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Photograph: *Largo da Pena Ventosa* in Historic Centre of Porto, Portugal. The photo was taken by Silvia Spolaor on 7 July 2023.

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EDITORIAL NOTE

Re-Centring the Built Environment and Forms in a Transforming World

Across geographies and disciplines, the built environment is undergoing profound transformation. Urban expansion, demographic shifts, climate pressures, technological acceleration, and changing patterns of mobility continue to reshape how cities grow, how territories adapt, and how individuals experience space. In this moment of global uncertainty and renewal, Built Form reaffirms its commitment to centring the built environment as a critical lens through which contemporary societal change and forms must be understood. Planning, urban design, and architecture are fields concerned with form-making or spatial arrangement on the one hand; they also offer interpretive frameworks for navigating ecological fragility, social complexity, and technological possibility on the other hand. This issue of Built Form brings together contributions that reflect this expanded responsibility. Each article opens new ways of reading and reshaping environments in transition.

The article 'The Syntax of Campus Planning: A Comparative Analysis of Qatar University and Education City in Doha, Qatar' examines two emblematic academic landscapes: Qatar University and Education City. Through figure-ground mapping, space syntax, and morphological analysis, the authors reveal how campus design mediates movement, legibility, and climatic realities. Their comparative study highlights the tensions between scale and intelligibility as campuses evolve into larger, more fragmented territories. The findings offer a reminder that contemporary educational environments must be more than collections of buildings; they must be coherent, walkable, and socially legible spaces that support meaningful academic life. As urban campuses increasingly resemble micro-cities, the need to integrate historical campus models with contemporary infrastructural demands becomes ever more urgent. Territorial transformation is approached from another perspective in the article 'Designing with Geomorphology: Adaptive Territorial Strategies for Regenerative Public Space in Southern Italy'. Here, regeneration is not framed as reconstruction but as reinterpretation. Instead of treating demographic decline as a condition of loss, the authors propose an alternative methodology—Reclaiming Without Antagonism—that views emptiness as a productive terrain. Through biophilic design, biomimicry, and Nature-based Solutions, the project reactivates interrupted metabolic flows and redefines the cultural meaning of voids. This contribution speaks to fragile territories worldwide, offering a replicable model for designing with, rather than against, ecological and demographic realities. Transformation also occurs at the level of perception and learning. The article 'Teaching Architecture Through Film: An Interdisciplinary Approach' presents an innovative teaching model where architecture is introduced through film. By focusing on experiential elements—light, sound, scale, landscape, and colour—students connect cinematic space to their own memories and bodily experiences. This pedagogical approach expands the cultural accessibility of architecture and demonstrates how new modes of education can cultivate architectural awareness beyond disciplinary boundaries. As built environments become increasingly complex, building public literacy around space is not optional but necessary. Historic cities, too, are re-contextualised through new tools. In a pioneering methodological contribution, the article 'A Pioneering LISP Framework for Diachronic Urban Analysis' introduces a LISP-based computational framework for analysing diachronic urban morphology. Grounded in the Italian school of urban morphology, the method automates the classification of urban elements across historical phases. The case study of Kashan illustrates how computational techniques can reveal spatial logics and typological transformations that traditional mapping alone cannot capture. At a moment when AI and digital methods are reshaping the discipline, this work offers a bridge between deep morphological theory and computational innovation. Finally, the article 'Assessing E-Motor Bikes Adoption: Challenges and Opportunities, The Case of

Nyarugenge District' turns attention to mobility transitions in rapidly developing urban contexts. Despite high awareness and perceived benefits, adoption is slowed by infrastructural and regulatory gaps. Yet the findings also highlight public support for environmentally responsible mobility solutions. The study demonstrates how transportation, technology, and policy intersect in shaping sustainable cities—reminding us that mobility systems are not neutral infrastructures but central components of urban transformation.

In addition to the research articles, Vol. 1, Issue 2 presents two thought-provoking viewpoints that extend our understanding of heritage in contemporary contexts. The first examines Berlin's modernist social housing estates, highlighting how the preservation of twentieth-century welfare-state architecture can serve as a form of progressive urbanism. These buildings—once criticised—now offer lessons on social equity, civic engagement, and the political potential of housing in times of crisis, demonstrating that heritage protection can challenge market-driven urban development and reinforce inclusive planning. Complementing this, the second viewpoint explores Göbeklitepe's unofficial heritage and associated local practices. By considering the intangible, living traditions of the local community alongside the globally recognised archaeological site, the viewpoint emphasises the value of inclusive heritage narratives that integrate local knowledge, ritual, and memory, enriching our understanding of both the past and its ongoing significance.

Taken together, these contributions show that re-centring the built environment and forms today requires more than designing spaces; it requires rethinking how we analyse, regenerate, teach, and inhabit them. The built environment and form are not fixed backdrops to human activity—it is an evolving medium through which societies negotiate identity, resilience, and possibility. This issue reflects the mission of Built Form: to connect research and real-world applications, and provide a platform where diverse voices and methods converge. We hope the works presented here encourage readers to envision new pathways for shaping resilient, legible, and meaningful environments. The transformations unfolding across our cities and territories call not only for technical expertise but for renewed imagination. In this shared endeavour, we invite both researchers and practitioners to continue advancing the conversations that will define the built environments and forms of tomorrow.

Muzaffer Ali Arat

BUILT FORM

The Syntax of Campus Planning: A Comparative Analysis of Qatar University and Education City in Doha, Qatar

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Abstract

The paper examines the campus planning of Qatar University (QU) and Education City in Doha, Qatar. The comparative study includes figure-ground mapping, land-use classification, active frontage assessment, building height documentation, pedestrian shed analysis, and space syntax analysis to evaluate the morphological and spatial configuration of these campuses. It serves as a foundation to explore the evolution of the 'campus' concept from its historical roots to contemporary forms. Both campuses are large. Free-standing buildings tend to compose both campuses, distinct from traditional urban-block structures, with a typical block size that is over twice the average for other Doha neighborhoods (Major & Tannous, 2024). Key findings include that the QU campus developed centrifugally (center outward), while Education City grew centripetally (edges inward). Education City shows more active frontages and greater building-height diversity than QU's more uniform low-rise profile. Vast distances and extreme summer heat hinder pedestrian accessibility, which metro, tram, and bus systems only marginally mitigate, favoring 'edge-in' vehicular access. Space syntax analysis reveals poor intelligibility, as peripheral expansions disrupt QU's original masterplan, while Education City's layout lacks any spatial coherence beyond its entry roads. Based on the review and analysis, the paper articulates three theoretical campus models: enclosed, edged, and scattered. Through all-line axial analysis and Visibility Graph Analysis (VGA), we argue that 1) the enclosed model can enhance focal visibility and multi-directional movement, and 2) the edged model can help to prioritize edge-to-edge readability, while 3) the scattered model tends to disperse visual and linear integration, resulting in reduced clarity for users. The paper concludes that contemporary campuses, such as QU and Education City, must integrate elements from all three models as their scale increases. However, they may suffer from compromised walkability and intelligibility if not carefully designed. The practical implications of these findings are significant, as they can inform planning practices and suggest improvements for campus walkability and coherence.

