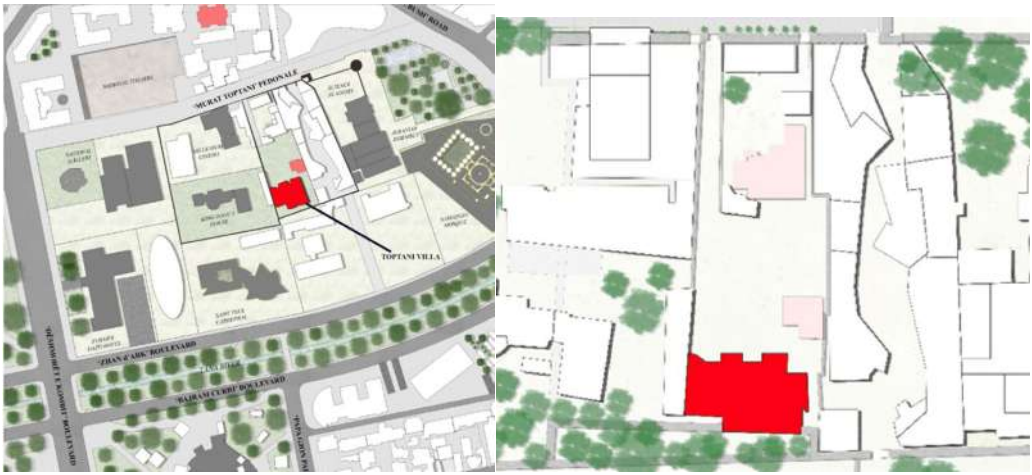



Figure 1. Location of Libohova Villa within Tirana Castle (Source: Author based on documentation)

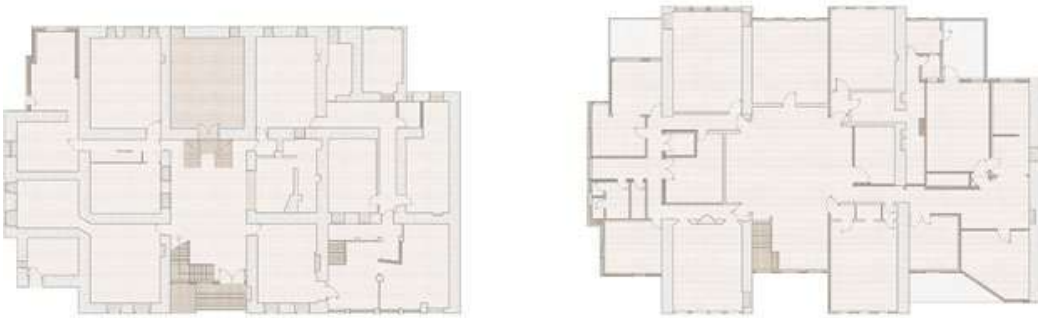


Figure 2. Ground and first floor plans of Libohova Villa

## 2.2. BUILDING SIMULATION MODEL

A digital model of the Libohova Villa was developed using DesignBuilder, operating with the EnergyPlus simulation engine. Climate data for Tirana were obtained from Meteonorm weather files. The Libohova Villa is characterized by thick stone masonry walls combined with timber structural elements, which strongly influence the building's thermal inertia and heat transfer behavior. The thermal properties of the building envelope were defined according to the original construction materials identified during the architectural analysis. These properties are summarized in Table 1.

Table 1. Construction Materials and Thermal Properties of Libohova Villa

| Construction Element | U-value (W/m²K) | Material Composition |
|---|---|---|
| **External wall (Stone masonry)** | 2.235 | Cement/lime plaster (0.025 m); Stone masonry (0.75 m); Cement/lir plaster (0.025 m) |
| **External wall (Radial oak wood)** | 1.131 | Cement/lime plaster (0.025 m); Lime sand render (0.05 m); Radial oak wood (0.10 m); Lime sand render (0.05 m); Cement/lime plaster (0.025 m) |
| **Windows** | 5.778 | Single clear glazing (6 mm) |
| **Ground floor** | 1.163 | Clay/silt layer (0.2 m); Alluvial clay soil with sand (0.2 m); Mortar (0.08 m); Plywood (0.03 m) |
| **Intermediate floor** | 0.551 | Plywood (0.03 m); Mortar (0.08 m); Radial oak wood (0.10 m); Radial oak wood (0.10 m); Plywood (0.03 m) |
| **Ceiling** | 0.620 | Radial oak wood (0.10 m); Mortar (0.08 m); Plywood (0.03 m) |
| **Internal wall (Stone masonry)** | 1.861 | Cement/lime plaster (0.025 m); Stone masonry (0.75 m); Cement/lir plaster (0.025 m) |
| **Internal wall (Radial oak wood)** | 1.027 | Cement/lime plaster (0.025 m); Lime sand render (0.05 m); Radial oak wood (0.10 m); Lime sand render (0.05 m); Cement/lime plaster (0.025 m) |
| **Roof** | 1.102 | Clay tile (0.025 m); Air gap (0.02 m); Roofing felt (0.005 m); Radia oak wooden beam (0.10 m) |

## 2.3. RETROFIT AND SIMULATION SCENARIOS

To evaluate the potential improvement in the building's thermal and energy performance, a set of retrofit scenarios was developed. The proposed interventions focus on improving the building envelope through wall insulation, roof insulation, and glazing replacement. Wall insulation was implemented using glass wool insulation installed from the interior side of the walls, preserving the historic façade. Three insulation thicknesses were tested: 5 cm, 7.5 cm, and 10 cm, each combined with a 2 cm plywood interior finishing layer. The existing single-glazed windows were replaced with Low-E argon-filled double-glazing systems consisting of two 6 mm glass panes separated by a 13 mm argon cavity. Additionally, 10 cm glass wool roof insulation was applied above the ceiling layer to reduce heat gains during summer and heat losses during winter. To evaluate the influence of these interventions, several simulation scenarios were developed combining different envelope improvements. The Base Case (BC) represents the existing building condition without retrofit measures. The complete set of retrofit interventions and simulation scenarios is summarized in Table 2.

Table 2. Retrofit Measures and Simulation Scenarios

| Code | Type | Description |
|---|---|---|
| BC | Base Case | Existing building without insulation improvements |
| SC01 | Simulation scenario | Double glazing |
| SC02 | Simulation scenario | Roof insulation |
| SC03 | Simulation scenario | Double glazing + roof insulation |
| SC04 | Simulation scenario | Wall insulation 5 cm |
| SC05 | Simulation scenario | Wall insulation 5 cm + DB + roof insulation |
| SC06 | Simulation scenario | Wall insulation 7.5 cm |
| SC07 | Simulation scenario | Wall insulation 7.5 cm + DB + roof insulation |
| SC08 | Simulation scenario | Wall insulation 10 cm |
| SC09 | Simulation scenario | Wall insulation 10 cm + DB + roof insulation |

## 3. RESULTS AND DICUSSION

The simulation results provide insights into the thermal performance of the building and the effectiveness of passive strategies and retrofit interventions.

### 3.1. IMPACT OF BUILDING ENVELOPE IMPROVEMENTS ON THERMAL PERFORMANCE

The impact of envelope retrofit scenarios was evaluated by comparing the base case (BC) with optimization scenarios SC1–SC9. The base case represents the original building without insulation improvements and shows indoor temperatures ranging from 14.75 °C in winter to 27.0 °C in summer, highlighting the limited thermal resistance of the existing envelope. Individual retrofit measures show moderate improvements. Double glazing (SC1) and roof insulation (SC2) slightly increase winter temperatures (≈0.25–0.36 °C) and reduce summer temperatures by about 0.13–0.17 °C. More significant improvements occur when wall insulation is introduced. SC4 (5 cm wall insulation) increases winter temperatures by approximately 1.3 °C, while combined scenarios such as SC5 improve winter temperatures by about 2.4 °C. Increasing wall insulation thickness further enhances performance. SC7 (7.5 cm wall insulation with roof insulation and double glazing) increases winter temperatures by 2.65 °C and reduces summer temperatures by about 0.6 °C. The best results are obtained in SC9, which combines 10 cm wall insulation, roof insulation, and double glazing. This scenario increases winter temperatures by 2.8 °C and reduces summer temperatures by 0.65 °C, resulting in an annual average improvement of 1.08 °C compared to the base case. Overall, the results demonstrate that integrated envelope retrofit strategies

significantly improve thermal comfort, particularly during winter months when heat losses are highest. Overall, the trends presented in Figure 3 demonstrate that integrated envelope retrofit strategies significantly improve indoor thermal comfort, particularly during winter months when heat losses are highest.

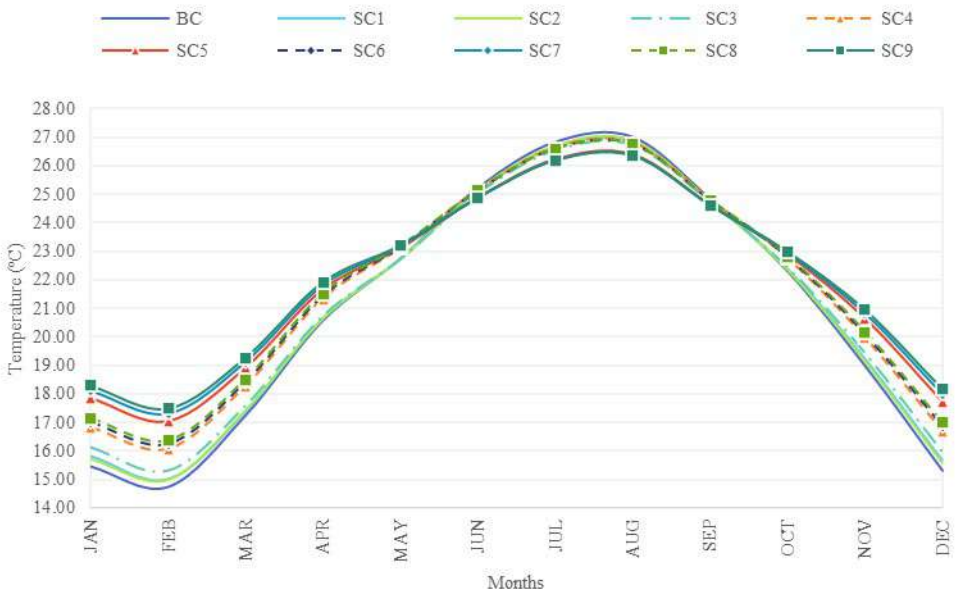



Figure 3 Indoor temperature results for rooms L1 (left) and Z19 (right) under building envelope improvement scenarios.

## 3.2. ENERGY PERFORMANCE

The annual energy demand values were calculated by aggregating the monthly simulation results obtained for each retrofit scenario. As presented in Table 3, the base case (BC) exhibits the highest annual energy demand, reaching approximately 72 kWh/m$^2$·year, reflecting the limited thermal performance of the original building envelope without insulation improvements. Progressive envelope improvements significantly reduce total energy consumption. Scenario SC1, which introduces double glazing, reduces the annual energy demand to approximately 66 kWh/m$^2$·year, corresponding to an 8% reduction compared to the base case. Similarly, SC2, which applies roof insulation, reduces energy demand to 68 kWh/m$^2$·year, representing a 6% reduction. More substantial improvements are observed when wall insulation is introduced. Scenario SC4 reduces the energy demand to approximately 52 kWh/m$^2$·year, corresponding to a 28% reduction compared to the base case. Combined retrofit strategies further improve performance. Scenario SC5 achieves 45 kWh/m$^2$·year, while SC6 results in approximately 48 kWh/m$^2$·year. The greatest reductions occur in scenarios combining wall insulation, roof insulation, and improved glazing systems. Scenario SC7

reduces the energy demand to 41 kWh/m²·year, while SC8 achieves 39 kWh/m²·year, corresponding to reductions of 43% and 46%, respectively. The best-performing configuration is SC9, which integrates 10 cm wall insulation, roof insulation, and argon-filled double glazing. This scenario reduces the annual energy demand to approximately 36 kWh/m²·year, representing an overall 50% reduction compared to the base case, as summarized in Table 3. The monthly distribution of total energy demand for all retrofit scenarios is illustrated in Figure 4. The results show that energy demand is highest during the winter months (January, February, and December), when heating loads dominate. The retrofit scenarios significantly reduce winter energy demand, particularly in scenarios with increased wall insulation thickness and improved glazing systems. During summer months, the reduction is more moderate, reflecting the lower cooling demand of the building.

Table 3. Estimated yearly total energy demand for each retrofit scenario.

| Scenario | Yearly total energy Demand (kWh/m²·year) | Reduction vs Base Case |
|---|---|---|
| **BC (Base Case)** | ~72 kWh/m²·year | — |
| **SC1** | ~66 kWh/m²·year | ~8% |
| **SC2** | ~68 kWh/m²·year | ~6% |
| **SC3** | ~60 kWh/m²·year | ~17% |
| **SC4** | ~52 kWh/m²·year | ~28% |
| **SC5** | ~45 kWh/m²·year | ~38% |
| **SC6** | ~48 kWh/m²·year | ~33% |
| **SC7** | ~41 kWh/m²·year | ~43% |
| **SC8** | ~39 kWh/m²·year | ~46% |
| **SC9** | **~36 kWh/m²·year** | **~50%** |

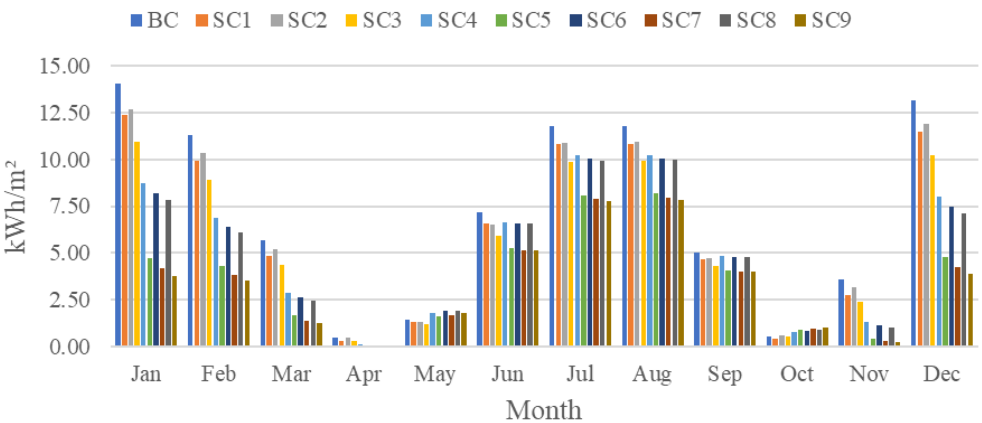



Figure 4. Total Monthly total energy demand (kWh/m²) for the Libohova Villa under different retrofit scenarios (BC–SC9).

## 3.3. ECONOMIC EVALUATION

An economic analysis was conducted to assess the feasibility of the retrofit scenarios. The base case presents the highest annual energy cost of approximately 5,999 €, including 3,369 € for heating and 2,631 € for cooling. Individual retrofit measures such as double glazing (SC1) and roof insulation (SC2) provide moderate reductions, lowering annual costs to 5,330 € and 5,492 €, respectively. Combined strategies produce significantly greater savings. SC5 reduces annual costs to 3,031 €, while SC7 lowers costs to 2,854 €. The most efficient configuration is SC9, which reduces annual energy costs to 2,744 €, representing more than 50% savings compared to the base case. Payback analysis shows that wall insulation scenarios provide the fastest return, with payback periods of approximately 1–2 years. More comprehensive retrofit strategies (SC05–SC09) require higher initial investment but achieve larger energy savings with payback periods of about 5–6 years.

## 4. CONCLUSION

This study evaluated the thermal performance and energy efficiency of the Libohova Villa, a traditional vernacular building located in the historic Tirana Castle area, using building performance simulation. The results demonstrate that natural ventilation strategies significantly improve summer indoor thermal comfort, particularly when night-time ventilation is utilized. Envelope retrofit measures further enhance building performance by reducing heat losses and improving indoor temperatures during winter. Among the tested scenarios, the comprehensive retrofit configuration (SC9)—including 10 cm wall insulation, roof insulation, and double glazing—achieved the best performance, reducing annual energy demand by approximately 50% and significantly lowering operational energy costs. These findings highlight the potential of combining vernacular architectural knowledge with modern simulation tools to develop effective energy retrofit strategies for historic buildings. Such approaches support both sustainable building conservation and energy efficiency improvements in Mediterranean climates. Future research should expand this methodology to additional vernacular buildings in Albania, enabling the development of broader strategies for sustainable heritage preservation.

## REFERENCES

Bano, P., Dervishi, S., 2021. The impact of vertical vegetation on thermal performance of high-rise office building facades in Mediterranean climate. Energy and Buildings, 236, 110761.

Belba, R., Dervishi, S., Osmani, I., 2022. The impact of glazing on thermal performance of a hotel building in Zagreb, Croatia: An early design-based study. Building Simulation Conference Proceedings.

Breçani, R., Dervishi, S., 2019. Thermal and energy performance evaluation of underground bunkers: An adaptive reuse approach. Sustainable Cities and Society, 46, 101444.

Breçani, R., Belba, R., Dervishi, S., 2019. Simulation-assisted energy optimization of abandoned agricultural facilities: An adaptive reuse approach. Building Simulation Conference Proceedings.

Coch, H., 1998. Bioclimatism in vernacular architecture. Renewable and Sustainable Energy Reviews, 2(1–2), 67–87.

Crawley, D.B., Lawrie, L.K., Winkelmann, F.C., et al., 2001. EnergyPlus: Creating a new-generation building energy simulation program. Energy and Buildings, 33(4), 319–331.

Dervishi, S., Baçi, N., 2023. Early design evaluation of low-rise school building morphology on energy performance: Climatic contexts of Southeast Europe. Energy, 269, 126790.

Dervishi, S., Mahdavi, A., 2012. Computing diffuse fraction of global horizontal solar radiation: A model comparison. Solar Energy, 86(6), 1796–1802.

Dervishi, S., Mazniku, G., Tafani, A., Dervishi, I., 2023. Assessing energy poverty and potential retrofit scenarios in residential stock in Tirana, Albania.

European Commission, 2021. A Renovation Wave for Europe – Greening Our Buildings, Creating Jobs, Improving Lives.

Fathy, H., 1986. Natural Energy and Vernacular Architecture. University of Chicago Press.

Mahdavi, A., Dervishi, S., 2010. Approaches to computing irradiance on building surfaces. Journal of Building Performance Simulation, 3(2), 129–134.

Merollari, J., Dervishi, S., 2024. Analyzing the impact of urban morphology on solar potential for photovoltaic panels across European climates. Sustainable Cities and Society, 115, 105854.

Nejat, P., Jomehzadeh, F., Taheri, M., Gohari, M., Majid, M., 2015. A global review of energy consumption, $CO_2$ emissions and policy in the building sector. Renewable and Sustainable Energy Reviews, 43, 843–862.

Olgyay, V., 2015. Design with Climate: Bioclimatic Approach to Architectural Regionalism. Princeton University Press.

Orehounig, K., Dervishi, S., Mahdavi, A., 2011. Comparison of computed and measured irradiance on building surfaces. Proceedings of Building Simulation Conference.

Orehounig, K., Dervishi, S., Mahdavi, A., 2014. Computational derivation of irradiance on building surfaces: An empirically-based model comparison. Renewable Energy, 71, 185–192.

Picari, V., Dervishi, S., 2019. Analysis of urban heat island phenomenon and mitigation strategies for Tirana, Albania. Building Simulation Conference Proceedings.

Rapoport, A., 1969. House Form and Culture. Prentice-Hall.

Rudofsky, B., 1964. Architecture Without Architects. Museum of Modern Art.

Stefanizzi, P., et al., 2016. Energy retrofit of historic buildings: Challenges and solutions. Energy Procedia.

Tafani, A., Mazniku, G., Dervishi, S., 2022. Assessing energy poverty and potential retrofit scenarios in residential stock in Albania. Building Simulation Conference Proceedings.

Ulliri, A., Dervishi, S., 2023. Exploring energy poverty and retrofit potential in Mediterranean masonry residential stock. Building Simulation Conference Proceedings.

# EVALUATING ACCESSIBILITY IN EDUCATIONAL ARCHITECTURE: A CASE STUDY OF PLM SCHOOL IN DURRËS, ALBANIA

Ina Dervishi, Flavia Paja
Department of Architecture, Epoka University
Rr. Tiranë-Rinas,Km. 12, Tirana, Albania
*iosmani@epoka.edu.al; fpaja20@epoka.edu.al*

## ABSTRACT

Accessibility in educational architecture is essential for ensuring equal learning opportunities and social inclusion for students with disabilities. This research investigates accessibility challenges and opportunities in Albanian schools through a case study of the 9-Year School "PLM" in Durrës. The study applies a qualitative spatial and sensory analysis combining site observations, architectural documentation, and an adapted accessibility checklist based on international standards such as the Americans with Disabilities Act (ADA) and ISO 21542, as well as Albanian national standards. The findings reveal significant gaps in physical accessibility, wayfinding systems, and sensory accommodations within the existing school infrastructure. Barriers include insufficient funding, limited technical expertise, and inconsistent implementation of accessibility policies. A comparative review of international best practices highlights the importance of universal design, multisensory navigation, and adaptable learning environments. Based on these findings, the research proposes design interventions that incorporate tactile guidance systems, sensory-friendly materials, and improved circulation strategies to enhance accessibility and independence for students with disabilities. The study emphasizes that inclusive school design benefits not only students with disabilities but improves the learning environment for all users.

KEYWORDS: Accessibility, Inclusive Education, Universal Design, Sensory Design, School Architecture, Albania

## 1. INTRODUCTION

Inclusive access to education is widely recognized as a fundamental human right and a key component of sustainable development. According to the United Nations Convention on the Rights of Persons with

Disabilities (CRPD), educational environments must be designed to ensure equal participation for individuals with diverse physical, sensory, and cognitive abilities (United Nations, 2006). In this context, accessibility in educational architecture extends beyond physical infrastructure and encompasses spatial, sensory, and social dimensions of the built environment. Historically, many educational facilities were designed primarily for able-bodied users, resulting in environments that inadvertently exclude students with disabilities. Architectural barriers such as stairs without ramps, narrow circulation corridors, and inadequate signage significantly limit accessibility and independence (Steinfeld and Maisel, 2012). As a result, inclusive design has emerged as a critical framework for creating environments that accommodate the needs of all users. Universal Design (UD) provides a widely accepted theoretical foundation for inclusive environments. Initially developed by Ronald Mace, universal design advocates the creation of products and environments usable by all people without the need for adaptation or specialized design (Mace, 1998). In educational architecture, this approach promotes flexible learning environments, accessible circulation systems, and multisensory navigation strategies.

International standards such as the Americans with Disabilities Act (ADA) and ISO 21542 provide technical guidelines for accessible buildings, including specifications for ramps, elevators, tactile signage, and sensory-friendly environments (ISO, 2011). These standards have influenced architectural practice globally and have become essential references in inclusive building design. In Albania, accessibility in school infrastructure has been addressed through the Decision No. 319 (2017) on School Design Standards, which aims to ensure equal educational opportunities for students with disabilities. Figure 1 illustrates different types of disabilities that should be considered in inclusive architectural design.

Figure 1. Representation of diverse disabilities in inclusive environments (Author).

However, the implementation of these regulations remains inconsistent across regions due to economic limitations and insufficient technical expertise (ADRA Albania, 2019; Save the Children, 2012). This research investigates accessibility conditions in PLM School in Durrës through spatial and sensory analysis. The study aims to identify existing architectural barriers and propose design strategies that improve accessibility and support inclusive education.

## 2. METHODOLOGY

This research adopts a qualitative case study methodology combining spatial analysis, accessibility assessment, and comparative case study analysis. This approach allows the evaluation of both the physical and sensory performance of the school environment and provides a comprehensive framework for identifying architectural barriers (Preiser and Ostroff, 2001).

### 2.1 CASE STUDY SELECTION

PLM School in Durres was selected as the primary case study because it represents a typical public-school building constructed prior to the implementation of modern accessibility standards in Albania. The school accommodates students from both primary and lower secondary education levels and reflects many of the spatial characteristics found in existing educational infrastructure. Architectural documentation of the school building was conducted through the analysis of floor plans and site observations. The spatial organization of the ground floor is illustrated in Figure 1, showing the distribution of classrooms, corridors, and entrance areas. The first-floor layout, presented in Figure 2, highlights the relationship between circulation spaces and educational areas.

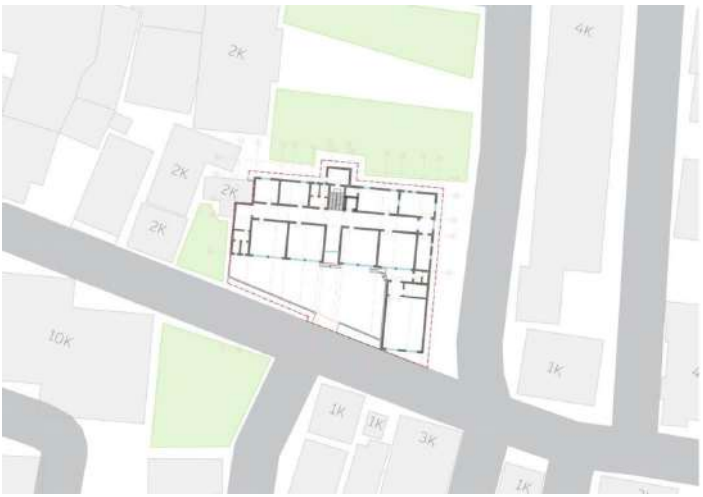



Figure 1. Ground floor plan of PLM School (Author).

Figure 2. First floor plan of PLM School (Author).

## 2.2. FIELD OBSERVATION AND SPATIAL ANALYSIS

Field observations were conducted to document the spatial configuration, circulation patterns, and existing accessibility conditions within the school building. Architectural plans and photographs were used to support the spatial analysis. Field observations were conducted to document the physical accessibility conditions of the school environment. During the site survey, particular attention was given to circulation systems, entrance accessibility, classroom accessibility, and environmental conditions that influence spatial navigation. Vertical circulation elements such as stairs and ramps were evaluated in order to identify potential mobility barriers. The existing stair and ramp configuration observed during the site survey is shown in Figure 3, where the absence of accessible alternatives limits movement for users with reduced mobility. In addition to circulation elements, the accessibility of classroom entrances was also analyzed, as door dimensions and maneuvering spaces are critical factors in inclusive educational environments. The existing door configuration observed during the site survey is illustrated in Figure 4, highlighting limitations related to accessibility and maneuverability for users with mobility impairments.

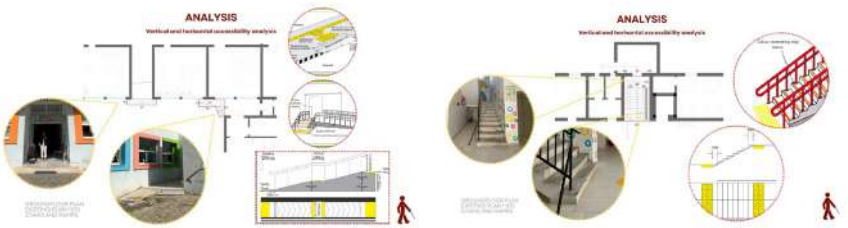



Figure 3. Existing stair and ramp conditions at PLM School (Author)

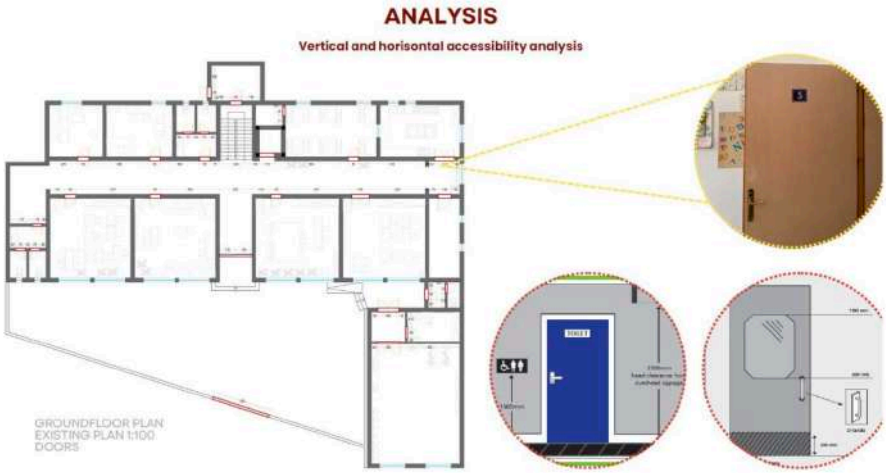



Figure 4. Classroom door accessibility conditions at PLM School (Author).

## 2.3. ACCESSIBILITY ASSESSMENT FRAMEWORK

To systematically evaluate the accessibility performance of the school building, an accessibility assessment framework was developed based on internationally recognized guidelines and national regulations. The evaluation criteria were derived from the Americans with Disabilities Act (ADA) accessibility standards, ISO 21542: Accessibility and usability of the built environment, and the Albanian School Design Standards (Decision No. 319, 2017). These frameworks provide technical recommendations for building entrances, circulation systems, classroom accessibility, and navigation elements in educational environments. The assessment focused on several key components of the built environment, including entrance accessibility, horizontal and vertical circulation systems, classroom accessibility, and the presence of wayfinding and signage systems. Each component was evaluated through direct observation and spatial analysis to determine whether the existing building conditions support safe and independent navigation for students with disabilities. Accessibility checklists are widely used in architectural research and post-occupancy evaluation studies to identify spatial barriers and assess the usability of buildings (Preiser and Ostroff, 2001). Table 1 summarizes the main accessibility criteria used during the evaluation process.

Table 1. Accessibility assessment criteria applied in the case study

| Accessibility Component | Evaluation Criteria |
|---|---|
| Building Entrances | Presence of ramps, entrance width, accessibility of doors |
| Vertical Circulation | Accessibility of stairs and ramps |
| Horizontal Circulation | Corridor width, visibility, and maneuvering space |
| Classroom Accessibility | Door width, circulation inside classrooms |
| Wayfinding Systems | Signage visibility and spatial orientation |
| Sensory Accessibility | Lighting conditions, tactile elements, acoustic clarity |

The evaluation framework allowed the identification of architectural elements that either support or limit accessibility within the school environment.

## 2.4. ACCESSIBILITY ASSESSMENT FRAMEWORK

In addition to physical accessibility, the research examined sensory aspects of spatial navigation within the school environment. Students with visual or cognitive impairments often rely on multisensory cues such as tactile surfaces, acoustic reflections, lighting contrasts, and spatial textures to orient themselves within architectural spaces (Passini, 1992). However, the field observations revealed that the existing school environment lacks effective sensory navigation systems. Tactile floor guidance systems, high-contrast visual markers, and acoustic orientation cues are not currently integrated into the building design. The absence of these elements can create difficulties for users who rely on sensory feedback to navigate complex environments. To explore potential strategies for improving sensory accessibility, the study analyzed international examples of inclusive educational architecture. One notable example is Hazelwood School in Glasgow, Scotland, which integrates tactile walls, acoustic treatments, and natural lighting to support spatial orientation for students with sensory impairments.

Figure 5. Sensory navigation corridor in Hazelwood School.

Similarly, the SEALAB School for the Blind in India demonstrates how architectural design can support navigation through multisensory spatial cues. Variations in floor textures, spatial acoustics, and lighting conditions help users recognize different areas of the building environment.

Figure 6. Multisensory corridor design in SEALAB School.

These examples illustrate how multisensory architectural strategies can significantly enhance accessibility and spatial orientation in educational facilities.

## 3. RESULTS AND DISCUSSION

The accessibility assessment revealed several architectural barriers affecting the usability of the school environment. The most significant limitations were identified in circulation systems, entrance accessibility, and spatial navigation. Vertical circulation elements represent one of the primary accessibility challenges within the building. Staircases without accessible alternatives restrict movement for users with mobility impairments and limit independent access to upper floors. Horizontal circulation spaces also influence spatial navigation within the school. Corridor widths and lighting conditions affect both visibility and movement, particularly for users with visual impairments. Another important issue identified during the assessment is the absence of effective wayfinding systems. Clear signage, tactile indicators, and visual contrasts are essential for enabling intuitive navigation within educational environments (Passini, 1992). Table 2 summarizes the key accessibility challenges identified during the analysis.

Table 2. Summary of accessibility challenges in PLM School

| Accessibility Element | Observed Condition | Impact on Users |
|---|---|---|
| Entrances | Limited ramp accessibility | Difficult entry for wheelchair users |
| Vertical Circulation | Stairs without alternatives | Restricted access to upper floors |
| Corridors | Limited navigation cues | Difficult spatial orientation |
| Classroom Doors | Limited maneuvering space | Reduced accessibility |
| Wayfinding Systems | Lack of signage and tactile guidance | Navigation challenges |

The comparative analysis with international case studies demonstrates that inclusive architectural design can significantly improve spatial accessibility. Multisensory navigation systems, such as tactile walls and textured floor pathways, provide intuitive guidance and reduce dependence on external assistance.

## 4. DESIGN PROPOSAL

Based on the findings of the spatial analysis and accessibility assessment, a design proposal was developed to improve accessibility within PLM School. The proposed design interventions focus on improving circulation accessibility, introducing tactile navigation systems, and creating sensory-friendly learning environments. One of the primary design strategies involves the implementation of tactile navigation systems within the building. Tactile floor guidance paths are designed to connect key functional areas such as entrances, classrooms, and administrative spaces, allowing users to navigate the building through sensory cues and spatial orientation. As illustrated in Figure 7, the proposed tactile floor system creates a continuous guidance path along the main circulation corridor on both floors of the school building, linking classrooms and shared facilities.

Figure 7. Proposed tactile floor guidance system in PLM School (Author).

In addition to tactile floor guidance, sensory wall panels are proposed along the main circulation routes to support tactile orientation and spatial recognition. These panels incorporate different textures and patterns that allow users to identify spatial zones through touch. As shown in Figure 8, each texture pattern corresponds to a specific destination or function within the building, such as classrooms, offices, restrooms, stairs, elevators, and communal areas such as the canteen. The variation of tactile patterns helps visually impaired users recognize spatial transitions and directions through physical interaction with the wall surfaces.

Figure 8. Proposed sensory wall panel system (Author).

These interventions aim to create a multisensory learning environment that enhances accessibility, spatial awareness, and independence for students with disabilities.

## 5. CONCLUSION

This study highlights the importance of accessibility in educational architecture and identifies several challenges related to the existing infrastructure of Albanian schools. The case study of PLM School in Durrës demonstrates that many educational facilities still lack adequate architectural adaptations for inclusive learning environments. The findings emphasize that accessibility should be considered a fundamental design principle rather than an additional architectural feature. Inclusive school environments must integrate both physical accessibility and multisensory navigation systems to support the needs of diverse users. The proposed design strategies demonstrate how universal design principles can be applied to improve accessibility within existing school buildings. By implementing tactile navigation systems, improving circulation accessibility, and integrating sensory design elements, educational environments can become

more inclusive and supportive for all students. Future school development projects in Albania should prioritize accessibility and universal design principles from the early stages of architectural planning in order to create equitable and inclusive educational environments.

## REFERENCES

ADRA Albania. 2019. Accessibility Assessment of Albanian Schools. Tirana, Albania.

Architizer. 2024. Hazelwood School / Alan Dunlop Architects. Available at: https://architizer.com (accessed March 2026).

International Organization for Standardization (ISO). 2011. ISO 21542: Building Construction – Accessibility and Usability of the Built Environment. Geneva: ISO.

Mace, R. 1998. Universal Design in Housing. Raleigh: Center for Universal Design, North Carolina State University.

Passini, R. 1992. Wayfinding in Architecture. New York: Van Nostrand Reinhold.

Preiser, W. F. E., Ostroff, E. 2001. Universal Design Handbook. New York: McGraw-Hill.

Save the Children. 2012. Accessibility of School Infrastructure in Albania. Tirana: Save the Children Albania.

Springer, T. 2011. Inclusive Design in Educational Architecture: Designing Schools for Students with Disabilities. Journal of Accessibility and Design for All, 1(1), pp. 45–60.

Steinfeld, E., Maisel, J. 2012. Universal Design: Creating Inclusive Environments. Hoboken: John Wiley & Sons.

United Nations. 2006. Convention on the Rights of Persons with Disabilities. New York: United Nations.

World Bank. 2019. Inclusive Education and Infrastructure: Improving Accessibility in Schools. Washington DC: World Bank.

Ministry of Education and Sports of Albania. 2017. Decision No. 319: School Design Standards. Tirana, Albania.

# DIGITAL & TECHNOLOGY

# INTEGRATING BIM AND IMMERSIVE VR FOR VERNACULAR HERITAGE DOCUMENTATION AND CONSERVATION IN ALBANIA

**Nikolla Vesho, Skervi Baushi, Ilda Rusi, Ardis Duka, Panagiotis Kyratsis, Klodjan Xhexhi**
Department of Architecture and Engineering, Faculty of Architecture and Design, POLIS University, Tirana, Albania
Regional Directorate of Cultural Heritage Gjirokaster, Albania
Department of Product and Systems Design Engineering, University of Western Macedonia, Kozani, Greece
*nikolla.vesho@unife.it; skervi_baushi@universitetipolis.edu.al; ilda_rusi@universitetipolis.edu.al; dukardis@gmail.com; pkyratsis@uowm.gr; klodjan_xhexhi@universitetipolis.edu.al*

## ABSTRACT

The sustainable preservation of vernacular cultural heritage requires methodologies that transcend conventional documentation, integrating advanced digital technologies with conservation practice. This study advances a hybrid framework that combines Building Information Modeling (BIM) with immersive Virtual Reality (VR) to document, analyze, and visualize cultural heritage objects from the Gjirokastër region of Albania. The approach moves beyond static representations by producing parametric BIM models that embed geometric precision, material characterization, and historical data, subsequently transformed into dynamic VR simulations through Twinmotion and Oculus platforms. This workflow enables immersive exploration of heritage assets across multiple states existing conditions, restoration interventions, and adaptive reuse strategies thereby supporting conservation planning, participatory decision-making, and public dissemination of heritage values. By bridging empirical survey data with interactive digital environments, the methodology enhances both the technical rigor of heritage documentation and the experiential understanding of architectural authenticity. To ensure reproducibility, the workflow integrates precise technical parameters: geometry simplification and scale unification in Revit, Rhino, and SketchUp; mesh cleaning commands such as Reduce-Mesh and Merge-All-Faces; optimized families and component management to minimize polygons; standardized texture resolutions of 2K (4K only for focal elements); and Twinmotion import settings with Triangulate Meshes, Weld Vertices, and Keep Hierarchy enabled. VR packages were optimized to 1-2 GB to guarantee smooth performance on Oculus Quest 2. The findings underscore the replicability and scalability of integrating BIM and VR in heritage contexts, offering a methodological contribution that strengthens accuracy, stakeholder engagement, and the sustainability of preservation strategies. This research highlights Albania as a critical case for demonstrating how immersive

computational workflows can complement traditional restoration practices while setting a precedent for broader applications in global heritage conservation.

KEYWORDS: Build Heritage; Vernacular Architecture; Hbim; Virtual Reality; Immersive Simulation; Digital Documentation; Restoration; Computational Design Tools

## 1. INTRODUCTION

The sustainable preservation of cultural heritage has become a global imperative, reinforced by contemporary conservation policies and digital transformation strategies. In recent years, digital technologies have reshaped methods for architectural documentation, analysis, and conservation, enabling a shift from static recording to dynamic and data-rich interpretation of heritage assets. Within the European context, integrated workflows combining Historic Building Information Modeling (HBIM), and immersive environments such as Virtual Reality (VR) and Augmented Reality (AR) have demonstrated significant potential to advance heritage documentation accuracy, structural diagnostics, conservation planning, and public accessibility [14]. These computational environments go beyond visualization: they enable parametric analysis, multi-scenario simulations, and digital storytelling, thus transforming heritage from passive artifact to interactive knowledge system.

Figure 1. (a) Zekate House photo during the 2024 Restoration Camp site-work. (b) Aerial photograph of Minguli Church, captured in 2023 using a DJI Mavic drone during photogrammetric scanning for 3D modeling purposes.

In contrast, the Albanian context remains in the early stages of adopting such methodologies. Despite possessing one of the richest tangible heritage landscapes in Southeast Europe, the implementation of digital documentation and immersive simulation techniques in Albania is fragmented and lacks methodological integration [1]. Traditional architectural survey practices continue to dominate conservation workflows, while HBIM-based environments and immersive VR experiences now standard in many European restoration laboratories are rarely implemented [15, 16]. This gap highlights the urgent need for methodological transfer from European research practice to Albania, not only to safeguard cultural assets but also to align national heritage research with international standards of innovation and scientific reproducibility. This need is particularly evident in the vernacular architecture of Gjirokastër, a UNESCO World Heritage city where layered construction systems, complex spatial morphologies, and richly ornamented interiors challenge conventional documentation techniques. Pressures from uncontrolled urban development, mass tourism, seismic vulnerability, and climatic degradation intensify the urgency for advanced tools that ensure measurable, traceable, and reversible interventions [2, 4]. Static drawings and photographic surveys are insufficient to capture the architectural materiality and spatial identity of historic structures, which require dynamic, multi-perspective analysis environments.

Figure 2. Refined immersive learning framework highlighting heritage-oriented technologies, key benefits, user experience metrics, and compliance with international guidelines (adapted from Source [18]).

Responding to these challenges, this study develops a hybrid HBIM-VR workflow designed for heritage environments with complex geometries and stratified architectural systems. The workflow integrates empirical 3D survey data with parametric modeling and immersive simulation, creating a bridge between

architectural research, conservation practice, and digital humanities. Extended Reality (XR) principles are employed to enhance perceptual understanding and cultural interpretation, offering interactive multimodal pathways for both expert users and public audiences (Fig. 2) [18]. The workflow is tested through two case studies in Gjirokastër: the Zekate House, an iconic Category-1 monument (Fig. 1a), and the Minguli Church (Fig. 1b), selected respectively for their typological significance and geometric complexity. A reproducible HBIM-VR pipeline was established, supported by a protocol for geometric simplification, polygon reduction, semantic metadata organization, and Twinmotion export optimization for Oculus Quest environments (Fig. 4) [18]. Implemented through an academic workshop, the methodology demonstrates its applicability for research, conservation planning, interactive education, and immersive heritage dissemination (Fig. 2) [18]. The study not only contributes to advancing digital heritage practice in Albania but also opens new pathways for VR-based conservation analysis, heritage tourism, and cultural communication [15-18].

## 2. METHODOLOGY

This study establishes a comprehensive digital workflow integrating on-site surveys, HBIM modeling, and VR simulation to achieve high-fidelity documentation, parametric analysis, and immersive visualization of vernacular and religious heritage in Gjirokastër. Field surveys recorded precise geometric, material, and pathological data for each architectural component, extending to fine-scale details to ensure that parametric models reflect the sites' actual condition. Empirical measurements were complemented with archival sources and outcomes from previous restoration camps, forming a robust evidential basis for modeling [7, 10, 12]. HBIM modeling was conducted in Revit, Rhino, and SketchUp, where every architectural element was reconstructed through dedicated families, material assignments, and texture mapping. Each component was enriched with semantic metadata describing material characteristics, pathologies, and historical interventions [6, 11]. This dual logic combining bottom-up empirical acquisition with top-down interpretative hypotheses [14] ensures methodological transparency and traceability throughout the modeling process. The resulting models were optimized for Twinmotion (Fig. 6), maintaining geometric precision and numerical fidelity while addressing performance challenges caused by large datasets both the Zekate House and Minguli Church models exceed 200 MB.

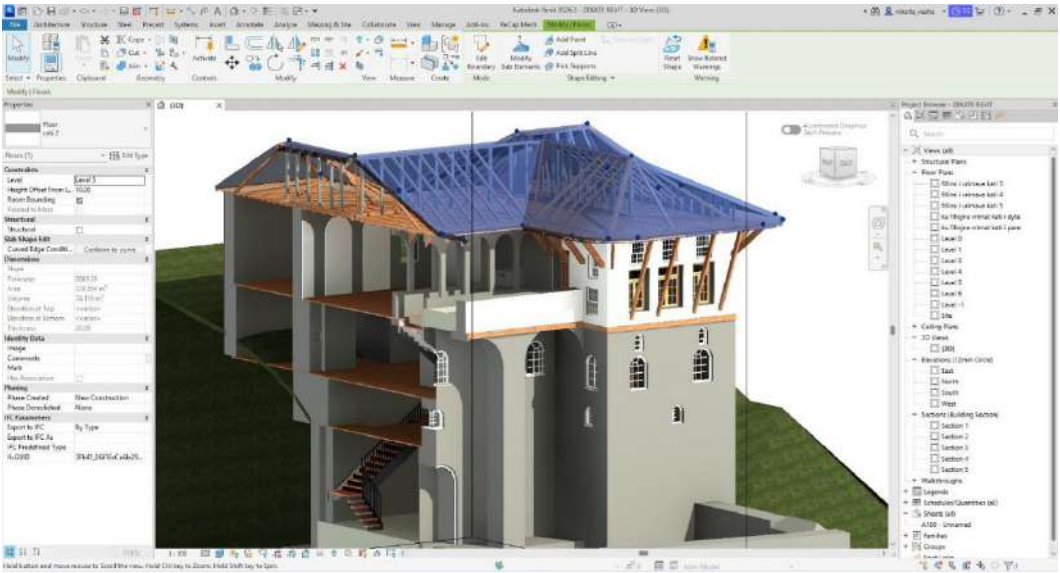


Figure 3. Application of a partial axonometric section using the BIM Section Box tool in Revit to visualize internal spatial and structural relationships.