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Introduction

We have used the word ‘campus’ since the Age of Enlightenment in the 17th century. It derives from Latin origins, meaning ‘a flat place, field, or plain,’ intrinsically related to the English word for camp. In Arabic, a university campus is haram aljamiea. Haram means restricted, forbidden, or sanctuary, whereas aljamiea means the inclusive or comprehensive gathering or assembly. Relying on hundreds of sources for the Online Etymology Dictionary, Harper (2001) argues that the first use of the word ‘campus’ in the academic sense occurred in 1774 at Princeton University in the USA, referring to a large open space on the college grounds. In 1826, it was used to describe the open square (~10 acres or 40,500 m²) located between buildings at the University of South Carolina in Columbia. This use expanded in the 19th century, eventually encompassing university buildings during the 20th century. Today, it refers to the physical space of an educational institution, typically a university, encompassing all the buildings and the surrounding land. In the 20th century, the concept of a campus expanded to encompass other, primarily non-educational settings and non-residential land uses, such as medical, business, and industrial facilities. It has evolved to mean that a campus could be 1) a single, identifiable, contiguous area or 2) a collection of buildings dispersed across a wider geographic area. The latter is more of an abstract, legalistic concept (i.e., related to ownership, identity, and economic opportunity). The former is a more concrete, morphological one grounded in a specific place.

Figure 1. Bird’s eye views of the campuses of (top left) University College London in the UK (Source: UCL/Polina Bayvel) and (top center) the University of Chicago in the USA (Source: University of Chicago), (top right) Mayo Clinic in Jacksonville, Florida (Source: Mayo Clinic), (middle left) Apple Park in Cupertino, California (Source: Daniel L. Lu/Wikipedia Creative Commons Attribution-Share Alike 4.0 International License), (middle center) Googleplex in Mountain View, California (Source: © 2018 David Oppenheimer), (middle right) the Jebel Ali

Industial Area Free Zone in Dubai, UAE (Source: UAE Ministry of Economy), and the (bottom left) Qatar University campus looking south focused on the central area of the original masterplan (Source: Aga Khan Trust for Culture) and (bottom right) northern part of the main campus in Education City looking east toward the Qatar Foundation Building, the Green Spine, and Qatar National Library (Source: Qatar Foundation).

Our contemporary use of the word 'campus' has become increasingly expansive, abstract, and complex to understand and study. For example, the physical delineation of the urban campuses of universities, such as University College London (UCL) in the United Kingdom (UK) or the University of Chicago in the United States of America (USA), is as much driven by the availability of land/buildings and economic opportunity as anything else. Non-educational campuses rely on other land-use factors, such as large-scale accessibility to major transportation routes and corridors (e.g., vehicular, rail, and water), commuter distances to housing opportunities, or calibrated separation from residential areas (in the case of industrial campuses). Examples of these campus types in the USA include the Mayo Clinic in Rochester, Minnesota, and Jacksonville, Florida; Apple Park in Cupertino, California; the Googleplex in Mountain View, California; and Tesla Giga Texas in Austin, Texas. Even singular, contiguous campuses have become so physically large that they are often referred to as areas or cities, as in the Middle Eastern example of the Industrial City. For instance, Ras Laffan, Mesaieed, and Dukhan in Qatar, or Mafraq in Abu Dhabi and Jebel Ali in Dubai, in the United Arab Emirates (UAE), both of which have a separately defined ‘Industrial City’ located further east and southwest, respectively. Even singular, continuous areas of educational campuses have become so large that they may be considered distinct cities, such as the University City in Sharjah, the Academic City in Dubai, and the Masdar City in Abu Dhabi in the UAE. It is also evident in Qatar, with Education City and Qatar University (QU) campuses in Doha. The latter is in north Doha, whereas the former is in west Doha, in relation to Doha Bay and the city’s historical origins near Souq Waqif in Old Doha (Figure 1). Both campuses are large, spanning 4.32 square kilometers (km²) (1,068 acres or ac) for the QU campus and 5.57 km² (1,376 ac) for the main campus of Education City. They are not as large as some American university campuses. For example, the largest public university campuses in the USA range from the University of Michigan in Ann Arbor (~3,000 acres) and Texas A&M University in College Station (~5,200 acres) to the United States Military Academy in West Point, New York (~16,000 acres) (Carnegie Dartlet, 2025).

The educational campuses in Doha serve as case studies for this paper. It includes a brief literature review of recent research on campuses, focusing on universities that utilize space syntax analysis, and examines the master plans and development strategies of both campuses. The review also outlines the research design and methodology used in our study of Education City and Qatar University. It includes on-site surveys documenting block sizes using figure-ground analysis, ground-level land uses, active and inactive frontages, and building heights, as well as space syntax analysis of their layouts. At the heart of this paper is a general question. What is a campus, in the more traditional sense of the word? We do not pretend to offer a definitive answer to this question. Instead, we use the morphological and spatial analysis of these campuses to lay a foundation. It enables us to have a more in-depth theoretical discussion about the nature of the campus and its potential contributions to future planning efforts for both traditional and non-traditional campuses in diverse locations worldwide. In this study, we are explicitly referring to a campus in its physical sense, i.e., its form. We are not exploring what digitally enabled urbanism can mean for a campus through its functional sense. This distinction is crucial as it sets the boundaries of our research. There are many debates on the meaning of a campus in its ontological sense, especially within digitalization and its accompanying emergent virtual realities. Platform Urbanism, a leading movement that merges digital (hidden) realities with the physical and social (visible) realities, is such an example (Barns, 2020).

Campuses and space syntax in the literature

The spatial dynamics of education settings in building analysis have been of theoretical interest to space syntax researchers for a long time. This interest tends to focus on the interface between inhabitants and visitors – those who belong, i.e., one of us, and those who do not, i.e., the Other – in long and short models of architectural space, emphasizing the role of strong and weak programming in shaping architectural space (Hillier & Hanson, 1984; Hillier, 1996). In this sense, they tend to focus on campuses with well-defined edges, delineating the difference between inside and outside, unlike the urban campus samples mentioned earlier. In urban analysis, space syntax researchers often treat campuses (educational, business, or industrial) as just another means of defining the edges of a site, like any urban development or neighborhood. It is fair to argue that this is correct, as urban issues are always contextual, one way or another, due to broader factors such as urban growth and development, movement patterns, and land-use planning. Stonor and Major's (1997) involvement as consultants for Space Syntax Limited in Michael Hopkins and Partners' (now Hopkins Architects) masterplan project for the University of Nottingham's Jubilee Campus is a classic example. It was an urban regeneration project on a brownfield site, formerly a bicycle factory, designed to subtly separate pedestrian and vehicular movement without detracting from its overall functionality as a place (Stonor & Major, 1997). The original site was 6 hectares (ha) or 15 acres (ac) in size, approximately 3.2 km (2 miles) from the city center (Source: Hopkins Architects). The campus opened to students in 1999 and later expanded to 26 hectares (65 acres) (Source: University of Nottingham). There was little, if any, explicit thought, nor was there time available to contemplate more significant questions, such as what a campus is or should be as a morphological thing.