Building upon techniques proposed by Chen et al. [17], the workflow integrates advanced 3D modeling, texture style transfer, and immersive audiovisual features to maximize realism. Material textures were refined to reproduce authentic finishes, while ambient soundscapes enhanced perceptual immersion in VR (Fig. 7). To ensure reproducibility and international interoperability [14, 18], a structured HBIM-VR protocol was followed: (i) geometry simplification removed sub-millimetric details imperceptible at architectural scale; (ii) modular classification grouped elements by material category (interior/exterior walls, partitions, ceilings, floors, windows, and structural members); (iii) layering and naming conventions ensured semantic clarity; (iv) scale normalization guaranteed real-world dimensional consistency; and (v) mesh optimization via Rhino commands (ReduceMesh, MergeAllFaces) balanced polygon density and visual fidelity. Optimized Revit families replaced overly complex objects, and SketchUp components were carefully curated to avoid redundancy. Exports to Twinmotion used .fbx or .datasmith formats with Triangulate Meshes, Weld Vertices, and Keep Hierarchy enabled. Scene optimization targeted 1-2 GB file sizes, with 2K textures as default and 4K reserved for focal elements such as murals in Minguli Church. Level of Detail (LOD) strategies prioritized high-detail rendering for foreground objects and simplified geometry for backgrounds.

VR integration began with the transfer of HBIM models to Twinmotion for interactive navigation, walkthroughs, and environmental simulation [19]. Models were subsequently linked to Oculus Quest 2 systems (display 1832×1920 px per eye, 90 Hz, Snapdragon XR2, 6 GB RAM, 6 DOF tracking). These hardware parameters informed optimization, particularly file size, foliage density, and texture resolution to sustain fluid frame rates. For extended interactivity, the workflow advanced to Unreal Engine 5 (UE5), which interfaces natively with Twinmotion (Fig. 4). Using Blueprint scripting, the VR environment incorporated

teleport locomotion (NavMeshBoundsVolume), line-trace interaction systems, and widget-based interfaces for material selection and floorplan visualization. Additional refinement employed Cinematic Cameras and Post-Processing Volumes to control exposure, bloom, and tone mapping, achieving photorealistic perceptual balance. The final applications were compiled via the Windows → Shipping Build pipeline, optimized for VR deployment. UE5's Nanite and Lumen technologies enabled real-time rendering with superior polygon management, extending scalability toward urban-scale heritage simulations (Fig. 4a–4b).

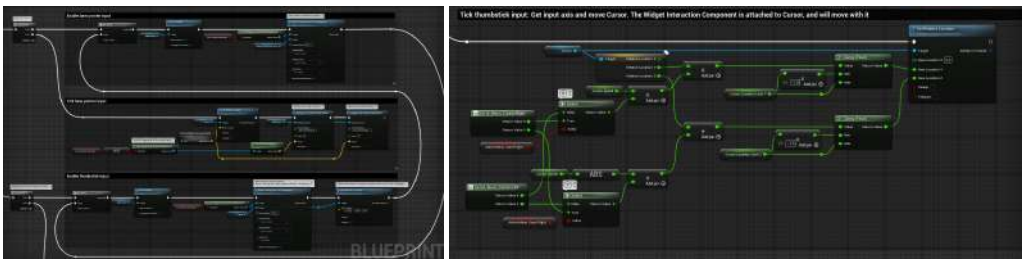


Figure 4. Final steps of menu implementation in Unreal Engine 5.3 integrates Oculus interaction: (a) laser pointer for precise user control, (b) thumbstick navigation for intuitive, fluid virtual exploration.

Two case studies the Zekate House and Minguli Church demonstrate this methodology, each posing distinct challenges of volumetric complexity, material articulation, and geometric irregularity [4]. The workflow follows the tripartite logic of documentation, analysis, and simulation proposed by Pietroni & Ferdani [14]: (i) Documentation: high-precision survey of geometry, materials, and pathologies; (ii) Analysis: HBIM modeling enriched with semantic metadata and enhanced textures; (iii) Simulation: immersive visualization in Twinmotion and Oculus for interpretative testing and conservation assessment.

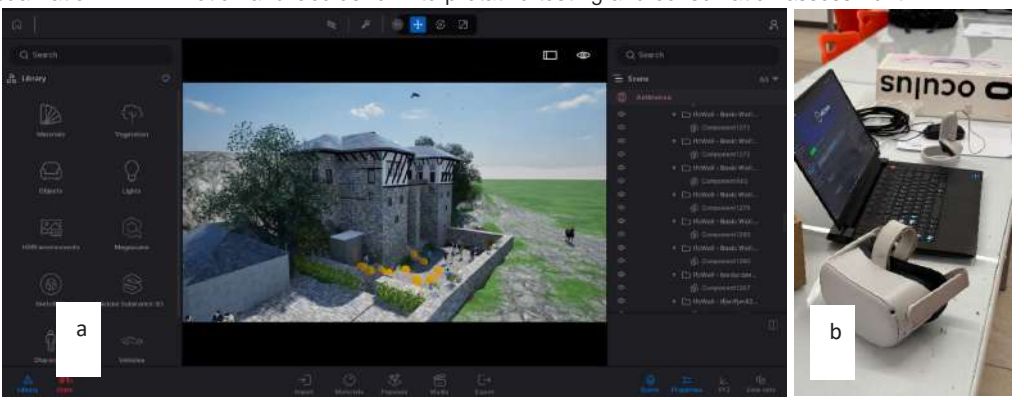



Figure 5. (a) Interactive 3D modeling in TwinMotion for VR. (b) Oculus integration enabling fully immersive user interaction.

By merging HBIM accuracy with interactive VR environments and applying reproducible optimization from mesh reduction to Oculus-based performance benchmarks the methodology elevates Albanian heritage documentation to international scientific standards. It establishes a replicable, transparent, and interdisciplinary framework linking architecture, conservation science, and computational technologies, advancing both analytical rigor and experiential understanding (Fig. 5) [17-19].

## 3. CASE STUDY: CASE STUDY: HBIM–VR DOCUMENTATION OF VERNACULAR AND RELIGIOUS HERITAGE IN GJIROKASTËR

Gjirokastër represents one of the most authentic ensembles of Balkan vernacular heritage. Its urban fabric, composed of fortified stone tower houses (kullë), steep cobbled streets, and post-Byzantine religious monuments, reflects a synthesis of Ottoman domestic traditions, local material logic, and adaptive construction practices suited to steep topography (Fig. 1). These monuments embody both defensive and residential functions: massive stone walls, slate roofs, and timber-frame çatmas ensure structural resilience, while carved interiors, stained glass, and panoramic verandas reveal social hierarchy and aesthetic sophistication (Fig. 3, 6) [2-4]. Yet, this architectural fabric remains fragile, threatened by structural decay, urban pressure, and the lack of systematic digital documentation.

Two monuments exemplify this challenge: the Zekate House and the Minguli Church (Monastery of the Transfiguration). The Zekate House (1811), located in the Palorto neighborhood, stands as one of the city's most distinguished kullë-houses, protected as a Category-I monument. Its tripartite organization expresses the logic of fortified domestic typology vaulted storage and cisterns at the base, compact winter rooms on the second floor, and the ceremonial oda e burrave crowning the third. The richly decorated main oda features carved fireplaces, painted ceilings, stained-glass windows, and intricate timber cupboards (musandra), culminating in the çardak veranda that dominates the valley view (Fig. 1a). The Minguli Church, inscribed as a cultural monument in 1973, exemplifies 18th-century post-Byzantine ecclesiastical architecture with a basilica plan, dome supported by four arches, and stone column capitals (Fig. 1b). Its irregular pumice-stone masonry and multi-phase evolution four distinct construction periods from nave to western annex make it particularly suited for stratigraphic reconstruction analysis [5]. Both monuments were documented through dense photogrammetric surveys exceeding 15 million points per model. The point clouds were processed via Recap and imported as IFC files into Revit and Rhino, where each architectural family stone masonry, timber çatma, vaults, domes, and columns were reconstructed with precise geometry, material attributes, and metadata on pathologies such as cracking, dampness, and mortar loss. These annotations connected visual deterioration with conservation records, forming a digital backbone for structural and material analysis. BIM models thus served not merely as geometric repositories but as integrated interpretative systems testing the adaptability of the workflow to contrasting typologies: the complex volumetry of a fortified house and the layered construction logic of a basilica (Fig. 6, 7).

Model optimization followed the methodology outlined previously: polygon reduction, modular exports, and texture calibration tailored to each monument. In the Zekate House, high-detail interiors and furnishings were simplified through optimized Revit families (Fig. 6), while in Minguli Church, high-resolution textures

(selectively 4K) were reserved for mural fragments and dome surfaces, with secondary elements standardized at 2K to balance fidelity and performance. File sizes were reduced from over 200 MB to approximately 120-140 MB per model without perceptible loss of accuracy. Cross-referencing in SketchUp (Fig. 6b, 6c) further refined interior detailing and artistic features, linking BIM precision with visual richness.

Semantic metadata were embedded directly into BIM families, allowing the preservation of interpretative knowledge and provenance during VR translation [1, 6]. This enabled users in immersive environments to toggle layers revealing Minguli Church's phased construction or Zekate House's structural pathologies, merging evidential documentation with cognitive interpretation.

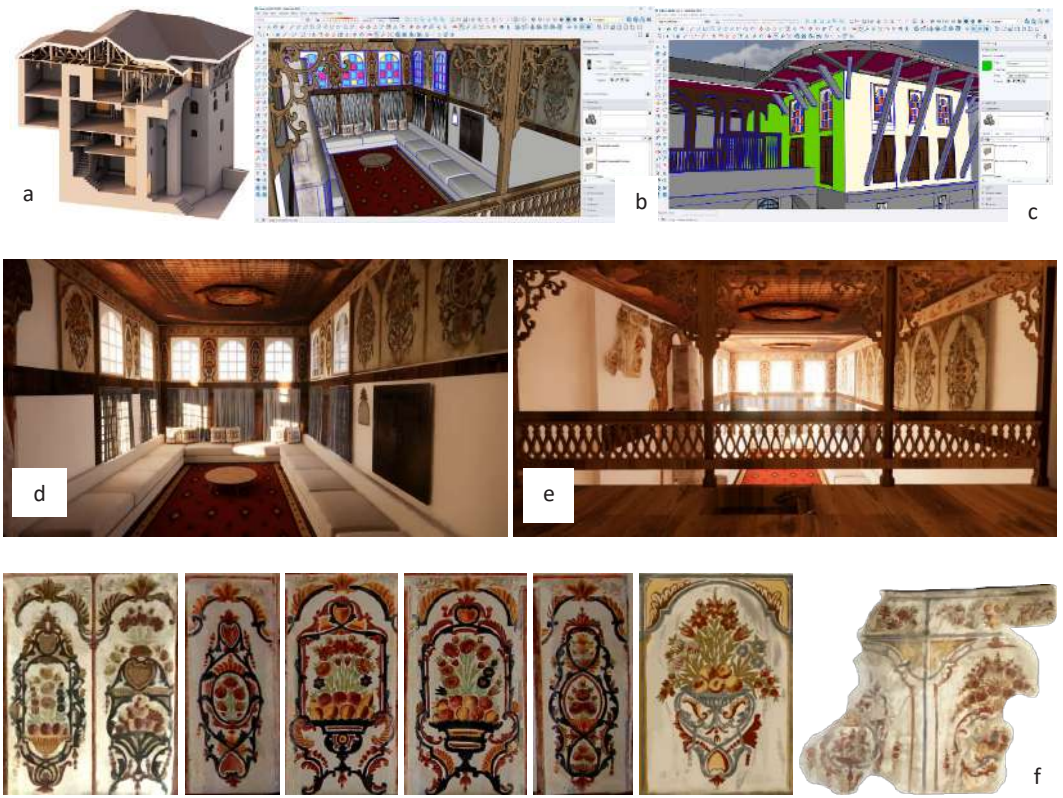



Figure 6. (a) Axonometric BIM model of Zekate House in Revit, sectioned to reveal structural and spatial composition. (b) Integrated SketchUp extracts detailing Oda e Burrave features. (c) Façade view highlighting çatma walls, testeke elements, and double windows. (d) Interactive 3D model of the men's room in TwinMotion. (e) Immersive VR perspective from the musandra level. (f) Digitized murals and artifacts integrated into the TwinMotion model for advanced heritage visualization.

In Twinmotion, both models were enriched with calibrated lighting, photorealistic textures, and navigable pathways, allowing exploration of courtyards and key interiors such as the oda e burrave and the church nave (Fig. 6, 7b). Integration with Oculus Quest 2 systems provided immersive simulation (Fig. 7), while optimization targeted stable performance: files below 1.6 GB, 90 Hz refresh rates, and polygon counts within Oculus hardware thresholds. To achieve this, the Zekate model was divided into interior and exterior sets, while the Minguli Church remained a unified model due to simpler geometry. Foliage density and dynamic lighting were minimized to ensure fluid interaction. Following Pietroni & Ferdani [14], the VR models differentiated between virtual restoration (representation of current, pathologically accurate conditions) and virtual reconstruction (hypothetical restitution of lost features). Color-coded certainty levels and metadata layers preserved transparency and methodological integrity [18]. Guided and free navigation modes were designed according to VR usability research, incorporating interactive “hotspots” that linked spatial navigation with historical and material data. In the Zekate House, these emphasized spatial hierarchy the oda e burrave as a ceremonial nucleus (Fig. 7a) while in Minguli Church they illuminated liturgical organization and construction stratigraphy. Experimental soundscapes were introduced to enhance immersion and presence, aligning with recent VR heritage frameworks [19].

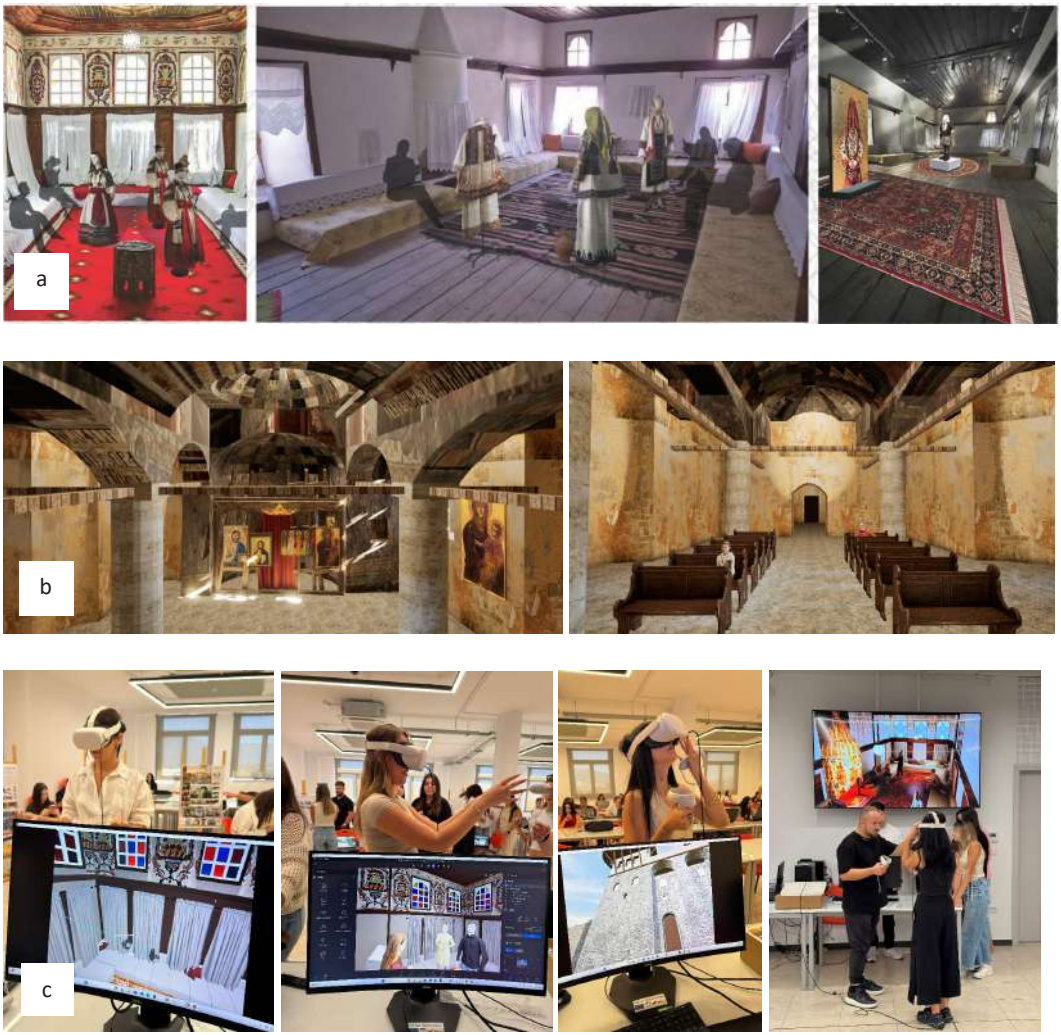



Figure 7. (a) TwinMotion-Oculus integration enabling immersive VR rendering and spatial exploration. (b) Selected VR views inside the Minguli Church. (c) In-class Oculus simulations linked to TwinMotion models, offering virtual tours of the Zekate House, including the Oda e Burrave and exterior walkthroughs.

Two experiential configurations were implemented: (i) Expert Mode, designed for conservationists, allowing analysis of structure, material decay, and phase logic (Fig. 4); (ii) Public Mode, oriented toward cultural narration and guided heritage appreciation (Fig. 6, 7). Both modes were underpinned by metadata-driven annotation tools and certainty layers to ensure interpretative clarity and compliance with international digital heritage guidelines [14, 17]. These case studies demonstrate the methodological robustness of

coupling high-resolution HBIM modeling with immersive VR for Albanian heritage. The approach transcends conventional documentation by integrating interpretative logic, cognitive engagement, and educational potential [13, 14]. As shown in user feedback, immersive environments enhanced spatial understanding, memory retention, and emotional connection, underlining the pedagogical and cultural value of VR [20]. While performance constraints posed challenges, the optimization strategies mesh reduction, modular exports, and standardized textures ensured seamless navigation without compromising realism (Fig. 6) [19]. Ultimately, these applications reposition Gjirokastër's monuments from static artifacts into interactive heritage experiences, preserving material authenticity while opening new frontiers in conservation research, analysis, and dissemination.

## 4. CONCLUSION

This research demonstrates the effectiveness of integrating Heritage Building Information Modeling (HBIM) and immersive Virtual Reality (VR) as a unified methodology for the documentation, interpretation, and dissemination of Albanian vernacular heritage. Through the case studies of the Zekate House and the Minguli Church in Gjirokastër, the study confirmed that combining dense photogrammetric surveys, parametric BIM reconstruction, and interactive VR simulations can surpass traditional heritage recording in both technical accuracy and cognitive engagement. The HBIM models achieved high geometric and material fidelity, embedding metadata on construction techniques, material typologies, and deterioration patterns directly within the parametric structure. When transferred to VR, these data enabled dynamic visualization of spatial hierarchies, structural relationships, and conservation scenarios, transforming static documentation into interactive analytical tools (Fig. 6, 7). By distinguishing between virtual restoration (evidence-based conditions) and virtual reconstruction (hypothetical restitution), the workflow ensured interpretative transparency, maintaining a clear boundary between factual documentation and scholarly hypothesis.

A critical outcome of this research is the establishment of a replicable and scalable HBIM–VR framework that bridges architectural documentation, digital conservation, and public communication. Technical optimization including polygon reduction, modular exports, and texture calibration (2K/4K) proved essential for achieving stable VR performance on Oculus Quest 2 systems (90 Hz refresh, 6 GB RAM), illustrating how computational efficiency can coexist with authenticity (Fig. 5, 7). Beyond technical innovation, the methodology contributes to modernizing conservation practice in the Albanian context, aligning it with European digital heritage standards while promoting participatory engagement. Workshops and immersive demonstrations confirmed that VR enhances spatial comprehension, cultural awareness, and retention, thus validating its pedagogical and communicative potential in restoration education and heritage interpretation.

Looking forward, future research should focus on expanding the framework toward large-scale urban simulations, leveraging AI-driven recognition, LiDAR/UAV integration, and cloud-based VR streaming to overcome hardware constraints. Such advancements would enable multi-user, real-time heritage experiences at the scale of neighborhoods and cultural landscapes. Ultimately, this study positions the HBIM-

VR hybrid as both a technical system and a cultural bridge a reproducible, evidence-driven workflow that preserves architectural authenticity, supports data-informed conservation, and fosters inclusive access to heritage knowledge. By transforming heritage documentation into an interactive and participatory process, it contributes to the broader goal of sustainable cultural preservation and the democratization of architectural heritage in Albania and beyond.

## REFERENCES

[1] C. &. M. M. Dore, "Current state of the art Historic Building Information Modelling (HBIM)," International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII-2/W5, p. 185–192, 2017.

[2] F. V. Frosina Londo, "Cultural/Heritage Tourism Strategic Planning in Albania. Analysing Berat, as a World Heritage Patrimony, Protected by UNESCO," Oeconomica, vol. 10, no. 2, pp. 129-138, 2014.

[3] A. Georgopoulos and C. Ioannidis, "Photogrammetric and Surveying Methods for the Geometric Recording," Workshop Book - Archaeological Surveys | WSA1 – Recording Methods , 22-27 May 2004.

[4] R. H. Jackson, "Gjirokastra: A City on Stone," OMB Series, Tirana, 2021.

[5] Konstantinos Andriotis, "Sacred site experience: A Phenomenological Study," Annals of Tourism Research, vol. 36, no. 1, pp. 64-84, 2009.

[6] I. Lavric, V.-E. Oniga, A.-M. Loghin, G. Covatariu and G.-C. Maleș, "Evaluating BIM and Mesh-Based 3D Modeling Approaches for Architectural Heritage: The Dosoftei House in Iași City, Romania," Applied Sciences, vol. 15, no. 17, 2025.

[7] E. Mamani and K. Merxhani, "Construction Materials In Historical And Monumental Buildings - Gjirokaster," in Cultural Heritage without Borders (CHwB), Tirane, 2012.

[8] F. Petzold and D. Donath, "Digital Building surveying and Planning in existing Building," in 1st ASCAAD International Conference, e-Design in Architecture KFUPM, Dhahran, Saudi Arabia, 2004.

[9] Unesco, "Gjirokastra historic town – World Heritage Centre documentation," United Nations Educational, Scientific and Cultural Organization, 2005.

[10] N. Vesho and B. Nika, "Analysis on the technology and structure of Vernacular Architecture. The case of Gjirokastra through site works and BIM," in Cultural Heritage- Based Sustainable Tourism Approaches | SPRINGER Series ISSN: 2522-8714, Perugia, 2025.

[11] N. Vesho, M. Guri and A. Sava, "The use of numerical models within the BIM environment, for the issue of Cultural heritage restoration. Buildings designed until 1940 in Albania," Architecture, Structures and Construction SPRINGER Journal. Vol.4, p. 37–53, 2021.

[12] N. Vesho and B. Nika, "Vernacular architecture and the state of cultural heritage in Gjirokastra through restoration camps. Analysis and Technology application," in 6th International Conference on Innovative Academic Studies, Volume: 6, ISBN 978-625-5900-01-2, Konya, Turkey, 2025.

[13] Y. Zhang and J. Deng, "Application of Mobile LiDAR in Heritage BIM Modeling," Journal of Cultural Heritage Management and Sustainable Development, 2023.

[14] E. Pietroni and D. Ferdani, “Virtual Restoration and Virtual Reconstruction in Cultural Heritage: Terminology, Methodologies, Visual Representation Techniques and Cognitive Models,” Information MDPI, vol. 12, no. 167, 2021.

[15] A. B. Y. S. X. L. Lei Jin, “The VR Technology-Based Image Restoration of Manchu Traditional Lifestyle and Culture,” Digital Applications in Archaeology and Cultural Heritage, 2025.

[16] H. J. Abukarki, “Beyond Preservation: A Survey of the Role of Virtual Reality in Experiencing and Understanding Historical Architectural Spaces,” Buildings MDPI, vol. 15, no. 9, p. 1531, 2025.

[17] Y. T. Y. W. Guanlin Chen, “Reconstruction of Cultural Heritage in Virtual Space Following Disasters,” Buildings MDPI, vol. 15, no. 12, p. 2040, 2025.

[18] M. Y. J. F. J. e. a. Anwar, “Metaverse and XR for cultural heritage education: applications, standards, architecture, and technological insights for enhanced immersive experience,” Virtual Reality, Springer, vol. 29, no. 51, 2025.

[19] V. C. N. B. S. B. Vishwas Paikra, “Exploring Cultural Heritage in VR: An Interactive Tour of the Majuli,” ACM J. Computational Cultural Heritage, https://doi.org/10.1145/3769073, vol. 9, pp. 1556-4711, 2025.

[20] P. K. A. G. L. H. S. C. M. G. A. D. R. M. N. Vesho, “Integrated Technical Assessment and Restoration Strategy for the Topulli House. Revitalization Pathways and Advanced Digital Technologies,” in Conference: International Conference, Digital Competencies in Higher Education 2025 by EU. (ISBN): 978 9928482969, Tirana, 2025.

# MAR AS A BRIDGE BETWEEN HISTORICAL NARRATIVES AND ARCHITECTURAL SPACES

R. Prageeth Amarasinghe, Nieto Fernandez F, M Thibault
Tampere University
Finland
*ruchira.karunapedidurayalage@tuni.fi; fernando.nieto@tuni.fi; mattia.thibault@tuni.fi*

## ABSTRACT

Architectural visualisation is important as it defines how people experience the built and natural environment through their visual senses. Over time, it has evolved from traditional 2D line drawings to computer-generated 3D models and virtual reality environments [5]. Among emerging technologies, augmented reality (AR) has proven to be an effective tool for making architectural visualisations more immersive and experiential. AR seamlessly integrates visual, auditory, and haptic elements into the real world, enabling users to interactively explore architectural spaces and historical narratives in real-time. This research investigates the transformative potential of augmented reality (AR) in preserving and interpreting architectural heritage, focusing on the events in the Finnish Civil War around Näsilinna Castle. Various AR tools exist, including headsets, glasses, and mobile devices, but mobile AR was chosen as a low-threshold, accessible solution for enhancing public engagement with cultural heritage. The mobile AR application developed in this study allows users to virtually explore historical artefacts and the castle's wartime architecture, overlaying augmented models onto real-world environments. This interactive approach deepens user engagement with historical narratives, enabling them to manipulate artefacts and architectural elements without compromising the safety of physical artefacts preserved in museums. By integrating multiple historical perspectives and architectural narratives, this AR application offers a new way to interact with heritage, shifting users from passive observers to active participants. Unlike traditional heritage preservation methods, AR enables users to experience historical transformations firsthand. Given the innovative and evolving nature of this research, the "Research through Design" (RtD) methodology was adopted, allowing for iterative testing and refinement to generate new insights. Lastly, this study contributes to exploring the role of augmented reality in architectural heritage preservation, highlighting its potential to explore another perspective on how we engage with and interpret spaces.

KEYWORDS: Architectural Heritage Preservation, Augmented Reality (AR), Research Through Design (Rtd).

## 1. INTRODUCTION

The built environment has been one of the main anthropic spaces for at least ten thousands years. It is a multilayered environment, where new layers of architectural constructions are added to existing ones, creating spaces, like cities, where elements from different historical eras coexist and are in constant semantic dialogue with each other. To the many historical physical layers existing in urban spaces, technological development has added a series of digital ones, that range from digital, mapping, and smart city technologies [17, 22] to Extended Reality Technologies (XR). The compresence of these different layers opens up to many potential interactions between them, in terms of integration of digital content in the urban fabric, recreation of architectural elements in digital form, visualisation of urban development projects in real time and much more. Despite the many possibilities, the main forms of integration that seem to take place vary according to the temporal direction. On the one hand, most projects that look at the past tend to focus on preserving architectural heritage by recreating it in digital form, and allowing visitors to access it in digital spaces often in Virtual Reality (VR)[20]. On the other hand, many projects that look towards the future of urban spaces make use of AR to help architects and communities to visualise future buildings or spaces in their contexts as overlays that are added to the current landscapes.

In this paper, instead, we wish to explore the connections between AR technologies and historical narratives and architectural spaces. In particular, we want to explore the possible use of Mobile AR (MAR) to act as a bridge between architectural spaces that hold connections and traces of historical events and the historiographical narration of the events themselves. In other words, we want to investigate how MAR can amplify such traces, visualise other historical elements, and guide users in experiencing and learning historical events. This exploratory research effort is connected with and influenced by the Anonymous project, which investigates the potential of XR in the creative industries by focusing on low-threshold technologies and strong connections between real and digital spaces.

To guide us in our exploration, rather than a specific research question, we have chosen to adopt a research through design approach by designing a MAR application dedicated to a specific historical event (the Battle of Tampere in the 1918 Finnish Civil War) and location (the Näsinlinna castle and the surrounding hill) , in close collaboration with the historians and curators of the Museum Center Vapriikki, which holds the historical artefacts and academic knowledge related to the event.

## 2. LITERATURE REVIEW

The role of XR and of both VR and AR specifically has been widely researched when it comes to architectural heritage. AR applications in cultural heritage touch various domains, including 3D reconstruction of artefacts, creation of virtual museums, gamification, education, and tourism [3]. Recent research highlights the potential of AR, especially in heritage preservation efforts, as well as to increase public understanding of historical sites [24]. In terms of preservation efforts, the ability to view 3-dimensional objects with realistic textures and materials in AR can be used to recreate heritage sites. While this is more common in digital spaces and VR [1], and is understood as a way to preserve architectural elements in a

virtual form, AR allows for the visualisation of the historical appearance of sites in their context, by superimposing digital reconstructions of lost or damaged architectural components onto current structures [12]. In terms of public understanding, existing research emphasises the informative benefits of enabling users to interact with historical contexts through AR and enhancing their engagement ([24], [10]). Users can comprehend the historical and contemporary value of heritage sites most sensibly by experiencing how architecture changes throughout time. Many studies that investigate the application of augmented reality (AR) for historical heritage focus on museum contexts or controlled indoor environments, such as reconstructions of artefacts, information layers, or manipulative elements like textures, details and materials to improve overall museum experiences and public engagement with historical content [14]. Outdoor spaces, however, while more challenging, host many historical architectural elements, and there is a strong potential for improvement in the use of AR in these environments [19]. Areas like AR for outdoor environment education have already started to break ground in this direction [11], but additional research is still needed when it comes to dynamic outdoor environments. Therefore, even though the literature on augmented reality is constantly expanding, there are many potential research directions that can be identified for the understanding of how AR can be applied in real-world architectural heritage settings, especially in outdoor spaces or natural contexts [3].

Augmented Reality can take many forms and, while there are currently different ways available to experience it, Mobile Augmented Reality (MAR) technology is emerging as a particularly useful tool for architectural heritage preservation. With MAR, users can engage and interact with heritage sites as active users since it allows anyone with a mobile phone to access the technology [28]. By using mobile AR applications, users can visualise and restore ruined structures, integrating layers of architectural information to showcase various conservation techniques and further data on real-world sites that traditional methods are struggling to exhibit [2]. M Thibault [25] highlights how AR enables digital overlays to superimpose on real-world environments, creating “media-generated alternative realities” (p.162). This technology enables heritage sites to be digitalised with historical narratives to provide users with an immersive experience. The presentation of digital reconstructions of historical events provides virtual access to sites or recreating historical events. These augmented reality applications are in place to facilitate the preservation and dissemination of architectural heritage and guarantee its ongoing significance in a modern context.

When considering mobile AR as the main technology, accessibility is a significant advantage of mobile AR in architectural heritage preservation. On the one hand, MAR does not require bulky or expensive headsets, but makes use of a device, the mobile phone, that many users already possess and habitually bring along. On the other hand, MAR allows broader, non-specialist audiences like students, tourists, and the general public to access the technology without prior knowledge, as it is based on a more familiar and intuitive interface [9]. However, there are still a few challenges that need to be addressed, like accurate localisation for overlaying the digital layer into real-world spaces. Many paths have been identified in previous studies to help us face these accurate localisation challenges. Previously, the Global Positioning System (GPS) was commonly used to create geo-location based AR experiences, but there are reliability issues with some use cases [23]. Another potential method is Visual Positioning Systems (VPS), which act as a location-based localisation technique much more accurate than GPS and uses computer vision algorithms to analyse visual data from cameras and compare it with known locations, enabling applications

in augmented reality, indoor navigation, location-based games and autonomous vehicles [16] Because of these findings mobile AR with VPS system showing promising potential technology for the development of this study.

If we look at existing literature and use cases, we can see that, while suggesting that MAR can indeed have potential when it comes to preserving historical architecture and enhancing public engagement with it, and MAR in particular can boost accessibility and interactivity, there are still several gaps to fill. First, many efforts to use AR for heritage preservation and engagement with historical artefacts focus on indoor and/or controlled environments. Developments in MAR and VPS technologies make it easier to deploy AR outdoors and therefore to focus on a wider range of architectural elements (e.g., facades) and spaces. Second, further research is required to explore how augmented reality might function not only as a tool focusing mainly on the visualisation of content, but also as a medium that allows some degree of interactive engagement with historical knowledge [29]. While this might be due to inheriting a "do not touch" mentality from traditional ways of engaging with heritage [26], it also hinders the use of the full potential of the technology. Third, despite the fact that several studies have emphasised the technology's potential to improve public education [15],[29], only a few of them have outlined how AR can be used to encourage active engagement in historical research.

With our study, we do not aim to fill all these gaps but to explore them and explore solutions that can address multiple challenges and opportunities at the same time. Hence, our research through design efforts will deal with the use of MAR and VPS technologies in an outdoor environment, the creation of content that allows some degree of interaction with historical artefacts, and engagement with architectural elements and dimensions that have rarely been approached before (currently building facades that will be "reskinned" to look at an older state).

Finally, This study aims to address these gaps by developing a mobile AR application that overlays historical artefacts and damaged architectural features onto the real-world environment of Näsilinna Castle while considering the practical challenges of outdoor implementation.

## 3. METHODOLOGY

Given the exploratory nature of this research, Research through Design (RtD) was chosen as the methodological approach. RtD emphasises the role of design practice as a means of generating new knowledge, making it particularly suitable for projects that involve emerging technologies and novel applications. This approach allows for iterative exploration and refinement, making it ideal for studies where research questions evolve alongside the design process [13]. Unlike other research methods and methodologies, which follow strict procedures to achieve specific results, often based on a hypothesis, RtD has an exploratory nature: it focuses on the design and creation of something new and, importantly, to learn something from the process. Gaver[13] argues that theory in design research should be seen as provisional and contingent rather than definitive and suggests that Research through Design should focus on producing substantial, conceptually grounded artefacts that reflect the insights developed through the design process.

This process emphasises the creative, reflective, and generative nature of research through design, where an iterative design activity plays a central role in knowledge generation.

The Research through Design (RtD) methodology follows an iterative testing and refinement cycle, incorporating designer insights and user feedback. This approach involves a continuous designing, prototyping, and evaluating process, where each iteration contributes to generating new knowledge and insights [13]. It advances through technical development and qualitative evaluation, recognising both as essential in producing meaningful findings within the design process.

Therefore, our study adheres to Gaver's [13] recommendation by adopting an RtD methodology and developing an AR application that progresses through iterative design cycles guided by user feedback and empirical testing.

More specifically, in coordination with our partners at the NEXR (Next Extended Reality) project, we have decided to design a MAR application dedicated to a specific historical location: the Näsinlinna castle and the surrounding hill. The castle was a key location in the Battle of Tampere, an important step of the 1918 Finnish Civil War, which marked the city and left behind several interesting historical objects conserved in the storage of the Museum Center Vapriikki. The castle itself has since been restored, and keeps no visible traces of the battle in its current form.

Based on Gaver's paper[13], we identified four main phases of the Research through Design process. The first phase, Exploring the context, involved close collaboration with experts from the Museum Centre Vapriikki to outline the historical and museological context in which our artefacts would be integrated. The second phase, Developing a design space, built on this context and the literature review to delineate the key features of the intended application and specify the software and hardware used in the process. The third phase, Refining and making, focused on designing the application by compiling existing materials, outlining a development workflow, conducting 3D modelling and content creation, and scripting interactivity. This work was iterative, with attention to user-centred refinement. The fourth phase, Assessment and learning, combined a small user study in which we collected qualitative feedback from expert users ($n = 11$) with self-reflection on the overall design process.

These four Research through Design (RtD) phases served as a foundation for broader reflections and recommendations that emerged through the iterative design process and were refined through continuous evaluation.

In terms of positionality, the authors of the present study include three men, and their ages range from the late twenties to the mid-forties. They are based in Finland, but their countries of origin are Sri Lanka, Italy, and Spain. They have backgrounds in architectural research and practice (1st and 2nd authors), human–computer interaction (1st and 3rd authors), and semiotics (3rd author). The authors hold a variety of views and experiences regarding XR technologies, ranging from curiosity about their potential to scepticism about current discourses surrounding them. We believe that these differences in perspectives and backgrounds, while still limited in range, strengthen the study by grounding it in a multidisciplinary perspective.

## 4. EXPLORING THE CONTEXT

This phase was dedicated to familiarising ourselves with events of the Finnish Civil War related to the Näsilinna area and with the traces they left or that have since disappeared in the architectural landscape of the city.

The Finnish Civil War was a divisive conflict that significantly shaped Finland's transition from a Grand Duchy under the Russian Tsar to an independent state. It took place from 27 January to 15 May 1918 [6] and, according to historical information provided by the Museum Centre Vapriikki, one of the most significant battles occurred in Tampere in the vicinity of Näsilinna hill. The battle caused heavy destruction to the built environment around Näsilinna and the surrounding area. Over the years, this area has undergone substantial renovations and restorations, and it now shows few visible traces of the conflict. Nevertheless, the war left lasting scars on the nation, shaping public memory and national heritage for decades [21]. For approximately a decade, the Museum Centre Vapriikki hosted an exhibition on these events titled Tampere 1918 [27]. Alongside historical context and maps, the exhibition presented artefacts collected from the battlefield immediately after hostilities ceased, including objects ranging from weapons to tools and even a doll. Although the exhibition was successful, it no longer exists, and the artefacts are now preserved at the

Museum Centre Vapriikki.

In recent years, the museum has initiated several projects to preserve the exhibition and its contents digitally. A digitised version of the exhibition is available via the Tampere 1918 website [27]. In addition, a digital experience of the battle has been created that uses a 3D recreation of the hills and their architecture (created by Zoan Oy). Users can choose one of the two sides in the battle and read a series of historical texts while viewing a short 3D animation that digitally reconstructs the events. Finally, Vapriikki and Zoan developed a VR experience, providing a digital replica of the physical exhibition (which also no longer exists). Users can visit this exhibition as a VR experience.

Our design was developed within the broader context of existing approaches that integrate digital and XR technologies into heritage preservation, with specific attention to this historical event. However, most existing projects primarily focus on virtual recreations of objects or spaces from the Battle of Tampere that are not location-dependent and can be accessed remotely via computers or smartphones. These approaches, while valuable, lack a direct connection to the physical spaces in which these events took place. In contrast, our research explores how AR can bridge historical narratives and architectural spaces, allowing users to engage with history in situ. By superimposing historical artefacts and architectural elements onto the original locations, our application offers a complementary perspective to existing museum initiatives and enhances spatial and contextual understanding of the past.

## 5. DEVELOPING THE DESIGN SPACE

This phase focuses on preliminary decision-making about project development, building on the context explored in phase one, our overall research objectives, and the gap identified through the literature review. Our exploration of the context led us to identify two opportunities for the use of MAR at Näsilinna. First, MAR

could be used to showcase the facade of the castle in its damaged state, revealing the physical and metaphorical wounds left behind by the civil war, even when the restoration has seemingly erased them. Second, MAR could be used to give users access to the artefacts collected after the battle, in their historical context, in a moment where there is no other way to access them. These opportunities are the areas on which we decided to focus our design efforts.

To guide the next steps of the process, we have set a series of key features for our final output. In particular, we want our AR application to:

- Enable users to explore the Näsilinna Hill area and interact with historical artefacts and architectural features through Mobile AR.
- Provide accurate overlays of 3D models of artefacts and the castle's historical façade on their real-world counterparts.
- Support educational engagement by offering contextual information about the historical artefacts and events.
- Ensure compatibility with commonly used mobile devices (iOS and Android), making it accessible to a wide audience.
- Offer way finding functionality to assist users in navigating the physical space and locating artefacts of interest.

These features outline an application that allows users to explore the physical space around the castle while interacting with a virtual recreation of historical artefacts and architectural elements superimposed on a real-world environment. By using mobile AR, we aimed to make the experience low-threshold, as it makes use of hardware (smartphones or tablets) that most users already own and are familiar with, without requiring additional devices, bulky headsets, or any advanced technical knowledge.

These features, then, guided us in the selection of appropriate technologies and design approaches in subsequent stages of development. In particular, we chose Unity as the primary development platform. In order to accurately localise AR content to the physical environment, we decided to use the Immersal Software Development Kit (SDK) because of its VPS functionality. In turn, the SDK is compatible with ARKit (for iOS) and ARCore (for Android) and ensures cross-platform functionality.

## 6. REFINING AND MAKING

The third phase focused on the development, testing, and bug fixing of the application. After having familiarised ourselves with the context and defined our design space, we had to make a series of concrete choices about what artefacts to show, what descriptions would accompany them, in which locations we would position them, and so on. In this phase, we worked in close contact with the personnel from the Museum Centre Vapriikki, which provided us with materials and expertise from its previous XR and digitalisation projects that were relevant to the Tampere 1918 exhibition.

Once we selected the artefacts and texts that we wanted to showcase, we created a technical Development Workflow for our AR application. The workflow involved several software tools and development frameworks. The primary tools used were Unity, Immersal SDK, Blender, ArchiCAD, and

Polycam. Each of these software played a role in creating 3D modeling, spatial mapping, and interaction systems that help create the experience.

This Figure 1 showcases the workflow used for the development process. These tools were used in developing the digital overlay interacting with the physical environment of Näsilinna Hill site, which allows users to explore both contemporary and historical environments.

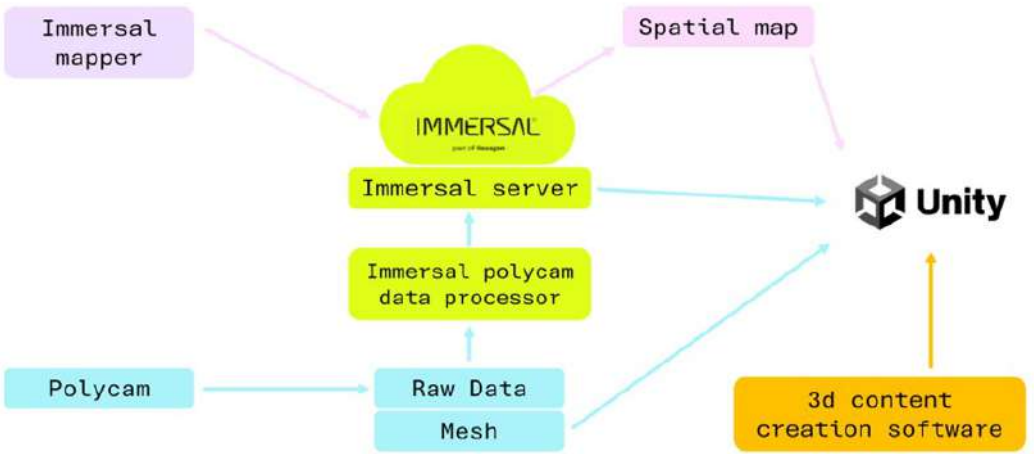



Fig. 1. Application Development Workflow.(created by the author).

## 6.1. SOFTWARE AND VISUAL POSITIONING SYSTEM (VPS)

Unity was selected as the primary development platform, providing flexibility in integrating various AR frameworks and facilitating the management of complex 3D environments. To ensure precise spatial alignment, the Immersal SDK, a Unity-based software development kit (SDK), was employed as the Visual Positioning System (VPS). This technology enabled the application to accurately overlay digital content onto the physical environment of Näsilinna Hill in real time, enhancing the authenticity and contextual accuracy of the augmented reality experience.

The development of the AR application began with the Immersal Mapper application, which helps generate spatial maps Figure 2 for localisation. The first step in the process was to map the study site by walking around the area and capturing a series of overlapping photographs in the app. The application then processed these images to generate a spatial map of the environment. Afterwards, the map produced by Immersal was imported into Unity for use in developing the AR application.

Apart from the Immersal mapper app, Polycam is another 3D mapping application used to generate a detailed 3D mesh Figure 3 of the ground planes and surfaces around Näsilinna Hill, which is also used for the Ground plane for AR navigation and content placement. Polycam also has the capability of capturing fine details of the physical environment, contributing to an accurate and stable AR experience while acting as a

second spatial map. Both of these map data ensured the precise alignment of AR components with the physical landscape and architectural structures.

The spatial data collected with Immersal and Polycam were imported to Unity to create a seamless representation of real world environment. These two data sets were combined to develop an initial robust localisation framework that provides the initial path to generate a successfully localised AR experience.

## 6.2. 3D MODELING AND CONTENT CREATION

Accurate 3D content was a crucial part of the development phase. It required a few specific 3D models to represent the historical artefacts from the Tampere 1918 period. Blender and ArchiCAD were widely used in the 3D modelling industry, especially in architecture, as a 3D modelling platform; they help create high-quality, realistic 3D models, which were used to create all the 3d models and damaged castle facades except historical artefacts. The references for the 3D models were technical drawings Figure 4, photographs, and documents provided by the Museum Centre Vapriikki to ensure the accuracy of historical details. Access to these materials and data from Vapriikki was governed by a contractual agreement ensuring ethical and authorised use for this study.