Of course, there are many space syntax researchers in academia worldwide. It includes researchers taking advantage of the opportunities to investigate the spatial layout and use of educational buildings and university campuses where they work or are familiar. There are several examples in the literature, including by the principal authors of this paper about QU buildings, i.e., the Women's Engineering Building, the BCR Corridors (and, by extension, most of the original campus masterplan), and the QU Main Library, or as case studies within more extensive studies (Major et al. 2019, 2020, 2022; Major & Tannous, 2024). Mohareb and Khalil's (2024) study of the spatial-social inclusivity of open spaces on twelve private university campuses in Cairo, Egypt, focuses on the solid-void ratio (i.e., buildings and open space), layout, visibility graph analysis, and use (based on questionnaires) to identify how design might affect users' perceptions of open spaces on these campuses. They conclude that ease of accessibility in user wayfinding and the perception of public safety, balanced with attractive hardscape and landscape features, best characterize the most successful open spaces on these campuses (Mohareb & Khalil, 2024). Özbil et al. (2018) and El-Darwish (2022) reached similar conclusions in their studies of common spaces on university campuses in Türkiye and Egypt. Hacar et al. (2020) examined the relationship between pedestrian density and space syntax measures at Davutpasa Campus, Yıldız Technical University, in Türkiye, including observational counts of pedestrian movement. They argued that the integration measure in axial analysis was the most reasonable means to explain pedestrian density on the campus. However, their axial maps cover only the campus, lacking a broader context (Hacar et al., 2020).

Ali and Kim's (2020) study employed methods to examine whether university open spaces should be publicly accessible or remain tightly controlled by the university in Cairo, Egypt. They recommend caution for intense urban conditions on a case-by-case basis. Abu Elkhair et al. (2023) examined and ranked the social qualities of university campus outdoor spaces (UCOS) at the American University in Cairo using space syntax —specifically, all-line axial analysis and Visibility Graph Analysis (VGA) — in combination with field observations and the classic classification of public, semi-public, semi-private, and private spaces, derived from Alexander (1987). They conclude that the most critical influences on the social use of outdoor spaces on the campus were mixed-use, accessibility, and density (Abu Elkhair et al., 2023). Alnusairat et al.

(2021 & 2022) follow a similar methodology in Jordan to argue for enhancing the design of university open spaces, considering the Middle East's microclimate and the consequences of the COVID-19 global pandemic. Likewise, Soares et al. (2020) examine the potential for fostering creativity in university open spaces using the case study of the Zernike Campus in Groningen, The Netherlands. Of course, these studies followed the tried-and-true methods of urban analysis in space syntax research (van Nes & Yamu, 2021). They answer specific questions using university campuses as case studies. There is no diving deeper into the generic nature of the campus as a morphological thing itself.

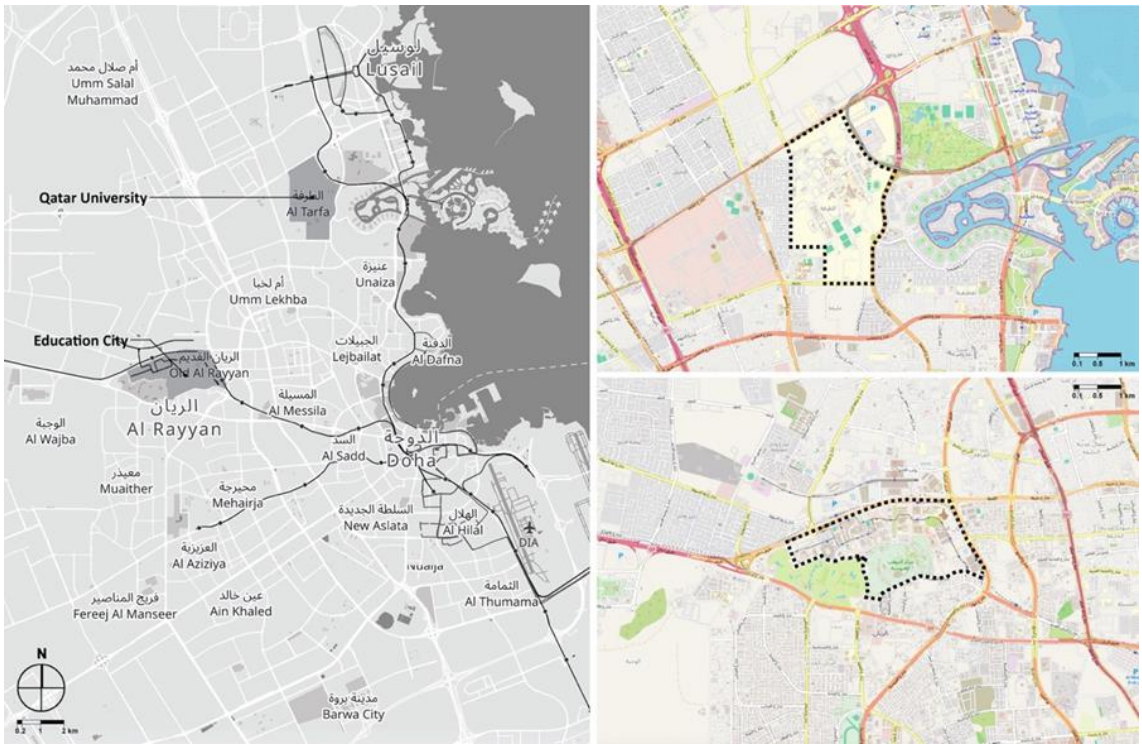

Figure 2. Transport Map of Doha showing the Doha Metro lines (left), and OpenStreetMap views of (top right) Qatar University and (bottom right) Education City outlining the studied bounds of both campuses (Source: Authors/© OpenStreetMap contributors. Tiles courtesy of Andy Allan).