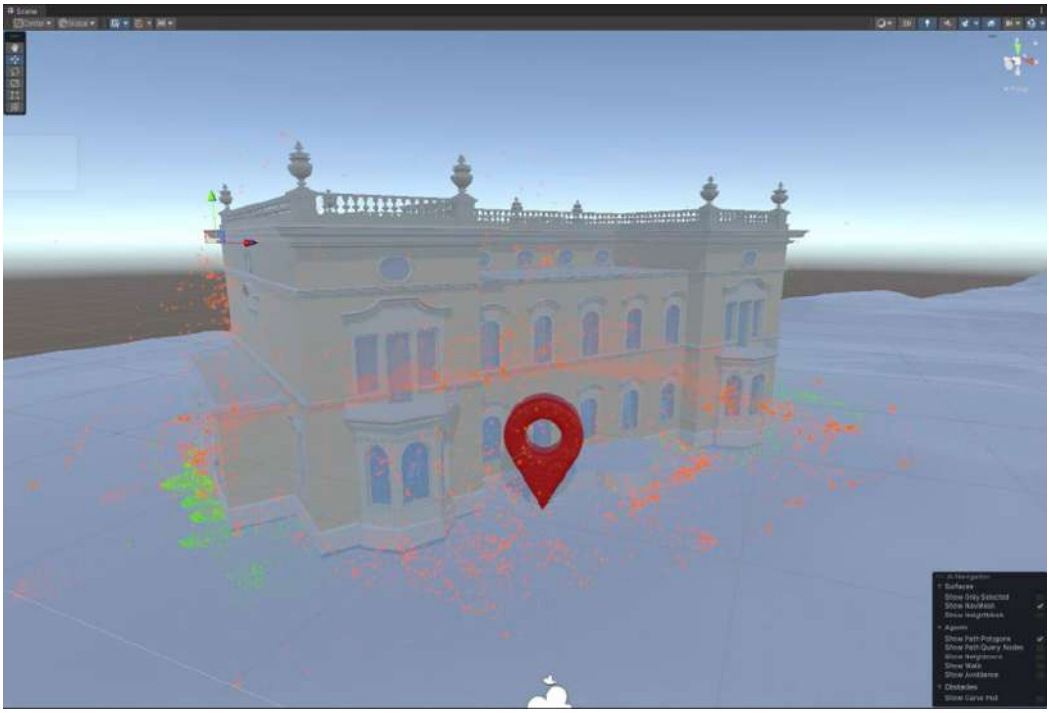


Fig. 2. Screenshot of Unity interface with the spatial map(green and orange dots) and 3d content. (created by the author).

The 3D models of the historical artefacts were provided by Museum Centre Vapriikki Figure 5. These 3D models are made by using 3D scanning technology to capture the textures and geometries that lead to a highly detailed replica.

Original artefacts of these models are currently preserved at the Vapriikki.

In addition to the artefacts, we created a 3D model of the destroyed castle façade Figure 6. The model was superimposed on the existing castle façade on site to show the way the castle façade looked during wartime, enabling users to interact with the 3D façade while moving around with their mobile devices, observing the wartime façade and the renovation of the present day façade.

As an additional content feature, audio and text transcripts were created to provide insights into the artefacts. A background audio introduction was incorporated, offering a brief historical overview and highlighting the architectural significance of the location and its connection to the historical event. Additionally, each artefact was accompanied by a text description Figure 7 available in both English and Finnish, ensuring accessibility for a wider audience and enhancing user engagement with the historical content.

Fig. 3. 3D mesh Generated by using Polycom application.(created by the author).

Using imported scanned maps of the site and other content, both Unity and Immersal SDK were utilised to develop the AR application. The Immersal SDK allowed for the integration of the spatial map into the Unity workspace, serving as the foundation for placing 3D content and enabling VPS (Visual Positioning System) localisation. The application was built using Unity's AR Foundation framework, which supports both ARKit for iOS and ARCore for Android, ensuring cross-platform compatibility and accessibility across multiple

mobile devices. Once the spatial map and 3D content were positioned in the designated locations, further refinements were made to ensure that 3D models of artefacts and architectural elements were accurately aligned with their real-world positions Figure 2. This precise placement was essential to achieving a seamless transition between the physical and digital environments, enhancing the authenticity and immersive quality of the AR experience.

## 6.3. SCRIPTING FOR INTERACTIVITY

An important aspect of the project is enabling user interaction with the AR artefacts and the environment. To achieve this, C# scripts were written within Unity to define how users would interact with AR elements; as a programming language, C# scripts enable users to visualise AR objects by pointing the mobile device's camera at them. As an example, when the user points the camera at an old wooden box (All the artefacts are placed inside wooden boxes that were scattered around the site), both a book with a description and an artefact will pop up on the mobile device screen. After that, users were able to tap on the screen to the specific 3D object to zoom in and rotate for the observations. In this process, as the user could explore the artefact in detail, it presents an educational and engaging value of the historical significance of each artefact.

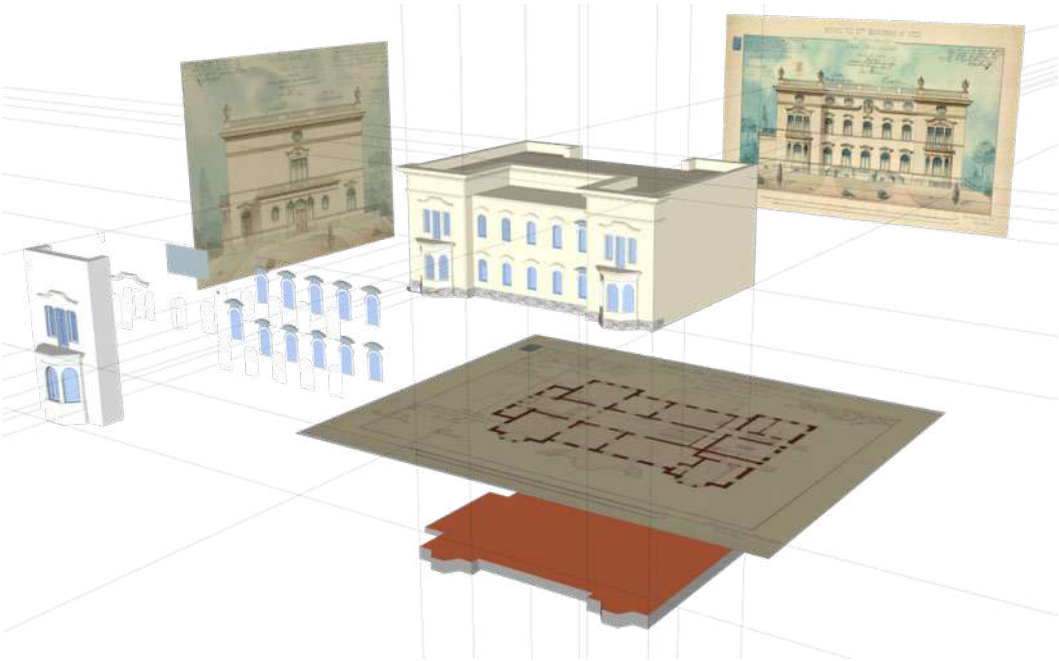


Fig. 4. Using historical architecture drawings and references to create an accurate model.(Created by the author).

Fig. 5. Some of the 3D scanned models were provided by Museum Centre Vapriikki.(created by Museum Centre Vapriikki).

The other interactive element is a 3D mesh of the castle's damaged vertical façade. Users could approach the façade with their mobile devices, and as they move closer, detailed layers of historical information will reveal themselves. For example, markers of battle damage or architectural details from 1918 would appear as overlays, guiding users to the historical context of the building's transformation over time.

Fig. 6. Finished model of the castle that represents the war situation. (Created by the author).

Fig. 7. From the Right: Text Description of the artefacts, How it is integrated into the AR layer as a 3D book. (Created by the author).

## 6.4. ITERATIVE DESIGN PROCESS AND USER-CENTERED REFINEMENT

Before the final development, early mockups of the AR application were created to demonstrate the core interaction mechanics and visual style of the AR experience and used to develop the application further. Coherent with Research through Design processes, we deployed an iterative process to test, refine, and evaluate the app, allowing the application to engage with real-world user interactions. The mock-ups served as a proof of concept, enabling us to test basic functionality and gather preliminary feedback through short interviews with a few users (n=4) with backgrounds in architecture, recruited from our research environment. The simple mockup scenario consisted of a virtual AR object representing an old wooden box placed on the ground near the Näsilinna castle. When users pointed their mobile or tablet camera at the box, the 3D scanned recreation of a historical artefact would emerge from the box, accompanied by a description of the object and its historical relevance, visualised on a digital parchment. The mockup also included the possibility to visualise an incomplete version of the damaged façade layer of the castle overlayed on the castle itself.

Participants provided feedback on different aspects of the application in short interviews, offering suggestions on how to improve both technical and educational values of the artifact. As an example, one participant suggested that providing extra contextual information about the artefacts, such as their use in the Tampere 1918 events, would significantly improve the educational impact of the experience.

Additional refinements were made to improve the User Interface (UI), making it simpler and easier to navigate. Following the feedback collected, the artefact-selecting drop-down menu was simplified to reduce confusion, and an audio description was added to guide users through the exploration process. These changes were made with the goal of making the application as user-friendly as possible while maintaining its educational focus.

Testing was the most crucial step for this kind of development to achieve the desired results because it enables the identification and resolution of any technical issues that occur in the development phase. Once the application's core functionality had been developed, continuous testing was conducted on-site at Näsilinna Hill to ensure that the application performed well under real-world conditions. Also, on-site testing was important for evaluating the performance of the VPS localisation system and the accuracy of overlays on the physical site. This testing phases faced several challenges, including localisation failures under poor lighting and in shaded areas, failures under rapidly changing weather conditions, or seasonal environmental changes. These issues were particularly prevalent during the autumn months in Finland, when the weather conditions can change drastically over a short period of time.

To address these challenges, we created multiple spatial maps that could be switched depending on the environmental conditions. This ensured that the AR content of the application localised accurately even when lighting or weather conditions fluctuated.

In addition to localisation issues, several minor bugs were identified during the testing phase. Including delayed responding time when the user interacted with the object and occasional glitches in the wayfinding system. These issues were addressed by optimising the C# scripts used for object positioning and improving the back-end processes that operate the wayfinding functionality. This phase marked the final round of testing, where the focus was on ensuring that the application ran smoothly on both iOS and Android devices.

## 6.5. FINALISATION AND DEPLOYMENT

The application was optimised to ensure mobile performance, smooth interaction, and responsive AR elements, even on mid-range devices. The 3D models were optimised by reducing polygon counts and compressing textures without compromising visual quality. This optimisation process ensured a continuous, high-quality experience for users regardless of their device.

Gradually the development of final project, the application was deployed for user testing at Näsilinna Hill Figure 8. This made the beginning of formal user experience evaluation phase, where qualitative data were collected on user engagement, satisfaction and educational and experiential outcomes.

Fig. 8. Screenshots of the application during onsite testing. From the Right: Navigation menu, Navigation pathway, Artefact, and the description, Detailed descriptions. (created by the author).

## 7. ASSESSMENT AND LEARNING

The fourth phase, focuses on what can be learned from the design process, but by engaging with the users and though our own self reflection.

### 7.1. USER FEEDBACK

After the finalisation of the application, we started a phase of user testing involving users from different professional backgrounds to collect qualitative data through a short survey with open ended questions. Before their involvement, all participants were informed of the study's purpose, their right to withdraw at any time, and the intended use of their anonymised data for research analysis and publication. Written/verbal informed consent was obtained, and no personally identifiable information was collected to ensure confidentiality. Data was aggregated and analysed to derive insights while safeguarding participant privacy.

The participants (n=11) were recruited through the Anonymous Project networks, and had backgrounds in architecture

(n=4), history and heritage (n=2), design (n=2), and other fields of academic research (n=3). According to self reported data collected as part of the survey, eight participants had no prior experience with augmented reality, and two had two years of experience in AR technologies. Simultaneously, respondents experience in architectural heritage or historical preservation ranged from none to more than

ten years for one participant. This diversity provided a comprehensive set of perspectives on the usability, feasibility and educational potential of the AR application.

Participants were asked to fill an online questionnaire immediately after testing the app. The questionnaire consisted on six open ended question focusing on: the application effectiveness, ability to integrate virtual artefacts with the real-world environment, ability to help the acquisition off historical knowledge, accessibility, potential in heritage preservation, and on possible improvements. Due to the small number of participants and the exploratory nature of the study we decided to focus exclusively on qualitative data collection, which is particularly indicated to understand the user experience of the design and the design process, and especially suitable for projects like architectural design [8]

[18].

We analysed the data collected from this survey, as well as the observations emerged from the short interviews after the mockup, making use of content analysis, which is a simple and useful way to helps analyse qualitative data in explorative research through design studies [7],[4]. Our content analysis, was articulated around three key sections, common to other application of the method ([7], [4]), namely: user engagement, user observations, and recommendations for future developments.

## 7.2. USER ENGAGEMENT WITH AR IN HERITAGE PRESERVATION

The first impression of the application experience was generally positive, as identified by the discussion with the users onsite. Several participants mentioned that it offered an engaging and immersive experience of interacting with historical artefacts and architectural elements of Näsilinna castle. Participants consistently mentioned the importance of engaging with 3D models, moving around the site, and interacting in a physical and digital world. For example, the "participant 7" with 1-5 years of experience in architectural historical preservation mentioned,

"It was impressive to study the objects at the site like as it is where those were decades ago. And the explanations were informative."

However, while many participants mentioned digital and physical interaction as a key strength, some of the participants mentioned the challenges with the user interface and navigation of the tools. The first participant with a

User Experience and Accessibility background mentioned,

"The UI is a bit confusing at the beginning. A clearer intro or guidance would help."

Another user which is Participant 5 suggested that defined paths and a clearer interaction solution would improve the smoothness of experience.

The general technical performance of the AR app was met with mixed reviews. Many of the respondents mentioned the app functioned well, especially with the 3D rendering of the models and localisation of the app at the Näsilinna Hill site. At the same time there were few issues mentioned about the localisation speed and the accuracy. An Architect and Professor, The fifth participant, mentioned that,

"It was rather effective, although with some technical problems yet, mainly related to the connection speed and localisation."

A recurring technical issue was the misplacement of AR objects, particularly in poor lighting or in different weather conditions. Respondents found a challenge in the Visual Positioning System (VPS), which sometimes struggled to accurately place artefacts, placing the objects sometimes a few meters above or into the bushes. This challenge has been repeatedly reported since the testing time was not taken under the same conditions, and there are rapidly changing autumn weather conditions. Addressing the localisation issue will be a critical aspect in the future development of AR applications, as users should receive a smooth and reliable experience in observing historical artefacts.

## 7.3. USER OBSERVATIONS ABOUT AR IN HERITAGE PRESERVATION

One of the key outcome from the AR application is its ability to blend in with contemporary architectural space at

Näsilinna castle. Users found the overlaying of wartime castle façade onto present façade engaging and informative. A Participant 9 mentioned that,

The app "The damaged walls of the castle were very detailed, and it's a really good way to look into the past that has already disappeared from the physical world."

Participants were able to navigate around the site using the app's way-finding system, which guided them to their desired places. As noted in the survey, participants found this feature interesting. One user compared the experience to geocaching,

"the navigation was clear, but I would have preferred more of a challenge, like solving puzzles to find the next object."

## 7.4. EDUCATIONAL OBSERVATIONS OF THE AR IN HERITAGE PRESERVATION

A key objective of the project was to enhance user understanding of the historical events of the Finnish Civil war that happened in Tampere 1918 and the historical architectural value of Näsilinna castle. Several users, including the users who had no experience in architectural heritage, mentioned that they learned new things about history through AR experience. One user commented,

"The voice and 3D images helps. I knew nothing before. I feel like I know something now about history."

This indicates that using AR has potential for delivering information and interacting with users. Participants appreciated the presentations of information through audio, text and 3D models. s the user feedback was considered improvements, some users suggested that the historical artefacts could be connected to some sort of a related specific place on the site. A user (Participant 7) with an architectural conservation background mentioned,

"It was impressive to study the objects at the site like as it is where those were decades ago. And the explanations were informative."

Participants found the AR application adds value to the experiential learning of architectural heritage. A participant

(Participant 5) who is an architect and a professor, found that, the app "This is a totally new and interesting material to study comparing the methods I have used to study architectural heritage so far. I think students will be eager to interact with this technology to do their studies. For me it's easy to understand and more likely to keep in memory."

This experiential learning use of the app identified by the participants with a teaching background suggests how the app could be used to deliver information in a significantly interactive way, which indicates future possibilities and potential future studies. This interactive nature of the AR application was identified as a special learning object over traditional methods. A response showed that (Participant 8),

"It's not like reading books and observing historical pictures. It was learning while being on site."

This involves the approach combined with spatial interaction, enabling the users to understand both the historical artefacts and the architectural transformation of Näsilinna castle through time. The participants were identified with AR applications in architectural education, especially engaging students with experiential education. Several participants based on architectural education background identified the ability to study detailed 3D replicas and architectural renovations in real-world contexts as offering a significant advantage over traditional learning methods. The sixth Participant with an architecture background suggested,

"This is a totally new and interesting material to study compared to the methods I have used before. I think students will be eager to interact with this technology."

Additionally, the hands-on nature of the application, combined with tactical digital elements, engages in a practical way with the young audience who may not be interested in traditional historical education.

## 7.5. RECOMMENDATIONS FOR CONTINUED DEVELOPMENT

A primary development opportunity that emerged from the survey was improving the application's storytelling and gamification aspects. Simply, gamification means adding mechanics that are used in games to non-game situations. Several users suggested incorporating puzzles and wayfinding clues to make the AR experience more engaging. These features would allow users to feel strongly engaged in the historical exploration and fill them with a sense of accomplishment. One participant with a background in architectural conservation suggested,

"The content needs to be gamified in the sense that finding the objects involves some kind of puzzles and clues, giving the user satisfaction and the story a pull."

This approach will align with research through design methodology by providing opportunities for iterative developments.

Improving the application's user interface (UI) is a huge improvement opportunity. Another participant's suggestion was to make the AR object zooming and rotating controls more intuitive. The fourth participant, who is a historian, mentioned,

"Using two fingers to rotate the model was unfamiliar to me. I expected to be able to swipe with one finger, which would have been more intuitive."

This option is impliment in the application in the testing processes and used for the test in the later participants.

A few participants also questioned expanding the application's multilingual options. Currently, the application has introduction audio in English and artefact text descriptions in both English and Finnish without audio descriptions. Nineth participants (from the Field of Architectural Heritage Conservation) noted adding another language to the audio description, like the Finnish language.

"I wish there were more audio descriptions for each artefact in different languages, at least in the Finnish language."

## 8. DESIGN CONSIDERATIONS

The development and iterative refinement of the AR application for Näsilinna Castle, as well as the survey and interviews, have provided meaningful insights into the opportunities and challenges of integrating AR with heritage sites, which led to several design considerations.

These considerations can be the base for future projects involving the use of XR, and in particular MAR, in connection with heritage sites. Due to the exploratory nature of this study, the following considerations are preliminary steps, illustrating possible resources for future designs and refinement.

- Outdoor MAR can be a tool to engage with large heritage sites. Despite some technical difficulties, the technology seems to be mature enough to allow an easy use of MAR in outdoor spaces and with changing weather conditions. This can support educational and conversational projects to engage with large heritage sites, architectural complexes and potentially urban areas as well. Researchers, conservationists, and developers interested in exploring different ways of engaging with large heritage sites, then, can easily introduce low-threshold MAR applications as part of their resources.
- AR can bridge between museums and heritage sites. Museums offer secure and controlled environments for the conservation of historical objects, while heritage sites embody continuity with the locations of historical events. AR can offer a bridge between the two by using 3D scans of artefacts that are conserved in museums, and allowing the general public to visualise them in the original environment. While many collections are undergoing digitisation efforts for preservation, it is likely that in the future most historical artefacts might posses some 3D digital counterpart. This will offer a wealth of 3D objects, whose counterparts might often not be visible for the public, to be showcased safely as part of outreach and educational efforts, as well as touristic and cultural applications.
- "Reskinning" can be a new strategy for engaging heritage through XR. While AR has often been used to showcase what is no longer there, in Battle of Tampere AR we have explored the possibility to show instead earlier stages of existing buildings. We believe that this can be support more multi-faced and deeper engagements with history and heritage. Rather then present historical sites as something that existed and has been lost, "reskinning" showcases change and mutation (rather than destruction) and can bring to the surface scars that have been hidden beneath fresh coats of paint in restoration efforts. Traces of conflicts, of negotiations, of iconoclastic periods, of changes in fashion and taste that are often hidden under the last layer - or efforts to restore heritage to their original form - can then be made visible and hence problematise narratives and offer more nuanced historical depth.

- AR can improve the engagement with history in heritage sites by providing active interaction. By allowing users to manipulate AR elements, compare past and present architectural states, and engage in explorationbased experiences, AR can serve as an immersive educational tool, fostering active learning and engagement with cultural heritage. In our application, having on site experience, immersive visual and audio, real-time manipulation of the real structures in the digital layer, and the ability to compare both current and past situations at the same time, including exploration games-like experience, seemed to enhance user engagement with the location and application and support their learning experience. Similarly, a curated use of AR, and especially of the possibilities of its affordances, can be used to promote a nuanced and multi-faced relation between users, historical artefacts, and heritage sites.

In conclusion, our exploratory study was able to inspire several design considerations that can help guide the development and use of AR in heritage. At the core of this study, we have witnessed how AR can revive lost architectural elements and bring history to life in a way that conventional preservation methods cannot. This realisation underscores the importance of leveraging emerging technologies responsibly, ensuring that they complement, rather than replace, traditional approaches to heritage education.

## 8.1. LIMITATIONS

Our research effort was explorative, and therefore features several limitations. First, scalability is major challenge for our study. Architectural heritage varies by location, culture, and environment, hence it is impossible to find one-size-fits-all design solutions on how better use AR in heritage. Further research and experimentation is needed to identify common patterns and develop adaptable guidelines, ensuring future studies can be more scalable and applicable across diverse geographical and environmental conditions.

Second, the number of interviewees and respondents to our survey was limited, and all the participants where in some way familiar with the project and/or the researchers. Importantly, the participants were representative only of some of the possible target groups of our application. While their involvement in our design process was mainly oriented towards gathering expert feedback on the different areas of interest of the application (architecture, heritage, XR) to support our research efforts, we stress that actual development projects of similar applications should be human-centred and involved diverse possible users in all stages of the design.

Third, there is a significant difference in user feedback between those with prior experience in AR and those without. This suggests that the novelty effect might have influenced the evaluation and feedback we collected. A broader study would provide deeper insights into how the general public engages with a project of this nature, leading to a more comprehensive understanding of its impact.

Finally, there is still a lot of potential to further develop the app. Based on the suggestions of our participants alone, there is space for developing gamification elements (for example by introducing puzzles, quests, and discovery-based tasks) that can make AR applications more engaging, encourage users to explore, and increase the quality of engagement time. Also, addressing missing accessibility features like text-to-speech, multilingual options, and age-based transcripts by using Gen AI can increase this user engagement and accessibility for diverse audiences, such as people of different ages or with accessibility needs.

## 9. CONCLUSION

In this study we have developed Battle of Tampere AR, a mobile application dedicated to the Näsilinna castle heritage site that made use of MAR to allow users to visualise and interact with historical artefacts preserved in the Museum Centre Vapriikki as well as an overlay to the castle's façade showing the marks of the battle. This design was part of a research through design effort that aimed at exploring the potential of AR technologies for cultural heritage and, in particular, in regard to outdoor spaces and architecture. Our research led us to formulate four design considerations, namely: Outdoor MAR can be a tool to engage with large heritage sites; AR can bridge between museums and heritage sites;

"Reskinning" can be a new strategy for engaging heritage through XR; AR Interactivity to Enhance Engagement and Learning in Heritage Sites. All in all, despite its small scale, our exploratory study suggests that AR reconstructions can be used to promote a deeper understanding of historical events and architectural changes and can offer new interesting strategies for architectural heritage preservation and historical education.

As heritage is a nuanced concept, and heritage sites can greatly differ, our considerations are not to be generalised, but rather they aim to be the basis for further research and exploration. Future research could investigate, for example, how AR applications could be expanded to other cultural heritage sites and how they could be combined with, for example, gamification and other engaging technologies.

## ACKNOWLEDGMENTS

This research was supported by the project NEXR – Next Extended Reality, funded by NextGenerationEU and Business Finland (co-research project number 5703/31/2023).

## REFERENCES

Alonzo C. Addison. 2000. Emerging Trends in Virtual Heritage. IEEE Multim. 7 (2000), 22–25. https://api.semanticscholar.org/CorpusID:206478364 [2] Aida Kesuma Azmin, Mohd Hisyamuddin Bin Kassim, Fadzidah Abdullah, and Alliyah Nur Zafirah Sanusi. 2017. ARCHITECTURAL HERITAGE RESTORATION OF RUMAH DATUK SETIA VIA MOBILE AUGMENTED REALITY RESTORATION. PLANNING MALAYSIA (2017). https://api.semanticscholar.org/CorpusID:55541562

Răzvan Gabriel Boboc, Elena Băutu, Florin Gîrbacia, Norina Popovici, and Dorin-Mircea Popovici. 2022. Augmented Reality in Cultural Heritage: An Overview of the Last Decade of Applications. Applied Sciences (2022). https://api.semanticscholar.org/CorpusID:252770028

Sheelagh Carpendale, Søren Bøllingtoft Knudsen, Alice Thudt, and Uta Hinrichs. 2015. Analyzing Qualitative Data. Proceedings of the 2017 ACM International Conference on Interactive Surfaces and Spaces (2015). https://api.semanticscholar.org/CorpusID:7690553

Miguel Baptista Tavares Carreiro and Pedro Luz Pinto. 2013. The Evolution of Representation in Architecture. https://api.semanticscholar.org/ CorpusID:51900962

Maeghan Chassé. 2016. THE CONSEQUENCES OF THE FINNISH CIVIL WAR IN FINLAND'S TRANSITION FROM GRAND DUCHY TO INDEPEN-

DENT STATE. In The post. https://api.semanticscholar.org/CorpusID:63047315

André Coners and Benjamin Matthies. 2014. A Content Analysis of Content analyses in is Research: Purposes, Data Sources, and Methodological Characteristics. (2014). https://api.semanticscholar.org/CorpusID:8319295

Nina Costa, Lia Patrício, and Nicola Morelli. 2018. A Designerly-Way of Conducting Qualitative Research in Design Studies. https://api. semanticscholar.org/CorpusID:150966194

Santiago Criollo-C, Andrea Guerrero-Arias, Javier Guaña-Moya, Agariadne Dwinggo Samala, and Sergio Luján-Mora. 2024. Towards Sustainable Education with the Use of Mobile Augmented Reality in Early Childhood and Primary Education: A Systematic Mapping. Sustainability (2024). https://api.semanticscholar.org/CorpusID:267370217

Aldo Franco Dragoni, Ramona Quattrini, Paolo Sernani, and Ludovico Ruggeri. 2018. Real Scale Augmented Reality. A Novel Paradigm for Archaeological Heritage Fruition. Advances in Intelligent Systems and Computing (2018). https://api.semanticscholar.org/CorpusID:108353442

Julie Ducasse. 2020. Augmented Reality for Outdoor Environmental Education. https://api.semanticscholar.org/CorpusID:219829198

Raissa Garozzo, Giovanni Pasqualino, Dario Allegra, Cettina Santagati, and Filippo Stanco. 2019. Augmented Reality for the Valorization and Communication of Ruined Architecture. In ICIAP Workshops. https://api.semanticscholar.org/CorpusID:202640678

William W. Gaver. 2012. What should we expect from research through design? Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (2012). https://api.semanticscholar.org/CorpusID:3349079

Zhe Gong, Ruizhi Wang, and Guobin Xia. 2022. Augmented Reality (AR) as a Tool for Engaging Museum Experience: A Case Study on Chinese Art Pieces. Digit. 2 (2022), 33–45. https://api.semanticscholar.org/CorpusID:247051036

Linda Hirsch, Robin Welsch, Beat Rossmy, and Andreas Martin Butz. 2022. Embedded AR Storytelling Supports Active Indexing at Historical Places.

Proceedings of the Sixteenth International Conference on Tangible, Embedded, and Embodied Interaction (2022). https://api.semanticscholar.org/CorpusID: 245840548

David Jhave Johnston. 2004. Position sensing and augmented reality. https://api.semanticscholar.org/CorpusID:12267085

Becky P. Y. Loo and Winnie S. M. Tang. 2019. "Mapping" Smart Cities. Journal of Urban Technology 26 (2019), 129 – 146. https://api.semanticscholar.

org/CorpusID:115521925

Joseph A. Maxwell and Margaret Chmiel. 2015. Qualitative Research Design. https://api.semanticscholar.org/CorpusID:169175505

Rui Miguel Pascoal, Bráulio Alturas, Ana de Almeida, and Rute C. Sofia. 2018. A survey of augmented reality: Making technology acceptable in outdoor

environments. 2018 13th Iberian Conference on Information Systems and Technologies (CISTI) (2018), 1–6. https://api.semanticscholar.org/CorpusID: 49540031

Eleanor Ramsey. 2017. VIRTUAL WOLVERHAMPTON: RECREATING THE HISTORIC CITY IN VIRTUAL REALITY. International Journal of

Architectural Research: Archnet-IJAR 11 (2017), 42–57. https://api.semanticscholar.org/CorpusID:115732534

Oula Seitsonen, Paul R. Mullins, and Timo Ylimaunu. 2019. Public memory, National Heritage, and memorialization of the 1918 Finnish Civil War. World Archaeology 51 (2019), 741 – 758. https://api.semanticscholar.org/CorpusID:213526088

Mona Y. Shedid. 2022. Exploring the different technological qualities of dynamic configurations in smart sustainable urban spaces. IOP Conference Series: Earth and Environmental Science 1113 (2022). https://api.semanticscholar.org/CorpusID:255150742

Bhagvender Singh, Ansh Kumar Choudhary, Ashish Negi, and Suhail Javed Quraishi. 2024. Visual Positioning Systems: Navigating The Future Of Precision Location Technologies. SSRN Electronic Journal (2024). https://api.semanticscholar.org/CorpusID:270006531

Hamka Suyuti and Arief Setyanto. 2023. The Use of Augmented Reality Technology in Preserving Cultural Heritage: A Case Study of Old Jami Mosque of Palopo. Ceddi Journal of Information System and Technology (JST) (2023). https://api.semanticscholar.org/CorpusID:259943354

Mattia Thibault. 2024. Exploring Interreal Translation. https://api.semanticscholar.org/CorpusID:269242441

[26] Mattia Thibault and Mila Bujić. 2020. Strategies of Representation and Degrees of Freedom in Virtual Cities. Meaning-Making in Extended Reality

(2020).

https://www.researchgate.net/publication/343140536_VRBAN_Strategies_of_Representation_and_Degrees_of_Freedom_in_Virtual_Cities [27] Museum Centre Vapriikki. [n. d.]. Tampere 1918. https://tampere1918.fi/ [Accessed: (02.02.2025)].

Jie Zhong and Zhiming Peng. 2024. Design and Experimental Study of Interactive Experiences in Architectural Heritage Education Based on Mobile Augmented Reality Technology. International Journal of Interactive Mobile Technologies (iJIM) (2024). https://api.semanticscholar.org/CorpusID: 271193708

Ünal Çakıroğlu, Merve Aydın, Yasemin Köroğlu, and Merve Ayvaz Kina. 2023. Looking past seeing present: teaching historical empathy skills via augmented reality. Interactive Learning Environments (2023). https://api.semanticscholar.org/CorpusID:256927701

Received 00 xxxx 2025; revised 00 xxxx 2025; accepted 00 xxxx 2025

# BEYOND AUTOMATION: HUMAN-CENTERED APPROACHES TO NEURAL NETWORK INTEGRATION IN ARCHITECTURAL DESIGN

Valerio Perna, Endi Bushati
EPOKA University
Rruga Tiranë-Rinas, Km 12, 1039, Tirana/Albania
*vperna@epoka.edu.al; ebushati19@epoka.edu.al*

## ABSTRACT

This research explores the contemporary relationship between AI-driven tools and human perception and examines both the opportunities and challenges emerging from the intersection between digital technologies and human-centered design approaches. The integration of neural networks in architectural workflows – spanning from simple image generation to more complex algorithmic optimizations – arises critical questions concerning the emotional, cultural, and phenomenological quality of the spaces that such AI-based models can produce. Tools such as Midjourney, Stable Diffusion, Finch3D, etc. have demonstrated a remarkable efficiency in terms of form-finding and spatial optimization, even though prioritizing computational perfection over perceptual nuance, with results of leading to the generations of bidimensional spaces that lack cultural specificity, place attachment or emotional resonance. From these premises, this paper aims to identify and analyze the limitations of existing generative design tools, propose and prototype alternative frameworks for human-centered AI in architecture. Grounded on a mixed-methods approach, it combines case study analysis and user-perception studies through eye-tracking and heatmap visualization, for the development of custom AI model called TheChair. The prototype is designed to tackle the identified limitations of existing generative tools by incorporating user-uploaded architectural vocabularies, enabling personalized, memory-informed design generation that maintains authorial identity while exploring the potentialities of computational power. Indeed, the research proposes a human-oriented generative framework where artificial intelligence is intended as a collaborative partner rather than a mere autonomous designer. Through the integration of perceptual feedback, cultural sensitivity, and ethical concerns into neural network training and deployment, some bias patterns inside AI-based tools are identified and analyzed to prevent architectural homogeneity towards diversity. The finding challenges deterministic fears of AI replacing architects, instead positioning technology as a medium through which human spatial intelligence could be improved while becoming computationally scalable without losing its essential human touch.

**KEYWORDS**: AI, Diffusion Models, Creativity, Human Perception, Digital Technologies

## 1. INTRODUCTION

Architecture is at an interesting crossroads. Neural networks are transforming design processes and human perception of buildings. Melding AI into structures offers unprecedented potential to craft spaces that are more responsive, adaptive, and attuned to human needs and their implementation goes beyond just the use of technology, uncovering the very relationship between artificial and human intelligence (Vogiatzaki, 2017; Del Campo, Leach, 2022). In this regard, the study field on intelligence and simulation has witnessed the emergence of networks inspired by the functioning of biological neural systems that excel in tasks, like pattern recognition and decision making in various applications within architecture such as structural optimization and generative design (Perna, Kyratsis, 2025). Furthermore, the implementation AI-based tools and neural networks, is changing with the human perception and psychology of space. A certain kind of neural network, a Convolutional Neural Network (CNN), is being used massively for the analysis and classification of architecture styles (Cantemir, Kandemir, 2024) through data interpolation with grid-like topologies, which allows them to detect complex details in building facades. This capability not only pertains to classifying architectural styles but also can be employed in studying the relationship of buildings with their context, which greatly helps in architecture analysis and conservation.

As of late, one of the most debated issues in design is the transition from theoretical AI to applied AI where architecture has undergone a change and has become more efficient, creative, and innovative owing to technology like CAD and BIM. In this spectrum, AI has the potential to revolutionize the architectural sector by eliminating repetitive tasks and creating design ideas for architects (Moussaoui, 2025) while accessible AI tools could soon change the way architects design and plan buildings while architects can easily use advanced AI tools on such platforms. These processes, through an ever-growing architectural database to pull from, enhance the design process, lessening design similarity between generated forms creating more interesting and desirable architecture (Yousif, Clayton, Yan 2018).

Indeed, the use of AI-based applications in architecture positively impacts the design iteration and prototyping processes where AI-based design processes, using technology like generative design, give architects access to an expansive range of design options based on a set of parameters and constraints enriching architectural potential. The power of AI-based platforms comes from their data-based insights, which improve decision-making in a range of sectors. These tools can analyse a large volume of data to uncover information that human architects may overlook but even thought, they can do this because they have been trained to understand the relationships between various design factors - what makes a design "work" in terms of physics and human experience. Nonetheless, as with any computational tool, there are limitations, especially concerning the reliability and validity of the outputs (Ahramovich, 2023) and the integration of these systems with existing architectural systems is quite complex since many architectural firms that lack access to in-house artificial intelligence capability may find the uncertainty around technology and architecture of AI-based systems problematic (Zhang, Tong, Liu, Butz, 2023).

This paper discusses the disparity between the abilities of neural networks and humans in architecture and how, even if neural networks are powerful design-enabled tools, their usage and outputs are not always compatible with human sensory experience or cognitive ability. Bridging this gap is essential to ensure that spaces are aesthetically pleasing and perceptually rich (Wichmann & Geirhos, 2023). The initiative aspires

to identify both opportunities and obstacles in applying neural networks in architectural practices by examining the aesthetic, cognitive, and emotional reactions evoked by AI-driven designs and present an original platform (TheChair) based on a human-oriented generative framework where artificial intelligence is intended as a collaborative partner rather than a mere autonomous designer.

## 2. METHODOLOGY

The research methodology includes an interpolation description of various methods and techniques that are to be used in the research. The approach combines computational designing methods with existing methods of human perception to capture the nuances of the artificial intelligence–architecture relationship and their impact on human perception. This strategy is essential to test the capacity of neural networks to create novel designs and simultaneously enhance the experience of a human user in the built environment.

Developing neural network models that can design architecture is an expected outcome related to the explained methodology. It involves selecting the appropriate network architectures, training data and evaluation metrics. The method uses already existing research and studies of generative design and adapts them to the issues faced in design and space. Zheng and Yuan (2021) proposed a method using artificial neural networks for generative architectural design and urban design. Their work highlights the potential of ANNs as a tool for generating architectural and urban forms, emphasizing the importance of customized geometric data structures to map design features to controllable parameters.

The study used a mixed methods research methodology that integrates both qualitative and quantitative data to provide a comprehensive analysis of the research problem. When both the qualitative and quantitative data are placed together (Salvo, Laschewicz, Doyle-Baker, McCormack 2018) a clearer understanding of the situation develops and overcomes the limitations of one approach. To train and access neural networks, data must be collected accurately to reflect human perception in architecture. For this reason, the methodologies rely on two main pillars: case study analysis and human perception studies.

### 2.1. CASE STUDY ANALYSIS

An assessment on existing platforms and tools is fundamental for the outcomes of this research to understand the functioning of some of most diffused ones and also the criticalities they present under the perspective of their integration of human perception. Architectural design increasingly explored with Large Language Models (LLMs). According to Dhar, Vaidhyanathan, Varma (2024), LLMs can be used to create decisions involving architectural design, resulting in automating and improving the design process. The Generative AI architecture consists of multiple layers for processing, generating, evaluating and deploying any kind of application. Tomaszewski and Lundberg (2005) stress the need to evaluate productivity between various development environments and the need of a detailed analysis among case studies to spot productivity bottlenecks and improvements. The selected examples were chosen based on their suitability for this research agenda: projects where generative algorithms or predictive modelling were used in novel

ways to show the latest trends. Each case study was analyzed from a design perspective, technological integration and user experience perspective. Specifically, the research focuses on Large Language Models (LLMs). LLMs are also among the biggest models when it comes to parameter count. GPT-3, for example, is pre-trained on a corpus of 45 terabytes of data, and it uses 175 billion ML parameters. One of the most important contributions LLMs can offer to design and architecture is to improve the creative process. Architects and designers frequently use brainstorming sessions and collaborative ideation to produce novel designs. They can boost creativity by processing and creating massive volumes of data. Architects can use LLMs to produce a variety of design alternatives and novel concepts by entering specified criteria and design limitations. For example, an architect could describe to a model the required building functionalities and aesthetic features. The model might then generate multiple unique design suggestions. These themes can include historical styles, present trends, and even future components, providing a greater range of inspiration options.

## 2.2. KAEDIM

Kaedim has launched a unique platform where users can model 3D and 2D using machine learning. The platform can transform any image into a 3D model that you can use. Because of this technology, the production process gets notably faster whereby the developers could make high-quality graphics very quickly as compared to the normal time. Kaedim allows developers to focus on improving game-play and designs by simplifying the basic stages of 3D modeling. The conversion from 2D to 3D modeling is an important process in digital modeling. This conversion represents a kind of bridge between 2D sketches and 3D models. The 2D sketch is used to design basic 3D elements to obtain complex 3D geometry. The system uses machine learning and a skilled employee to reduce the time it takes to create a 3D model. This combination has allowed game developers to cut the time required to ship a game by 10 times. They can quickly generate 3D design assets which are production ready. Kaedim's service turbo-charges iteration and experimentation of 3D models with an easy on-demand service that speeds up the creation process. The platform allows developers to overtake feedback loops using AI technology for real time scaling. In addition to saving tons of production time, Kaedim's ability brings creative explorations within reach through quick prototyping and innovations. The technique used to develop a 3D model from 2D data is known as a technical pipeline. A variety of applications, including virtual reality, cultural heritage, and retail sales, depend heavily on the crucial factor. The pipeline consists of various steps. First, the data acquisition can be done using several physical techniques like laser scanning, structured light, time-of-flight and so on. Methods that acquire enough data for the production of a 3D object (Bernardini, Martin, Rushmeier, 2002). The 3D pipeline stage applies surface information to determine how the surface looks like colored and spectral reflectance. It adds a pattern to the 3D object so the computer can render it efficiently on the graphics hardware. This procedure guarantees that the transition from 2D to 3D is performed accurately. Depth estimation using AI predictive models has seen an exponential uptake in computer vision use-cases. In other words, these models enable the extraction of depth from a given 2D image, depth map and binocular vision image. These cues are useful for scene depth estimation, pose estimation, as well as 3D reconstruction.

The techniques implemented in the models can vary significantly, which may, among other things, include computer vision and machine learning methods to enhance the depth estimation accuracy and efficiency (Lee, Kim, 2020).

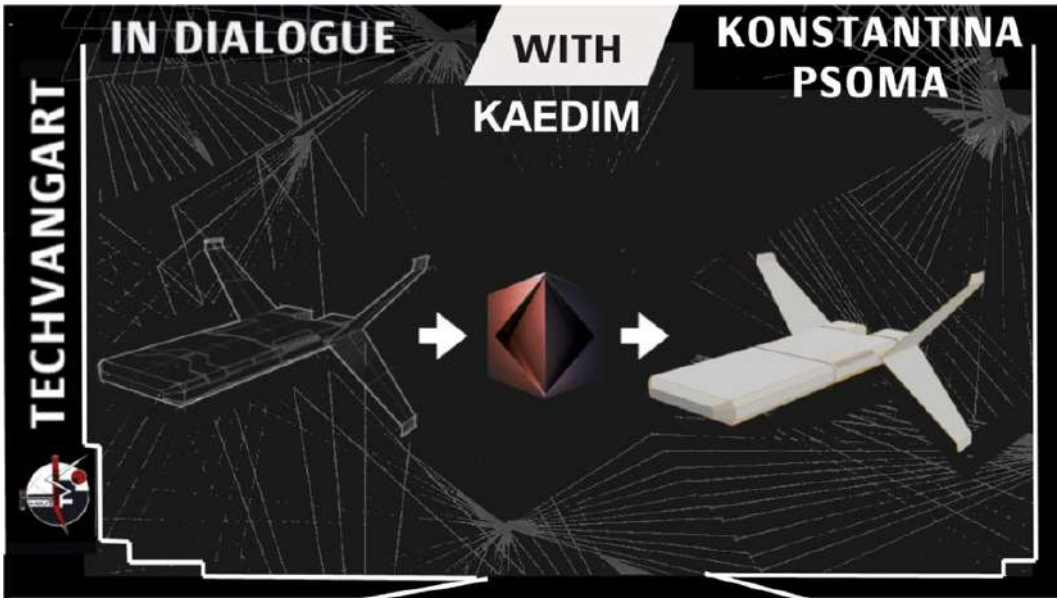



Figure 1: AI Tool Turns 2D-to-3D
Note. From "AI 2D-to-3D Conversion," by Kaedim, n.d., (www.kaedim.com)

## 2.3. LEONARDO AI

The Leonardo AI platform packs in a range of creative tools that help you produce high-quality images, videos, and 3D textures faster than a flash, and with uncanny accuracy making feasible for a heterogeneous number of applications spanning from graphic design, architecture, marketing, and more. The Leonardo AI platform utilize generative AI to create innovative images for your creative project. Experience next- gen image generation. It provides a variety of tools for beginners and professionals. Indeed, they help users generate images, videos, and 3D textures quickly and stylishly. The platform can be used for anything from character designs to game assets to advertisements. The Image Guidance feature of Leonardo AI offers multiple ControlNet options that are relevant to the prototype of the TheChair discussed in this paper. The AI Image Generator of Leonardo AI allows the user to produce high-quality images at high speed and a high degree of style for any purpose. From characters to marketing materials. Through the AI Canvas on the platform, users have strong editing functions that they can use to master every pixel of their design. Moreover, the 3D Texture Generation tool offers a great way to create textures for 3D assets with contextual intelligence. These tools are user-friendly and suitable for novice and expert users. Therefore, it will allow

everyone to create with competent AI-powered treatments. The Canvas Editor is an innovative tool that allows users to create and modify images using AI encoding. This tool enables the community to create, edit and refine images easily with a learning curve that can be mastered by both new and more experienced users. This ability is very important since today there is more demand than ever for good quality pictures and videos. The tool mixes AI and the user's own input. Because of this, the creation process is easy and removes the hard work associated with image editing. Users may modify parameters and integrate other modules on the platform for improved performance on specific tasks. Additionally, Leonardo AI's interface has over 18 million creators, thus creating a community of users who can share perspectives and techniques. This community part is an important element of what makes the platform appealing as it offers a support network for users and incites creativity in one another. The interface and ease of use of Leonardo AI play an important role in its accessibility and usability of users.