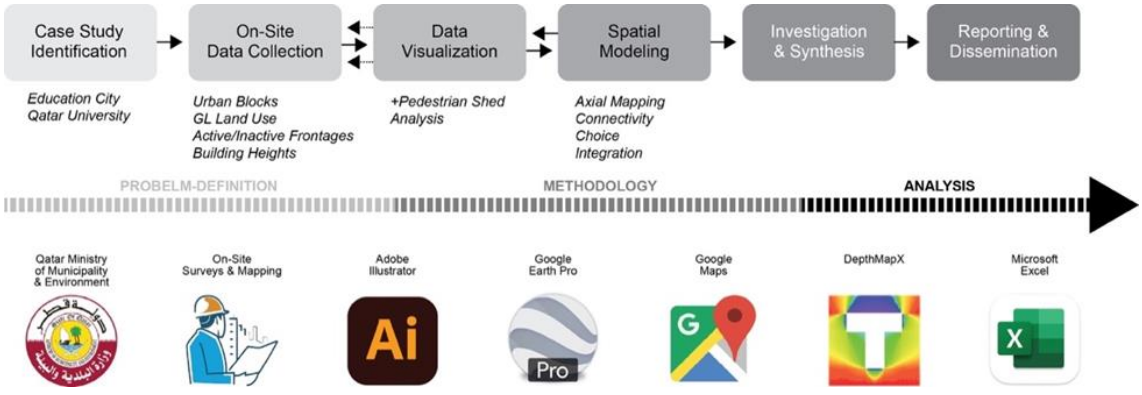

Figure 3. Research design, methodological process, map resources, and software tools of the study and the paper (Images: Authors/Qatar Ministry of Municipality/Google/Adobe/University College London/Microsoft).

One example that does is da Silva's (2017) excellent research on the characteristics of fifty-two (52) university campus layouts worldwide, with the overwhelming majority (~80%) in North America (USA, Canada, and Mexico) and Europe. It is the most comprehensive attempt to classify university campuses as precincts by morphological type and contextual conditions (da Silva & Heitor, 2014; da Silva et al., 2017). In this sense, a precinct refers to an area within the perceived boundaries of a particular place (Source: Oxford English Dictionary). She defines these at the macro-scale by their autonomous and rooted nature in urban conditions, or, more simply, by whether they are inside or outside the recognized bounds of a city, and by the relative dominance of one or the other. For example, consider a university town like Gainesville, Florida, home to the University of Florida, versus a city like London in the UK, which hosts many university campuses (such as UCL and the University of Greenwich) but is not defined exclusively by them. Da Silva (2017) further classifies campus precincts at the micro-scale: autonomous ones are distinct, attached, inner, or central, and rooted ones are self-enclosed, open, scattered, or ubiquitous (as in 'present everywhere'). University campuses differ due to the historical, social, and cultural factors unique to each, which Hillier (1989) termed Type 3 laws of the urban object, in a similar sense as the Lived Space according to Lefebvre's (1974) classification of spaces, which later received more elaborate terminology in the field of urban theory in Soja's (1996) Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places. Da Silva's (2017) research is comprehensive and exhaustive, covering nearly 800 pages. Her classifications are as much about the location of university campuses as what they are. Still, her findings suggest the possibility of a more straightforward classification of the generic campus regardless of land use based on Hillier's (1989) Type 1 laws governing the generation of the urban object itself (Major, 2018).

The design of the research methodology

The study in this paper relies on data collected and collated by graduate and undergraduate researchers in the Education City and Qatar University campuses for data visualization purposes in late 2022 and early 2023. Senior researchers standardized this data collection and conducted on-site verifications in 2023. The QU campus is in north Doha, approximately 10 km north-northwest of Souq Waqif in Old Doha. The major arterials of Al Tarfa Street bound the campus to the north and Al Jamiaa Street (turning into the Al Khor Coastal Road at its northeast corner) to the east. Gliya Street (which becomes a major arterial, Al Duhail Street) bounds the campus to the south. Jeryan Nejaima Street, a local road, defines the western edge of the campus. At Education City, major arterials define the bounds of the main campus to the north and east. It includes Al Luqta Street to the north. For this study, we are excluding the Education City campus north of Al Luqta Street and focusing on the main campus. The whole of the Education City campus is twelve (12) km² in size. Huwar Street, running north-south, defines the eastern edge of the main campus. The local road, Al Shagab Street, and the historic area of Old Al Rayyan define its southern edge. The Education City Golf Club, course, and local perimeter roads define its western edge (Figure 2).

A diagram outlines the research design and methodology, from the case study identification to the methods for on-site data collection, built environment surveys, data visualization, and space syntax modeling, as well as analysis comprising investigation, synthesis, reporting, and dissemination (Figure 3). This diagram also outlines the map resources and the principal software packages used in the study for data visualization and analysis. Researchers collected primary data through on-site surveys of morphological characteristics of the built environment, supplemented by photographic/video documentation, as well as a review of Google Earth/Maps satellite imagery information. This includes a figure-ground representation of urban blocks, where blocks are in black and space is white (or vice versa). The most continuous or standard building line defines the urban blocks, with allowances for free-standing buildings that can compose an entire urban block. The figure-ground representation serves as the basis for quantifying the average block size of the case study areas using Google Earth measurement tools. This is achieved by calculating the

metric area, subtracting a standard 20% deduction for public right-of-way, and then dividing the result by the number of blocks reported in previous research (Major & Tannous, 2024). Researchers deducted an additional metric area (either the actual area or a percentage) from the individual case areas to account for vacant land, surface parking lots, etc. It also includes ground-level land-use mapping using a standard color key for land-use types (commercial, retail, low-, medium-, and high-density residential, public, utility, etc.). Both campuses require specialized land-use categories (such as administrative and student center) compared to other typical Doha neighborhoods (Major & Tannous, 2024). Historic resources are typically designated as special use, which is only applicable to Education City.

Figure 4. Kamal El-Kafrawi's concept for Qatar University's original masterplan (left) (Source: Aga Khan Award for Architecture). and a rendered 2012 version of Arata Isozaki's masterplan for Education City in Doha focused on the main campus south of Al Luqta Street and north of Old Al Rayyan (right) (Source: Qatar Foundation/Doha News).