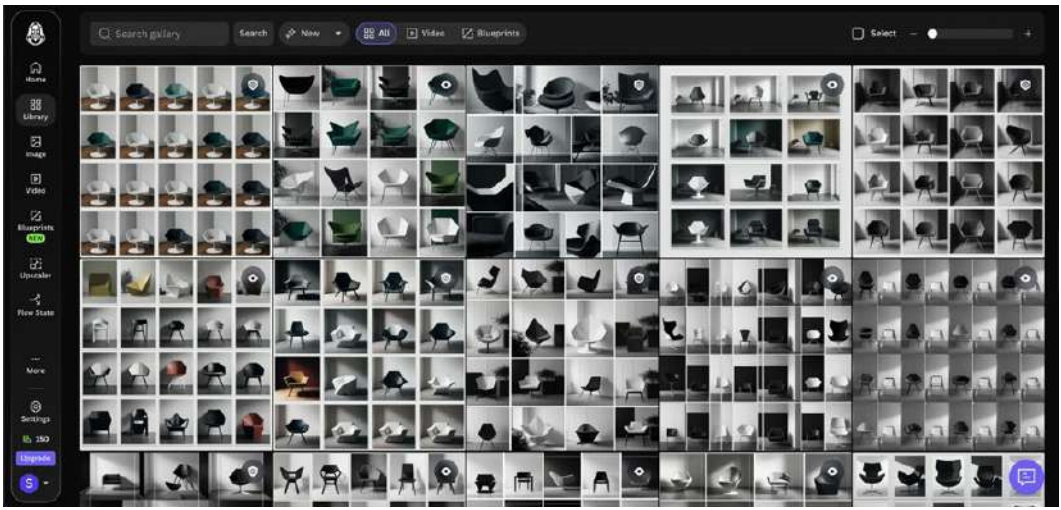



Figure 2: Leonardo AI – Author's Gallery (Perna)

## 2.4. DREAMCATHER

Autodesk's Dreamcatcher it's a generative design system letting designers define their design problems through goals and constraints. This technique offers a way to develop multiple design solutions so designers can explore and select the optimal solutions for manufacturing. This lets designers create endless designs with fixed constraints (like how to use materials, make something structurally stable, or create a minimal environmental impact). The inclusion of constraint-based optimization in Dreamcatcher is especially important as it overcomes challenges associated with conventional design, which is mainly based on trial & error processes that can be time-consuming (Wortmann, 2019). Indeed, the system doesn't just optimize designs; it also frees designers from technical constraints. Without having to worry about optimizing their designs manually, designers have the freedom to create new and optimized designs. In spite of that,

constraint-based optimization poses a real challenge. One major problem is to accurately characterize the constraints and objectives, which is not an easy task. It requires a good insight into the design problems and the optimization algorithm used. A concern with optimization tools is that users often rely on them too much. If the constraints are not well-defined, or if the optimization process is not well- managed, it may lead to poor design results (Colombo Zefinetti, 2023). Although it has a lot of difficulties, constraint-based optimization in Dreamcatcher can improve design quality and reduce environmental footprint. However, the resultant designs are not always aesthetically pleasing. When the designer's desire is absent, the desire for a creative input is removed from the design outputs. This results in a homogenization of the design outputs. Also, Dreamcatcher can explore several designs, it doesn't prioritize or value the design of human architects. It is feared that architects will lose their identity and expertise as a result of this limitation. Dreamcatcher can generate powerful design solutions, but ultimately it has to be used along with human creativity to ensure rich style and character to the final designs.

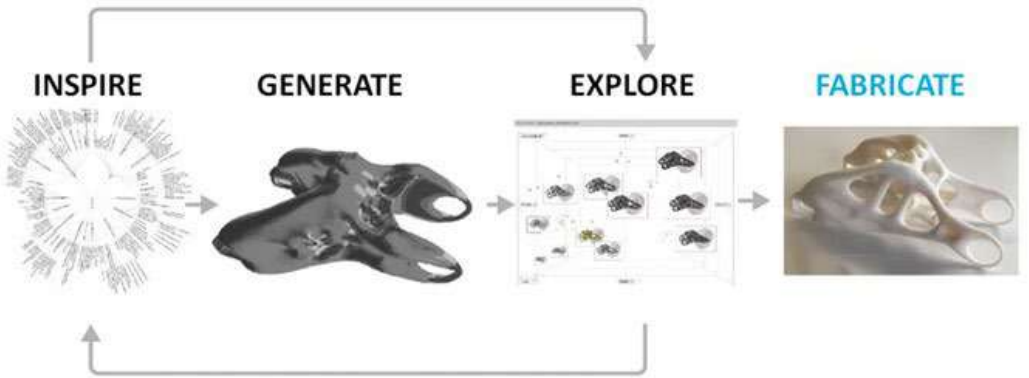



Figure 3: Dreamcatcher workflow

## 3. PERCEPTION STUDIES

Understanding how people perceive, experience, and emotionally respond to architectural space is not incidental to design but it is one of the main issues and constraints when it comes to evaluate or asses a design option. When it comes to the field of AI-generated architecture, this topic becomes even more fundamental. Indeed, even though contemporary generative tools can produce images at a speed and formal variety that goes beyond human capacity, we still pose to ourselves the question if those really correspond to what human beings actually find meaningful, comfortable, or spatially coherent when prompting and communication with the diffusion model behind the interface. This section aims to explain how perception studies were addressed as part of this research, arguing that empirical evidence on how users visually relate with AI-generated spaces from their own prompts is not merely a validation exercise based only on personal or aesthetic categories but rather have to be intended as a proper design input.

The scientific basis for this claim rests on a growing body of literature at the intersection of neuroscience and architecture. Contemporary researchers (e.g. Wang et al., 2024) have argued on how

distinct architectural features – such as curvature, scale, and luminosity of spaces – can activate distinct brain networks, including the default mode network (DMN), which it's at the base of self-referential thought, memory retrieval, and emotional processing. Therefore, the spatial decisions contained in an architectural image are to be considered not aesthetically neutral but they can stimulate specific neurological responses that impact how a person feels within, or even in front of, a designed environment. For AI-generated architecture, this has a direct implication considering that every generative model that has never been exposed/trained towards the perceptual consequences of its outputs it's likely not able to produce spaces that are emotionally coherent, despite of the complexity of its algorithm.

Wichmann and Geirhos (2023) points out that many generative models are exposed to what it is called "shortcut learning": the tendency to identify superficial statistical correlations in training data rather than the deeper structural principles that govern human perception as in many of the case studies analyzed in the previous sections. Indeed, a model trained to generate architectural visual out might learn to recreate the stylistic and visual signatures of common building typologies – such as rhythm, silhouette, materiality, etc. - without understanding in which way those characteristics can activate spatial and emotional experiences for the users that pass through those spaces. To fill this gap, there is the need to structure an assessment feedback loop that can link the output deriving from the model to real human perceptual responses. Bridging this gap requires an evaluative feedback loop that connects the outputs of generative models to real human perceptual responses. This research presents an attempt to structure a first methodology to overcome this issue through a perception experiment that was design precisely to receive from the users this kind of needed feedback.

A series of architectural images, all generated by the AI platform TheChair, were submitted to eye-tracking analysis using iMotions software - the industry standard for biometric and perceptual data collection – and five participants were engaged and exposed to generate images representing diverse spatial typologies: from intimate domestic interiors, to gallery spaces, from residential facades to an open-plan kitchen environment. The use of the eye-tracking sensors, facilitated the creation of a heatmap for each image to identify the attention intensity from the movements of the participants eyes, and while the red and yellow zones indicate areas with longer eyes' pauses, the green and blue zones indicate moderate or peripheral engagement, with the blank areas to be intended not interesting from a visual perspective.

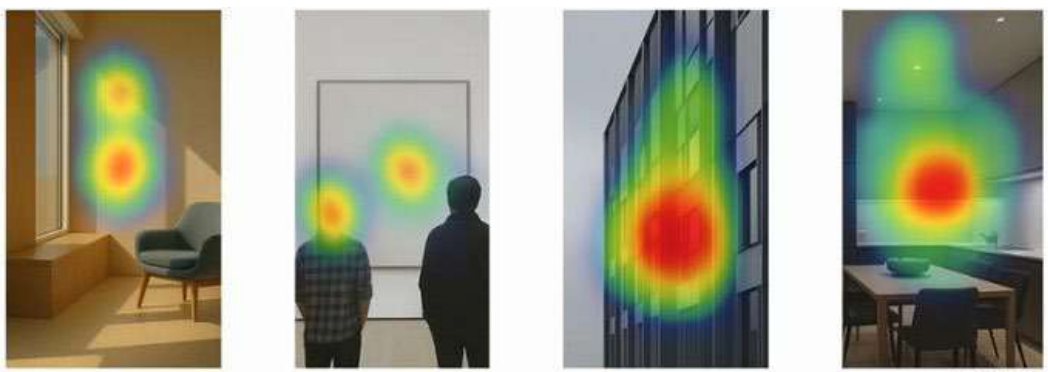


Figure 4: Heat Map Imotion Detection (E. Bushati)

What was identified as a pattern is that, on all the four typologies of the images presented to the participants, the attention always focused on some specific set of spatial qualities like natural light sources, human-scaled objects, material surface and their contrasts, and focal elements that suggested human direct interaction or simple presence. In the lounge interior, for example, both the window and the chair where the more considered focal points: the first one because of its luminosity range; the second because connected to the users' everyday use. In the image showing a gallery, the central artwork on the background is considered as attractive as the shadowed figures, confirmed the relation between visual cognition and the presence of humans (Chandra, 2025). The building facade image saw a big amount of attention toward window rhythms and surface articulation, while the kitchen scene drew fixation to the table centerpiece and vertical light volumes. What it is interesting to analyze is that, in each case, attention was not captured by formal complexity or geometric novelty but rather spatial legibility, material warmth, and the implicit presence human body and its relationship with those spaces.

These results embed a direct design consequence: they define the perceptual qualities that an AI generative platform must be able to produce if its outputs have the aim of framing architecture from the experiential sense of the term. Therefore, light, material specificity, human scale, and spatial hierarchy are not stylistic preferences to be replicated only from a visual perspective, but rather perceptual constants to determine whether a generated image reads as a livable space or a formal exercise. This insight is what connects the perception studies to TheChair experiment presented in this research. The platform was not designed with aesthetic goals in mind but with perceptual ones: in fact, the eye-tracking data from the participants provided an empirical map of what human vision seeks in architectural images from an emotional and perceptive point of view, and the maps from the eye-tracking movements became the implicit training criteria for the platform's generative model.

This affirmation relates to Pallasmaa's (2014) concept of peripheral perception. According to the him, architecture communicates not only through the elements that stimulate direct visual attention - the focal point of a room, the signature gesture of a facade - but through the atmospheric, tactile, and textural qualities that surround the user without ever being consciously annotated in his mind. Furthermore, the experiment's heatmap data not only highlighted the fixation and focus peaks, but also blank zones – the so-called areas of peripheral disengagement – which are equally informative.

In conclusion, the perception studies establish a double function in this research. On the one hand, they act as an empirical validation tool - a means of measuring whether the outputs of AI generative systems correspond to what human users actually attend to and value in architectural imagery. On the other, they represent a generative instrument: the evidence they produce about human visual behavior in space becomes the design brief for the creation of a platform that takes perception seriously as an input in the diffusion model database, rather than a stochastic expected outcome. In this sense, TheChair an be understood not as a tool that generates images for human evaluation, but as one that was itself shaped by human perceptual data: a platform built, from the outset, to acquire information and produce images based on how and what humans see.

## 4. THECHAIR: A HUMAN-ORIENTED GENERATIVE PLATFORM

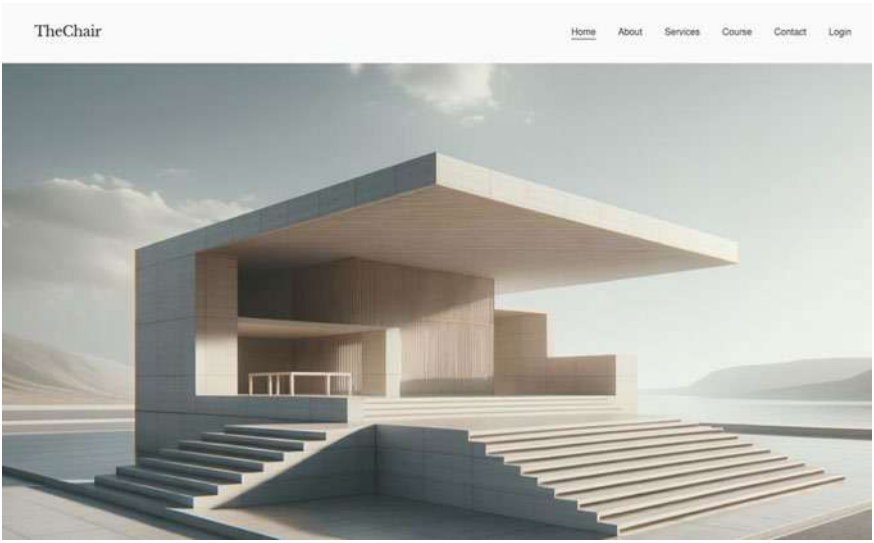



Figure 5: TheChair homepage (E. Bushati)

The original outcome is this research is the development of TheChair, a digital platform and architectural intelligence prototype which is still under development and limited to a selected number of users. The platform is the culmination of the theoretical and empirical work conducted throughout this study, that aim to translate to overcome the identified limitations of existing generative design tools through a concrete, functional alternative where the human component could be considered as a fundamental part in an AI-assisted design processes.

As explained before, the main motivation behind TheChair emerged from a critical observation: the existing and most diffused generative tools such as Midjourney, Stable Diffusion, etc. undoubtedly present visually and technically sophisticated outcomes, but also offer limited control over authorship, personalization, or cultural specificity of their users. Even though trained on large, anonymous datasets and can generate formally diverse outputs, these tools cannot reproduce the designer's personal architectural vocabulary and language (e.g., the spatial memory, the preferred material palette, the cultural references, etc.) that define individual authorship. TheChair was conceived to fill this gap: a platform where AI does not simply generate but responds — a partner to the designer, not merely a prompt executor.

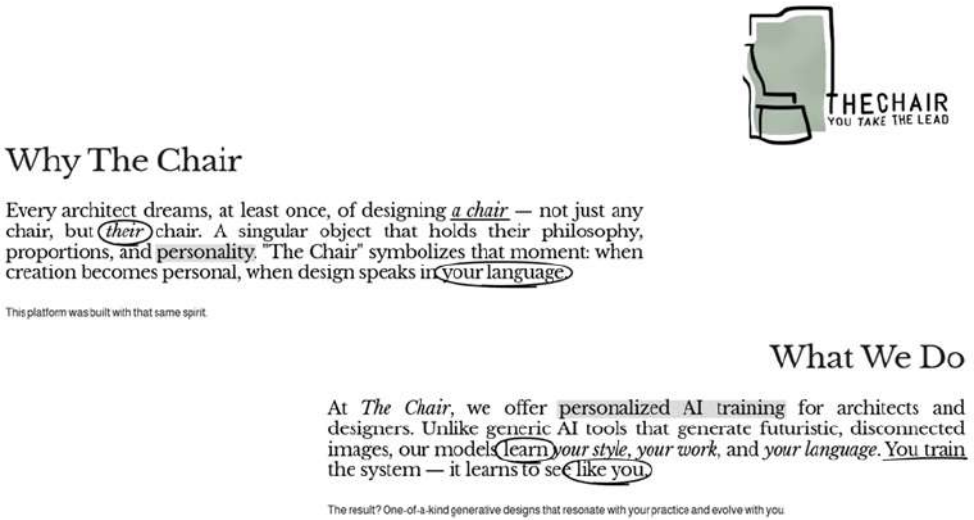



Figure 6: TheChair (About Section). (E. Bushati)

## 4.1. CONCEPTUAL FRAMEWORK AND TECHNICAL ARCHITECTURE

Philosophically, TheChair asks what it means to see - not in the biological sense, but in the architectural one: to see a space, a memory, a shadow, and to make something out of it. The platform insists that the training process must rely on personal data, not to monitor and merely map the user preferences, but to remember and generate with them. Every prompt submitted to the platform functions as a "Do you remember this?" question that tries to address the neural network from an emotional perspective; indeed, the machine answers with an image shaped by the visual and semantic memory the user has provided and described. Concerning the name, "TheChair" was chosen with deliberate symbolism. The chair is not merely an object or a functional furniture; it is an emblem of perceptual contemplation and reflection before action. In relation to this, Risueño Dominguez (2022) argues that furniture functions as our body's mediation with the world, unfolding in the sense of community and affectivity - a view that gives designers reason to rethink even the smallest elements of their practice. Therefore, the platform name wants to captures the idea of sitting still to sketch, to remember, and to imagine, while creating at the same time an emotional connection with the surrounding environment.

From a technical point of view, TheChair is a modular web platform consisting of front-end and back-end systems interconnected through a machine learning pipeline. The back-end is developed using Python and the Flask framework, intended as a lightweight server, with a PostgreSQL database managing user session data and image metadata. The image-generation engine is built on a customized implementation of

Stable Diffusion running on PyTorch - the AI core of the platform. Furthermore, the model is not used out of the box but is fine-tuned based on user-submitted content to increase its sense of personalization and human proximity. Currently, TheChair accepts up to 40 architectural images per user - including renders, sketches, collages, and drawings. These images are preprocessed through resizing, normalization, tagging, and fine-tuning of the model's architectural visual latent space. React.js and Tailwind CSS have been used to create the front-end interface with the aim of making it similar to a digital sketchbook, while three.js was studied for a possible further implementation of a module that could directly realize 3D visualizations of generated forms.

A TensorFlow.js allowed the functioning of BERT-based Natural Language Processing model, which is able not only to analyze the prompts but also to catalogue them in consideration of the used spatial semantics. This allows users not be confined to simple formal attributes of the desired outcome but also to enrich their prompts using a certain degree of phenomenological richness and variety - "a courtyard that feels hidden" or "a window where light lingers in the afternoon" - rather than being limited to formal attributes. The whole system is hosted on Google Cloud Platform that benefit from NVIDIA GPU virtual machines dedicated to a faster inference, with consistent versioning and deployment via GitHub Actions. The platform's components can be used also through local installation and offline use without the need of an internet connection.

Figure 7: Code applied for using generated images from TheChair Note. From "Code Section". (E. Bushati)

## 4.2. RESULTS AND COMPARATIVE ANALYSIS

The outcomes of TheChair can be understood through a confrontation with some standard and more diffused AI image generators on the market. For example, the same prompt - "A two-story house with a

pitched roof, large windows, and set in a green landscape, generated in photorealistic style at golden hour" - was used both to a mainstream AI platform and to TheChair and the resulting images differed from one another in terms of aesthetic character and, even more, in relation to an emotional register. The mainstream generator produced a hyper-futuristic, over-abstracted structure: angular, metallic surfaces, aggressive geometry, and an overall aesthetic that emphasized formal novelty and richness at the expense of habitability. The result was visually impressive but, in the end, spatially alienating with a tendence towards dystopian narratives. TheChair produced a completely different result considering its training trained personal vocabularies emphasizing human-scaled proportions and material warmth: warm stucco and timber surfaces, a soft lighting atmosphere, pale landscaping, and a clear sense of domestic familiarity. The difference was not accidental but the direct product of the platform's design philosophy. The algorithm shows promising features on being aware of the emotional sphere of colour and its relation to perception, through the specific training and the eye-tracking studies in the precedent section. Indeed, while other generators interpret "a house," TheChair the aim to understand how do people feel in relation to that house.

The generated images produced also responded meaningfully to prompts requiring cultural and geographic specificity. For example, a prompt stating "Stone masonry Mediterranean hill town, narrow winding streets, textured facades, terracotta roofs, crafted by local artisans" produced outputs with a recognizable regional character (material specificity, spatial rhythm, and tectonic logic) rather than a generic pastiche of different elements. Similarly, a prompt for "A hand-drafted axonometric drawing of a traditional Japanese teahouse, exposed wooden beams, tatami mats, nestled in nature, human-scaled proportions" generated outputs that respected the proportional and material logic of the described tradition, demonstrating the platform's capacity to operate with cultural sensitivity rather than cultural homogeneity.

Figure 8: TheChair – Generated Images. (E. Bushati)

Prompt 1: Stone masonry Mediterranean hill town, narrow winding streets, textured facades, terracotta roofs, crafted by local artisans

Prompt 2: A hand-drafted axonometric drawing of a traditional Japanese teahouse, exposed wooden beams, tatami mats, nestled in nature, human-scaled proportions

Furthermore, the heatmap perception studies conducted with the images generated by the system confirmed that participants engaged with the outputs in ways consistent with natural visual attention patterns: fixating on light sources, human-scaled objects, material contrasts, and spatial focal points. This alignment between generated imagery and natural perceptual behaviour represents a meaningful step toward AI-generated environments that are not merely formally interesting but genuinely habitable in the experiential sense.

## 5. DISCUSSION

The results of this study show that while neural networks have demonstrated satisfying abilities for form-finding, optimization, and rapid iteration, they repeatedly show a consistent lack knowledge and generative power in regards to the perceptual, emotional, and cultural dimensions that make architecture meaningful. Furthermore, the case studies, together with perception experiments, and the development of TheChair highlighted that one of the possible development directions for AI generative tools does not rely on the sophistication of generative models alone but rather on the possibility to develop specific frameworks within which those models are embedded.

The perception studies confirmed that human visual attention in architectural image generation is influenced and evaluated through a conscious/unconscious a complex interplay of light, human presence, material texture, and spatial rhythm: all qualities that existing generative tools reproduce inconsistently or just superficially. The eye-tracking data revealed that even AI-generated images can trigger meaningful engagement when they inherit from their dataset sufficient spatial legibility and material warmth. However, they also showed that generic AI outputs frequently generate visual complexity without perceptual coherence - images that are formally sophisticated but experientially disorienting.

Precisely. those perception studies have to be intended as a methodological contribution contained in this work – even though still at an initial stage. By generating empirical evidence - through eye-tracking and heatmap visualization - about how users actually attend to AI-generated architectural imagery, they transform perception from an implicit assumption into a set of explicit design criteria. The consistent pattern that emerged across all test images - fixation on light, human presence, material texture, and spatial hierarchy – can be used a series of perceptual standard through which any generative tool can be evaluated. TheChair represents a direct attempt to answer to these concerns. Using personal, user-submitted training data, the platform displaces the anonymous, aggregate dataset as the primary source of AI architectural knowledge and replaces it with individual authorial memory. This shift has implications that goes beyond the technical: it suggests that the appropriate role of AI in architecture is not to distil a universal spatial

intelligence from mass data but to amplify and extend the particular intelligence of each designer (Natarajan, Morales, Yi, 2025).

Figure 9: TheChair – Series of Generated Images. (E. Bushati, V. Perna)

## 6. CONCLUSIONS

This research has demonstrated that the integration of neural networks into architectural design practice goes along with significant promise balanced by significant risk. The promise lies in AI's capacity to accelerate iteration, expand the range of possible design solutions for the users, and bring quantitative rigor to questions of performance and optimization. On the other hand, the risk lies in the tendency of current generative models to give more importance to formal complexity over perceptual depth, and to reproduce biases already present in their training data, and therefore to menace the cultural specificity and authorial identity that give architecture its meaning (Hegazy, Saleh, 2023).

The perception studies conducted through eye-tracking and heatmap visualization have provided empirical evidence that human visual attention in architectural environments is driven by light, material texture, human presence, and spatial rhythm - qualities that AI generators must be explicitly trained to incorporate. Demmer et al. (2023) demonstrate that users respond more positively to environments perceived as intentionally designed for them, and less positively to those that appear algorithmically indifferent to their presence. These findings establish that perception is not a post-hoc evaluation criterion but a generative one: the data produced by observing how users see must inform how platforms are built. These findings showed how perception is not to be considered a post-hoc evaluation category but rather a generative one. In a few words, the data produced by observing how users see must inform how platforms are built.

TheChair currently stands as student prototype to highlight a possible way on how this human-centered vision of architectural AI might be deployed into practice. By grounding the generative model in personally uploaded architectural vocabularies, enabling phenomenologically rich prompting through natural language processing (Patel, 2023), and training the system to prioritize spatial warmth and material legibility, the

platform shows that AI-generated architecture can be both balanced on being computationally efficient while emotionally resonant. The comparative analysis between TheChair outputs and standard AI generators confirms that the philosophical and technical choices embedded in a platform's design have a direct and measurable impact on the perceptual quality of its outputs. Indeed, architecture cannot be reduced to the formal manipulation of geometry considering its peculiar quality of combining together spatial articulation with human experience, memory, and culture. Neural networks, however sophisticated, are tools in service of that articulation and must not be its autonomous authors. The architect's role in an AI-augmented design future is not to become a passive operator of generative systems but to become a more deliberate and critical curator of the data, prompts, and parameters through which those systems are trained to avoid homogenization and simple formal exploitation.