Based on this ground-level land-use pattern, we surveyed and mapped active and inactive non-residential and residential frontages: active non-residential frontages in green, active residential frontages in gold, and all inactive frontages in red. An active frontage is one where there is an opportunity for co-presence or interaction between people in public space and those inside the building along at least 50% of the building façade, i.e., windows, doors, and arcades. Allowances are made for the extensive use of opaque reflected tints in windows due to the climate conditions in Qatar, i.e., opportunities for co-presence or interaction between inside and outside the building are more likely at night, or only one-way (inside-to-outside) during the daytime. We also mapped the pattern of building heights using a standard scale for the number of stories, i.e., 1-story, 2-4 stories, 5-8 stories, 9-12 stories, and 12+ stories. Half-stories (0.5) based on high ceilings are rounded down, so the building height mapping accurately accounts for the number of floors, not the vertical height in meters (m). Finally, the study incorporates pedestrian shed analysis using standard radii of 200 and 400 m (i.e., a 3- to 5-minute walk) due to the hot summer months of May to August in Qatar. This differs from the Western standard of 400 and 800 m (e.g., a 5- to 15-minute walk) for more pleasant climates experiencing four seasons. There are no shaded walkways at Education City, other than those provided by natural vegetation. The most significant shading devices at Education City are associated with its tram stops. There is only one significant shaded walkway at the QU campus, running parallel to a large surface parking lot and connecting (more or less) between the QU Main Library and the Women's Engineering Building. The BCR Corridors in El-Kafrawi's original master plan utilize shading screens in exterior connections between buildings. Major et al. (2020) already outlined the difficulties that these ground-level shading screens cause for wayfinding in the large BCR Corridors complex. Finally, we examine the pedestrian sheds from the geometric center of the case study areas, as well as from Doha Metro stops, in parallel with Visibility Graph Analysis (VGA) of the metric step shortest-path length (or actual distances considering impediments to route choice) using DepthMapX, with

measured distances in meters (m) represented by each color using Google Earth measurement tools. All the gathered information is analyzed and discussed throughout the remaining sections of the paper.

The masterplans

Egyptian architect Kamal El-Kafrawi in consultation with Ove Arup & Partners and the United Nations Educational, Scientific and Cultural Organization (UNESCO) on behalf of His Highness Sheikh Hamad bin Khalifa Al Thani, Emir (now the Father Emir) of the State of Qatar, designed the original Qatar University (then Gulf University) campus masterplan, which was planned and constructed from 1973 to 1985. It included the earliest buildings on campus, such as the Higher Administration Building, Information Technology Services Building, separate Men's and Women's Activity Centers, Faculty Office Building (originally Women's Library), Main Women's Building, and the BCR Corridors (Figure 4, left). The last three collectively formed part of the BCR Complex, based on a modular design concept by El-Kafrawi, which, in theory, enabled expansion ad infinitum in the future. Its wind tower architectural vocabulary – repurposed as light wells – forms the most iconic image of the campus, later incorporated in the university's official logo (refer to Figure 1, bottom left). The design was a shortlisted project for the Aga Khan Award for Architecture during the 1989 Cycle. Today, Qatar University is home to over 9,000 students (excluding Foundation Studies) and more than 1,100 faculty members from fifty-two nationalities. At Qatar University, approximately 65% of students are Qatari, and more than 70% are female (Major et al., 2020). The QU campus features a segregated campus layout, separating male and female students. As a result, female students are free to move anywhere on the campus, while male students are restricted to their designated area. In some ways, it could be argued that educational campuses with gender segregation policies like this are a form of gated community with varying definitions of who is an insider and an outsider across scales, such as in campuses. Here, gender plays a crucial role in defining insiders and outsiders: male and female students are insiders at one level, while gender defines outsiders at another. The dividing line between the male and female sides of the QU campus runs (more or less) along the western façade of the BCR Corridors complex and through the QU Main Library. However, this campus division has been effectively abandoned north of the library.

Education City is an initiative of the Qatar Foundation, under the guidance of Sheikha Moza bint Nasser, the mother of the current Emir of Qatar, and was established in 1997, with an official inauguration date in 2003. It was designed and planned to be an educational and research innovation district with educational facilities across school ages to satellite campuses for some of the world's leading universities at the time of our study, including Carnegie Mellon University, Cornell University, Georgetown University, Northwestn University, Texas A& M University, Virginia Commonwealth University and Hamad Bin Khalifa University (HKBU), in buildings and stadia designed by some of the world's most renowned architects. It includes the Qatar Foundation Headquarters and Qatar National Library, designed by Rem Koolhaas/OMA; the Centre for Islamic Studies (home of HBKU), designed by Mangera Yvars Architects; and the 2022 FIFA World Cup Education City Stadium, designed by Fenwick Iribarren Architects. The aim of the Qatar Foundation's Education City initiative is to integrate tradition and technology while meeting the functional needs of a state-of-the-art campus, advancing education, research, and innovation in the region as a critical component of Qatar National Vision 2030 (QNV, 2008). Qatar Foundation also implemented Smart City initiatives on the campus, utilizing technology to improve operational efficiency and promote sustainability, including a local tram system. Japanese architect Arata Isozaki master planned the Education City campus in 2001 as a piecemeal aggregation of various developments, incorporating a unifying infrastructural axis, a green spine, and the Qatar Foundation Ceremonial Court. Moriyama & Teshima Architects later developed a comprehensive planning framework addressing the functional needs of various institutions and public spaces, the campus's strategic development, and future expansion (Figure

4, right). The master plan incorporates a diverse mix of land uses, including housing, leisure (parks and a golf course), commercial, social, and cultural facilities, to enhance urban life through a range of diverse activities. The aim is to create spaces that foster social interaction, promoting a sense of community among its users and visitors. Parsons Corporation has overseen the overall planning of construction activities, including roads, infrastructure, cooling plants, parking structures, pumping stations, parks, open spaces, and water treatment facilities. Any gender segregation on the Education City campus occurs exclusively within its buildings.

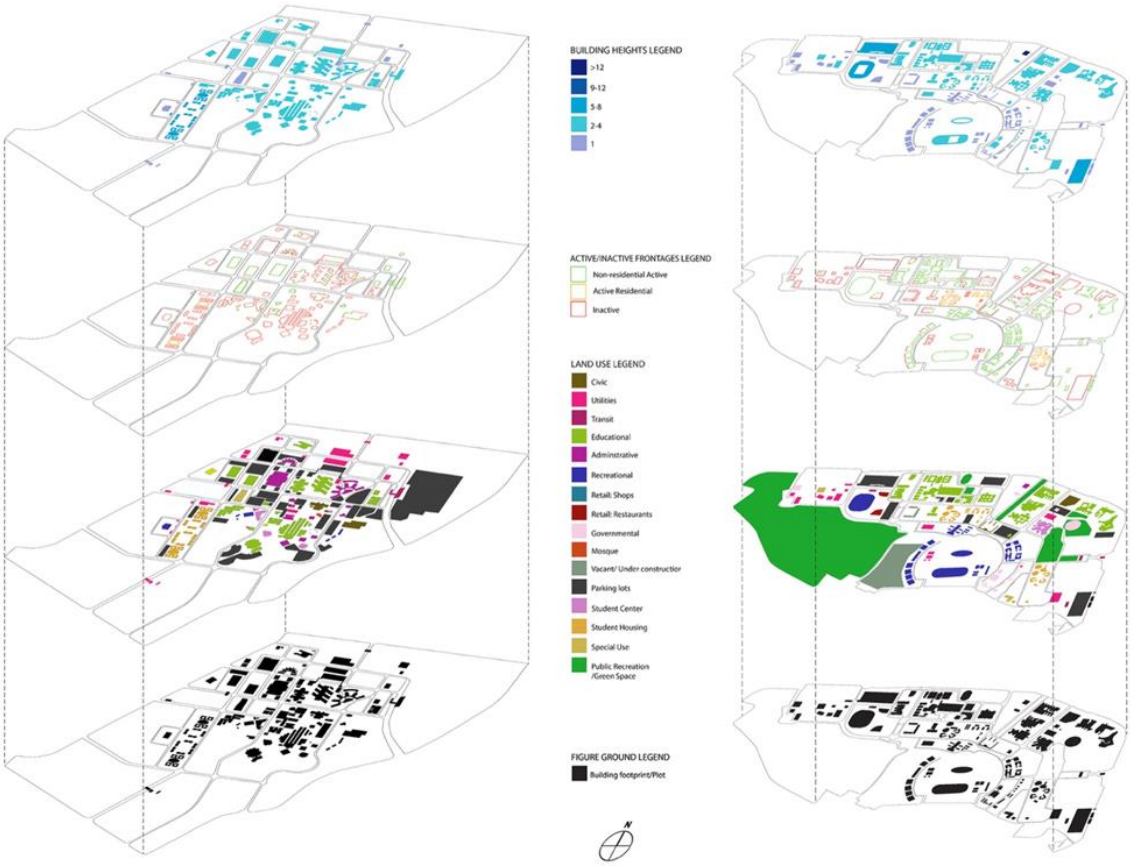

Figure 5. Axonometric layered views of the data visualization maps for the (from bottom to top) figure-ground (blocks in black, space in white with key routes outlined), ground level land uses, active and inactive non-residential and residential frontages, and building heights in (left) the QU campus and (right) the main campus of Education City (Source: Authors).

Data analysis and findings

Axonometric layers summarize the morphological data for urban blocks/free-standing buildings, ground-level land use, active and inactive non-residential and residential frontages, and building heights in the QU and Education City campuses (Figure 5). The figure-ground representation (bottom layer) illustrates the significant open space (in white), including vacant land for future expansion, surface parking lots (especially on the QU campus), and recreational facilities. One difference discernible between the two campuses is that the QU campus has developed from the geometric center outward towards its defined edges. In contrast, the main campus of Education City has developed from its edges inward toward the geometric center. Large, free-standing buildings tend to characterize both campuses to the north than to the south, with the exception being the oval Al Shaqab Equestrian Center to the south and a large, 5-story parking structure at the southwest corner of Education City. There is a large amount of open space surrounding this

equestrian facility. In the ground-level land use map, we can see a larger amount of vacant land to the immediate west of the equestrian center for the Al Shaqab village (which will include 100 housing units) and the massive grounds of the Education City Golf Club and Course, which define the entire western perimeter of Education City. The large footprint of the FIFA World Cup 2022 Education City Stadium is immediately north of the golf course. East of the equestrian center is Oxygen Park, a public park designed to promote physical activity and social interaction with recreational and sports zones. The Green Spine of Education City is also clearly visible to the northwest of Oxygen Park. Educational facilities in the northern portion of the main campus dominate the ground-level land-use map. There are clusters of smaller-footprint residential housing (dorms) south of these education facilities and Oxygen Park, as well as utility/governmental facilities in the northwest. Education facilities in the central portions, residential housing dorms for students and faculty to the west, and the clustering of surface parking lots (approximately twenty) throughout characterize the QU campus. There is only one multi-story parking structure located immediately to the north of the large footprints of the new College of Engineering and College of Business and Economics buildings. Most utility buildings are in the north of the QU campus.

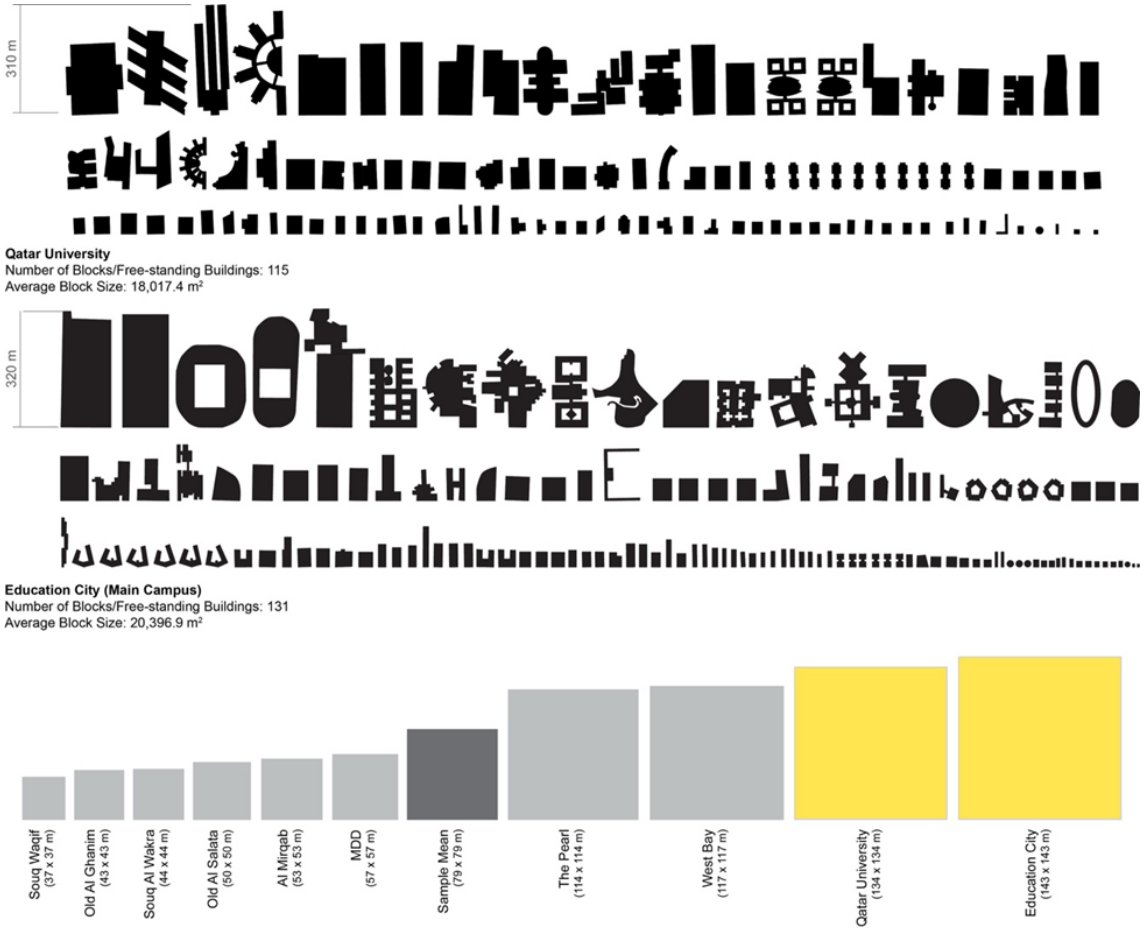

Figure 6. The rank order of urban blocks/free-standing buildings from the largest to the smallest for metric area (left to right in three rows) for (top) Qatar University and (middle) the Education City main campus, and (bottom) a visual representation of the average block size in ten (10) Doha neighborhoods including the QU campus and Education City main campus (highlighted in yellow) with the sample mean (in dark grey) (Source: Authors/Major & Tannous, 2024).