Future research should explore the scalability of personal-vocabulary training approaches, investigate multi-user collaborative frameworks for shared cultural vocabularies, and develop more robust methods for evaluating the emotional and phenomenological quality of AI-generated spaces (Sung, 2025). The integration of VR and real-time biometric feedback into perception studies would also significantly enhance the ecological validity of future experiments. TheChair itself remains a work in progress - a beginning rather than a conclusion - and its ongoing development will continue to be informed by the human-centered research principles established in this study.

## REFERENCES

Ahramovich, A. (2023). AI in architecture. iTransition. Retrieved from https://www.itransition.com/ai/architecture

Bernardini, F., Martin, I. M., & Rushmeier, H. (2002). High-quality texture reconstruction from multiple scans. IEEE Transactions on Visualization and Computer Graphics, 7(4), 318-332.

Cantemir, E., & Kandemir, O. (2024). Use of artificial neural networks in architecture: determining the architectural style of a building with a convolutional neural networks. Neural Computing and Applications, 36(11), 6195-6207.

Chandra, N. (2025). Deepfake-Eval-2024: A multi-modal in-the-wild benchmark of deepfakes circulated in 2024. arXiv preprint. https://doi.org/10.48550/arXiv.2503.02857

Colombo Zefinetti, F. (2023). Generative Design and Topology Optimization of Disk Brake Floating Carrie. ASME International Mechanical Engineering Congress and Exposition.

Del Campo, M., & Leach, N. (2022). Machine hallucinations: Architecture and artificial intelligence. Architectural Design, 92(3), 14–21.

Dhar, R., Vaidhyanathan, K., & Varma, V. (2024, June). Can llms generate architectural design decisions?-an exploratory empirical study. In 2024 IEEE 21st International Conference on Software Architecture (ICSA) (pp. 79-89). IEEE.

Salvo, G., Lashewicz, B. M., Doyle-Baker, P. K., & McCormack, G. R. (2018). Neighbourhood built environment influences on physical activity among adults: a systematized review of qualitative evidence. International journal of environmental research and public health, 15(5), 897.

Hegazy, M., & Saleh, A. (2023). Evolution of AI role in architectural design: between parametric exploration and machine hallucination. MSA Engineering Journal, 2(2), 262-288.

Lee, S., & Kim, J. (2020). Deep architecture with cross-guidance between single image and sparse LiDAR data for depth completion. IEEE Access, 8, 79801–79810.

Moussaoui, E. (2025). Architectural pedagogy in the age of AI: The transformation of a domain. In M. El Moussaoui & K. Krois (Eds.), School of architecture(s): New frontiers of architectural education (pp. 87–93). Springer.

Natarajan, S., Morales, A., & Yi, W. (2025). Human-in-the-loop or AI-in-the-loop? Automate or collaborate? arXiv preprint, 39(28), 28594–28600.

Pallasmaa, J. (2014). Space, place and atmosphere: Peripheral perception in existential experience. In C. Borch (Ed.), Architectural atmospheres: On the experience and politics of architecture (pp. 18–41). Birkhäuser. https://doi.org/10.1515/9783038211785.18

Patel, D. (2023). Pretrained language models as visual planners for human assistance. Proceedings of ICCV 2023.

Perna, V., & Kyratsis, P. (2025). Diffusion models in product design: optimizing form toward digital prototyping. CAD/CAM: Computer-Aided Design and Manufacturing, 17, 21.

Risueño Dominguez, M. (2022). The furniture as a mediator: A way of living in the sense of community and affectivity. Journal of Design and Society.

Toet, A., Henselmans, M., Lucassen, M. P., & Gevers, T. (2011). Effects of dynamic texture on the perceived mood of urban park scenes. Journal of Environmental Psychology, 31(2), 99–113.

Tomaszewski, P., & Lundberg, L. (2005). Software development productivity on a new platform: An industrial case study. Information and Software Technology, 47(4), 257–269.

Sung, W. (2025). Floor Plan Design Collaborator: A Data-Driven Approach to Assist Human Architects in Design Exploration (Doctoral dissertation, Massachusetts Institute of Technology).

Vogiatzaki, M. (2017). Editorial. archiDOCT 6(1), , 6–13.

Wang, R., Liu, J., & Xu, L. (2024). Segregation, integration, and balance of large-scale resting brain networks configure different cognitive abilities. Proceedings of the National Academy of Sciences, 121(10).

Wichmann, F. A., & Geirhos, R. (2023). Are deep neural networks adequate behavioral models of human visual perception? Annual Review of Vision Science, 9, 501–524.

Wortmann, T. &. (2019). From Optimization to Performance-Informed Design: Simulation-based Design Tools and Methods. SimAUD 2019: Proceedings of the 2019 Summer Simulation Conference.

Yousif, S. H. E. R. M. E. E. N., Clayton, M. A. R. K., & Yan, W. E. I. (2018). Towards integrating aesthetic variables in architectural design optimization. In 106th ACSA annual meeting proceedings, the ethical imperative. ACSA Press (pp. 430-436).

Zhang, Z. T., Tong, S., Liu, Y., & Butz, A. (2023, August). Is overreliance on AI provoked by study design?. In IFIP Conference on Human-Computer Interaction (pp. 49-58). Cham: Springer Nature Switzerland.

Zheng, H., & Yuan, P. F. (2021). A generative architectural and urban design method through artificial neural networks. Building and Environment, 205, 108178.

# CATALYZING ARCHITECTURAL INVENTION: AI MIMESIS AND CRITICAL RECOMPOSITION IN DESIGN EDUCATION

Fabio Balducci
Department of Architecture and Design, Sapienza University of Rome
Via Flaminia 359, 00196 Rome, Italy
*fabio.balducci@uniroma1.it*

## ABSTRACT

This paper examines how generative AI can enter first-year architectural pedagogy as a driver of recombinatory invention. Framed within a theory of creative mimesis, AI is treated as a contemporary extension of architectural memory that helps students move from precedent to project through critical recomposition. The topic is especially relevant today because AI is rapidly permeating design practice and education, making it necessary to define forms of AI literacy grounded in judgment, representation, and the formulation of design questions.

Methodologically, the paper presents an ongoing exploratory case study developed at Sapienza University of Rome. The research combines theoretical reflection and studio experimentation through lectures on invention, type/model, and generative AI; curated dataset building from canonical and contemporary works; supervised multimodal and image-generation experiments; analogue–digital hybridization through interpretive drawings, tectonic maquettes, and verified CAD; and iterative critiques with visiting critics. The study draws on the analysis of exercises, reviews, and student outputs produced across the different stages of the protocol.

At this preliminary stage, the experiment suggests the pedagogical potential of AI in supporting the critical reading of precedents, widening the field of formal variation, and strengthening the relation between image-based exploration and compositional decision-making. It also points to the importance of explicit attention to authorship, data selection, and bias. The contribution of the paper lies in outlining a transferable studio protocol that combines theoretical ambition with controlled experimentation, offering a concrete trajectory in design education for integrating AI while preserving architectural judgment.

**KEYWORDS**: AI Literacy; Architectural Mimesis; Critical Recomposition; Architectural Pedagogy; Invention

## 1. INTRODUCTION AND METHODOLOGY

Architectural design education constitutes a decisive field in which the discipline clarifies its own statutes, tests its instruments, and transmits its forms of knowledge through operative practice (Leveratto and Brighenti, 2024). Within the recent reflections developed at Sapienza, the design studio emerges as an environment of learning where theories, techniques, spaces, and subjects form a productive relation, shaping a pedagogical horizon founded on experience, dialogue, and critical construction of autonomy. This paper is situated within that horizon and investigates the integration of artificial intelligence into the didactics of architectural design as a question internal to the culture of the project itself. Its theoretical premise lies in the idea that invention proceeds through the recombination of pre-existing elements selected within a memory understood as archive, imagination, and repository of figures. Mimesis, in this sense, acquires a generative value: it offers the ground on which architectural knowledge is decomposed, interpreted, measured, and re-elaborated until it becomes a new project. The research therefore focuses on the passage from translation to transformation, from the critical reading of models to the emergence of an autonomous design voice. Within this process, AI could expand the field of architectural pedagogy by intensifying the operations of selection, comparison, variation, and recombination that already belong to the discipline's formative tradition (Carpo, 2023). The methodological framework combines theoretical inquiry and studio experimentation. It draws on the operative conception of learning formulated by Luigi Pareyson (Pareyson, 1954), on the didactic role of imitation and its conscious betrayal within the first-year design studio, and on an ongoing Sapienza research project that tests guided interactions between students and multimodal conversational and image-generation systems through lectures, dataset construction, image-based experiments, drawing, collage, model making, and collective reviews. As an exploratory case study, the research is based on the observation of the studio process and on the analysis of exercises, intermediate reviews, final outputs, and comparative discussions developed across the four stages of the protocol. At its current stage, the paper aims to clarify the conceptual premises of the experiment, describe its pedagogical structure, and identify its first critical implications for architectural judgment, authorship, and design learning.

## 2. SCIENTIFIC BACKGROUND AND RESEARCH PROBLEMS

Recent debate on architectural pedagogy in Italy has restored a strong disciplinary centrality to the design studio, understood as the environment in which architectural knowledge is organized, transmitted, and verified through integrated forms of learning. In this framework, the wider DT2 initiative—The Recovery Demand and the Educational Supply: A Design Toolkit for Design Teaching—offers a particularly relevant horizon. Developed as a PRIN (Projects of Relevant National Interest) 2022 research project, an editorial platform, and a space for exchange on architectural education, DT2 focuses on the pedagogical model of the design studio and investigates its methodological infrastructure, including class organization, coordination among courses, and the relation between teaching formats and emerging social demands. Its broader objective lies in promoting, among future architects, a critical vision of design capable of overcoming

the traditional separation of specialized knowledge and of restoring the synthetic vocation of the project (Leveratto and Brighenti, 2024).

Within this horizon, first-year education acquires a strategic value, since it coincides with the formation of an initial architectural grammar, the acquisition of operative methods, and the construction of a repertoire of figures, precedents, and compositional procedures. The research problem addressed in this paper emerges at the intersection of that foundational pedagogical field and the rapid expansion of artificial intelligence in higher education and design culture (Bond et al., 2024; Mustafa et al., 2024; Qian, 2025). AI has already entered a broad spectrum of academic and professional debates (Kasneci et al., 2023; Bond et al., 2024), while its implications for architectural design teaching still call for a more precise theoretical framing and a more controlled methodological verification. The issue therefore concerns the ways in which generative systems can enter the studio as instruments of inquiry, comparison, and recombination, contributing to the formation of judgment, authorship, and critical awareness within the disciplinary culture of design (Allen and Kendeou, 2024; Kim et al., 2022; Ng et al., 2021).

## 3. MIMESIS, OPERATIVE LEARNING, AND ARCHITECTURAL RECOMBINATION

Architectural pedagogy takes shape within a formative tradition that assigns a central role to making, interpretation, and the progressive construction of judgment. Luigi Pareyson's Teoria della formatività, first published in 1954, offers a crucial philosophical foundation for this horizon, because it understands artistic learning as an operative process in which form emerges through action, verification, and continuous adjustment (Pareyson, 1954).

From this perspective, design education advances through exercises that organize observation and transformation into method. Mimesis acquires, in this field, the value of an active cognitive procedure: precedents become structures to be read, decomposed, measured, and reworked, so that the project can grow from a disciplined engagement with existing forms toward an autonomous elaboration of new relations (Pareyson, 1954; Carpo, 2023). Within this broader pedagogical lineage, John Hejduk's Education of an Architect and the Nine-Square Problem occupy a significant position, framing the design exercise as a controlled exploration of elementary spatial relations and of the productive tension between rule and deviation (Franzen et al., 1999). Current debate on generative AI has brought this question back to the centre of architectural theory. Mario Carpo's recent reflections on AI, imitation, style, and precedent identify machine learning as a technology of patterned recognition and variation that reactivates the historical problem of imitation within contemporary visual culture (Carpo, 2023). In this light, the dataset becomes a field of selection, hierarchy, and interpretation; recombination becomes a design operation; and authorship is redefined as the capacity to guide, filter, and critically reframe the outputs of automated variation. AI therefore enters architectural education as an intensifier of disciplinary operations that already belong to the longue durée of design pedagogy: memory, choice, analogy, transposition, and invention.

## 4. THE SAPIENZA CASE STUDY: DESIGN STUDIO 1 AS A PEDAGOGICAL DEVICE

The case study develops within the first-year Design Studio of the Bachelor's degree in Architectural Sciences at Sapienza University of Rome, a course structured through a two-semester teaching model, with mandatory attendance, a class of about eighty students, and the support of a group of tutors working through smaller seminar units. This organization gives the studio the character of a collective pedagogical device in which continuity of objectives coexists with methodological differentiation, and where the tutor assumes a decisive mediating role in the transmission, translation, and verification of the design process. The first semester functions as a design gymnasium centred on elementary architectural figures—wall, column, opening, roof, stair—and on the progressive construction of a grammar of space through observation, abstraction, drawing, and model-making. The second semester transfers this initial disciplinary armature into a fully urban condition, where precedents become instruments for contextual interpretation and for the controlled transformation of architectural form. Within this didactic sequence, the movement from imitation to invention acquires an operative consistency: students read, redraw, decompose, and recompose selected models until they become capable of producing situated project hypotheses with growing formal and critical awareness. The research on AI is embedded in the studio from the outset, entering the first semester through exercises of visual reading and elementary spatial articulation, and becoming progressively more explicit in the later phases, as the internal logic of the course unfolds. Generative tools therefore do not appear as an external addition to an already completed pedagogical structure, but as a differentiated set of instruments distributed across the full didactic sequence. Their outputs are subsequently filtered through drawing, collage, maquettes, and collective review. The Sapienza case therefore offers a particularly fertile ground for exploring how AI may intensify architectural learning within an environment governed by dialogue, authorship, and disciplinary control.

## 5. EXPERIMENTAL PROTOCOL: AI AS AN INSTRUMENT OF ANALYSIS, VARIATION, AND AUTHORIAL CONTROL

The experimental protocol is structured as a progressive sequence of four exercises through which AI enters the studio as an instrument of reading, transformation, and critical verification. At the operational level, the protocol combines two distinct families of models. The first includes multimodal conversational systems, here tested primarily through ChatGPT and Gemini, used for visual reading, prompt construction, comparative critique, and iterative verbal reformulation of design intentions. The second includes controllable image-generation workflows based on open or low-cost diffusion models—here exemplified by FLUX.1-schnell and Stable Diffusion 3.5—implemented through the node-based environment ComfyUI and guided through ControlNet conditions derived from edge maps, sketches, grids, and reference images. This distinction allows the studio to separate dialogic interpretation from controlled visual transformation, assigning to each family of models a specific pedagogical role.

In the first exercise, centred on visual perception and relief, students conduct a Gestalt reading of an image and translate its internal forces into a small sculptural panel. Here conversational systems support

the analytical phase through description, comparison, and prompt refinement, while controlled diffusion workflows generate visual variants from the students' own graphic reductions.

In the second exercise, which reworks the Nine-Square Problem within a 3×3×3 grid, the same systems assist the formulation of the rule-based grammar of the exercise, whereas diffusion models conditioned by the grid and by minimal sketches act as morphological provocateurs, multiplying formal alternatives without dissolving the syntactic constraint that underpins the work.

The third exercise, focused on the relation between model and context, introduces a more explicit human–machine workflow: students select a precedent, define contextual invariants, generate an adapted proposal through image-to-image procedures, and then revise it through sketches and targeted corrections. In this phase, conditional GAN-based image-to-image translation remains a research option rather than the default classroom solution: conditional models such as pix2pix or CycleGAN become relevant when sufficiently coherent paired or unpaired datasets can be assembled, whereas diffusion-based adaptation currently offers a more accessible and controllable workflow for studio teaching.

The fourth exercise, the inventive plate, condenses the process into a manifesto image capable of distilling the poetic core of the project through collage, drawing, and selective recombination of references. At this stage, conversational systems support image prompting and comparative evaluation, while diffusion models produce controlled layout, style, and model-mixing variants that students edit, overwrite, and finalize manually.

Across the four exercises, the protocol constructs a coherent pedagogical trajectory: analysis becomes pattern recognition, pattern recognition becomes spatial grammar, spatial grammar becomes contextual adaptation, and adaptation becomes invention. In this way, AI is positioned as a tool that can potentially reinforce the studio's traditional operations—comparison, abstraction, recombination, and verification—while keeping judgment, authorship, and formal control at the centre of the design process (Kim et al., 2022).

## 6. AUTHORSHIP, CONTROL, AND THE NON-NEUTRALITY OF TECHNOLOGY

The integration of AI into the design studio reshapes the conditions under which authorship is formed and exercised. In this pedagogical framework, authorship lies in the capacity to construct the dataset, define the field of references, orient the prompt, interpret the output, select relevant variations, and transform algorithmic material into an architectural proposition governed by judgment. Control therefore becomes a multilayered operation involving choice, verification, reduction, correction, and compositional synthesis. In this perspective, authorship does not coincide with the origin of every formal variation, but with the capacity to establish criteria of relevance, redirect the process, and convert variability into architectural intention.

The project takes shape through a continuous oscillation between automated proliferation and critical restraint, and for this very reason the teacher's role acquires greater intensity: guidance, discussion, and collective review become the places in which the value of the generated image is tested against spatial coherence, contextual pertinence, tectonic plausibility, and formal necessity. Within such a process, technology appears as a cultural agent endowed with specific logics, constraints, and biases (Bond et al.,

2024; Mustafa et al., 2024). Its presence affects the hierarchy of references, the readability of form, the speed of variation, and the very perception of what counts as a plausible projective move. A pedagogical use of AI therefore requires explicit forms of literacy capable of making these conditions visible and discussable (Allen and Kendeou, 2024; Ng et al., 2021). The studio becomes the site in which students learn to recognize the power of generative systems without surrendering the autonomy of architectural thought. This critical stance gives consistency to a broader humanistic ambition already embedded in the research: to inscribe emerging technologies within a disciplinary culture centred on invention, responsibility, and reflective awareness, so that the expansion of technical means may correspond to an equally strong expansion of judgment.

## 7. PRELIMINARY OUTCOMES AND DIDACTIC IMPLICATIONS

Since the experiment is still underway, its outcomes remain provisional and should be read as early indications rather than consolidated results. At this stage, the pedagogical trajectory suggests several lines of interest. The first concerns the progressive consolidation of both technical and conceptual skills, which appears in the students' movement from the translation of references to their conscious reworking, and from that reworking to the initial emergence of a more autonomous design voice. A second indication lies in the strengthening of critical reading as a design competence: interaction with AI-generated visual variants seems to encourage students to compare, classify, select, and verify formal hypotheses with greater explicitness, making the criteria of judgment more visible within the studio discussion. A third implication concerns the quality of the questions that structure the project. The experimental protocol appears to foster a more reflective relation between image and form, between figurative suggestion and spatial decision, and between the proliferation of possibilities and the necessity of compositional control. In this sense, the pedagogical value of generative AI lies in its capacity to widen the field of variation while intensifying the demand for choice. Drawing, model-making, collage, and collective review acquire a sharper function as instruments through which generated material is tested, corrected, and transformed into architecture. Within the limits of an ongoing single-case experiment, these preliminary observations suggest that the integration of AI into the first years of architectural education may reinforce the formative sequence that leads from mimesis to invention, provided that the process remains anchored to a rigorous studio structure, to explicit criteria of evaluation, and to a strong humanistic conception of authorship and responsibility (Kim et al., 2022; Allen and Kendeou, 2024; Qian, 2025).

## 8. CONCLUSION

The Sapienza case study suggests that the integration of artificial intelligence into architectural design education can support the formative sequence through which students move from imitation to invention, from the reading of precedents to the construction of autonomous projective hypotheses. Within this framework, AI acquires pedagogical value as an instrument of analysis, variation, and critical verification,

capable of intensifying those operations of comparison, abstraction, recombination, and judgment that already belong to the disciplinary tradition of the design studio. The experiment also indicates that authorship retains a central role when the process is governed by explicit criteria, by the continuity of drawing and model-making, and by a strong culture of review and discussion. More broadly, the case points to a significant question for contemporary architectural pedagogy: generative technologies expand the field of available tools and require a corresponding refinement of critical literacy, methodological control, and reflective awareness (Allen and Kendeou, 2024; Bond et al., 2024). The present paper remains limited to an ongoing exploratory case study and therefore calls for further comparative and longitudinal verification. Even at this preliminary stage, however, it outlines a promising direction in which technical experimentation, theoretical inquiry, and pedagogical practice converge in the redefinition of architectural learning.

## ACKNOWLEDGEMENTS

The present paper is part of the research project Artificial Intelligence and Architectural Design education. Integration of machine learning in the creative process, developed within the 2024 Sapienza research funding framework.

## REFERENCES

Allen, L.K. and Kendeou, P. 2024. ED-AI Lit: An Interdisciplinary Framework for AI Literacy in Education. Policy Insights from the Behavioral and Brain Sciences, 11(1), pp. 3–10.

Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S.W. and Siemens, G. 2024. A meta systematic review of artificial intelligence in higher education: a call for increased ethics, collaboration, and rigour. International Journal of Educational Technology in Higher Education, 21, Article 4.

Carpo, M. 2023. Formal Analysis, Generative AI, and the Eternal Return of Precedent. Log, 58, pp. 133–139.

Franzen, U., Pérez-Gómez, A. and Shkapich, K., eds. 1999. Education of an Architect: A Point of View. The Cooper Union School of Art & Architecture: 1964–1971. New York: The Monacelli Press.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeiffer, F., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., Stadler, M. and Kasneci, G. 2023. ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274.

Kim, J., Lee, H. and Cho, Y.H. 2022. Learning design to support student-AI collaboration: perspectives of leading teachers for AI in education. Education and Information Technologies, 27, pp. 6069–6104.

Leveratto, J. and Brighenti, T., eds. 2024. Il laboratorio di progettazione. Note per un progetto didattico. Milano–Udine: Mimesis.

Mustafa, M.Y., Tlili, A., Lampropoulos, G., Huang, R., Jandrić, P., Zhao, J., Salha, S., Xu, L., Panda, S., Kinshuk, López-Pernas, S. and Saqr, M. 2024. A systematic review of literature reviews on artificial intelligence in education (AIED): a roadmap to a future research agenda. Smart Learning Environments, 11, Article 59.

Ng, D.T.K., Leung, J.K.L., Chu, S.K.W. and Qiao, M.S. 2021. Conceptualizing AI literacy: An exploratory review. Computers and Education: Artificial Intelligence, 2, 100041.

Pareyson, L. 1954. Estetica: teoria della formatività. Torino: Edizioni di filosofia.

Qian, Y. 2025. Pedagogical Applications of Generative AI in Higher Education: A Systematic Review of the Field. TechTrends, 69, pp. 1105–1120.

**CIP Katalogimi në botim BK Tiranë**

6th International conference on architecture and urban design: 6-ICAUD: proceedings / edt. Edmond Manahasa, Valerio Perna, Anisa Cenaj. - Tiranë: Epoka - Turgut Ozal Education, 2026.
284 f. ; 16.5x23.5 cm.
ISBN: 9789928135476

71/71 (062)

ISBN:9789928135476