There are significantly more active non-residential and residential frontages in Education City than on the QU campus. It is difficult to discern any pattern in the distribution of active and inactive frontages on the QU campus, almost to the point where it seems random. In contrast, active frontages in Education City are clustered around the equestrian, northern, and northwestern sections. Its northern portions include Qatar Academy Primary School, Virginia Commonwealth University, and Education City Female Housing. Its northwestern portions include the Qatar Foundation Headquarters, the Centre for Islamic Studies/HBKU, and Northwestern University. The profile of building heights on both campuses is low-rise, though there is greater variation in Education City. Building heights on the QU campus are predominantly 2-4 stories, with a scattering of one-story buildings throughout. 12% of the blocks/free-standing buildings on the QU campus (14) are one-story in height. All the rest are in the 2- to 4-story range. The average building height on the QU campus is approximately two stories (1.83). In Education City, the buildings surrounding the Al Shaqab Equestrian Center (except for the arena itself) are one-story structures. The northern portions of the Education City campus feature buildings ranging from 2 to 8 stories in height, with most falling within the 2- to 4-story range, typically four stories. Half of the urban blocks/free-standing buildings on the main campus of Education City are one-story (67, or 51.1%), primarily driven by the large number of structures associated with the equestrian center. More than a quarter of the urban blocks/free-standing buildings on the main campus of Education City are 5- to 8-story (36 or 27.5%). The rest are free-standing buildings nine stories or higher, including the Qatar Foundation Headquarters and the Education City Stadium. Collectively, this translates to an approximate building height average of two and a half stories (2.47).

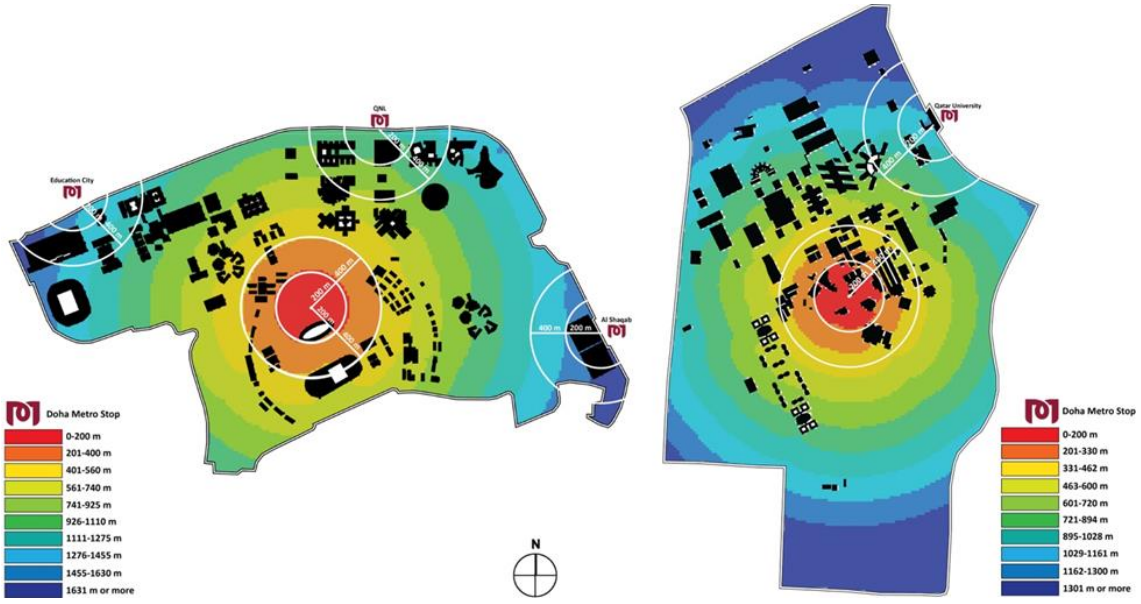

Figure 7. Pedestrian shed analysis of 200 m and 400 m from the available Doha Metro stops and the geometric center based on the formal shape of the (left) main campus of Education City (without the Education City Golf Club grounds) and (right) QU campus, overlaid on analysis of the metric step shortest-path length. The metric distances associated with the color ranges of metric step, shortest-path length (or actual distance considering built forms) (Source: Authors).

Neither campus is composed of urban blocks in the traditional sense, i.e., using shared walls. Every building is a free-standing structure (Figure 6). The only exceptions might be the BCR Corridors complex on the QU campus and the residential areas on both campuses, depending on how flexible or rigid the selected definition of an urban block. Our survey treats them as free-standing buildings because they do not share a common wall. What is clear is that the larger the

building footprint, the stronger the tendency for a building to be an irregular polygon, except for stadiums, multistory parking structures, and the Qatar National Library. Predictably, this is due to the need to introduce natural light into the interiors of these large buildings, as they incorporate small courtyards or light wells. The smaller the building footprint, the greater the tendency for a regular polygon shape, i.e., square-ish or rectangular. Major and Tannous (2024) have already shown that the average urban block size (or building footprint, in the case of these two campuses) is significantly larger than the rest of the metropolitan region, based on their study of urban centrality in 10 Doha neighborhoods. The average block sizes at Qatar University and the main campus of Education City are 18,017 m² and 20,397 m², respectively (Major & Tannous, 2024). This translates into a typical block/building footprint (if square) of 134 m x 134 m at the QU campus and 143 m x 143 m on the main campus of Education City. However, the largest blocks/buildings on campuses are more than 310-320 m in their longest direction. The average urban block/building footprint on these two campuses is 23% larger than the average for The Pearl-Qatar and the West Bay Business District, almost two and a half times larger (2.43) than the sample mean for ten Doha neighborhoods, and over eight times larger (8.22) than the average block size of the five Old Doha neighborhoods within the B-Ring Road (Major & Tannous, 2024).

Metric step depth, or actual distances (in combination with pedestrian shed analysis), reveal key features of these campuses (Figure 7). First, Education City has an enlarged core for metric step depth, as there is ample open space at its geometric center. In contrast, the buildings of the original El-Kafrawi masterplan populate the geometric center of the QU campus. Nonetheless, due to the greater distances within the color ranges, Education City's east-west extended shape is less walkable (up to 300 m more at the extremes) than the QU campus's north-south extended shape, when accounting for building locations. In part, this might explain a greater need for public transportation options (metro and tram stops) in Education City, options provided by the Qatari government and Qatar Foundation. Second, there is their size. It is 1,000 m to reach 'as the crow flies' the eastern and western edges, and an average of ~1,500 m to reach the northern and southern edges of the QU campus from its geometric center, located adjacent to the Women's Engineering Building and Women's Health Facility on the female side of the campus. It is ~1,000 meters to the QU stop on the Doha Metro, on the northeast edge of the campus. To date, the only significant academic buildings within 400 m of the Doha Metro stop are the College of Medicine and the Research Complex at QU. Most everything within 400 m of the campus's geometric center follows the original El-Kafrawi masterplan. Most everything outside this 400 m radius is an extension of that masterplan. A local bus system serves the QU campus, with multiple stops, easing movement around the campus. At Education City, the distances to the northern and southern edges are 1,000 m, to the northwestern and eastern edges are 1,400 m, and to the western edge of the golf club are 600 m from the geometric center of the main campus of Education City. The only structures within 400 m of this geometric center are equestrian center facilities. However, the Doha Metro better serves Education City, with three stops (two on the northern edge and one on the southeastern edge), than the QU campus. There are eleven structures within 400 m of these metro stops, including two massive, multistory parking structures affording 'park and ride' opportunities. Local bus and tram systems also serve Education City, with multiple stops, making it easier to move around the campus. Nonetheless, despite these local transportation options, the distances to walk on both campuses are prohibitive due to the hot summer conditions in Doha from May to September. Lastly, the public transportation options for the Doha Metro emphasize an 'edge-in' reading of the campuses, which will be reinforced by the later expansion of the Doha Metro and the opening of an additional stop, located somewhere west of the QU campus in the Duhail area. On both campuses, a local bus or tram system supplements movement within the campuses. This generates distinct experiences between 'getting to' the campuses and 'getting about' them.

In planning terms, it appears that the strategy for both campuses is to set up distinct 'parts' within the urban 'whole' of each campus (Education City more so than the QU campus), centered around the Doha Metro and, by implication, vehicular entry points. But is that how they function

spatially? The space syntax model of the spatial layout of both campuses provides more information. Based on the analysis, the answer is problematic. Highly integrated globally and locally, high global-choice routes define the perimeter roads of both campuses, highlighting the importance of vehicular access (Major et al., 2023).

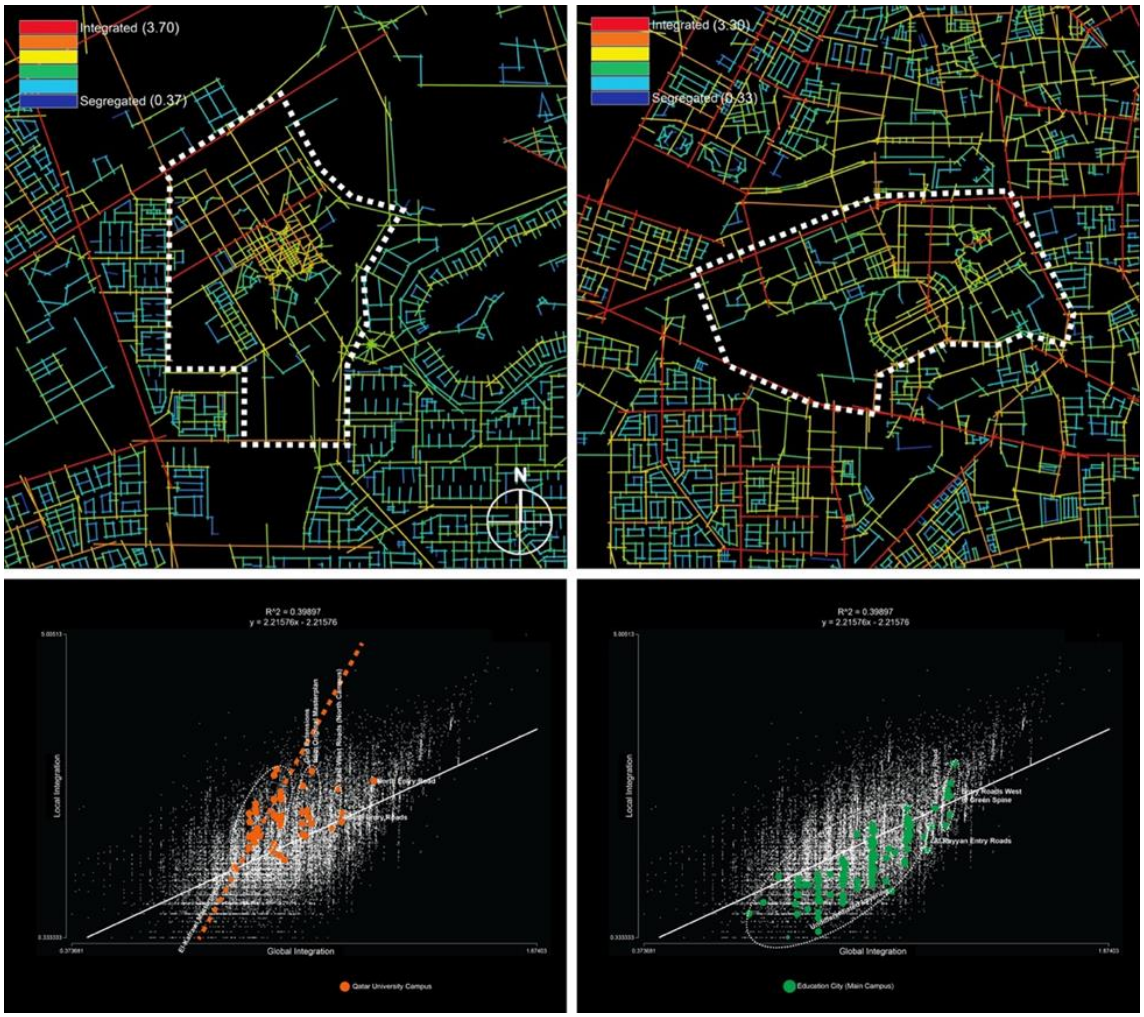

Figure 8. Calibrated pattern of local integration (radius=3) for the (top left) QU campus within its north Doha urban context and (top right) the main campus of Education City within its west Doha urban context, and the Intelligibility scatter (per global vs. local integration) in the (bottom left) QU campus (in orange) and (bottom right) Education City main campus (in green) within the space syntax model of Metropolitan Doha 2020, including identifying critical routes in each area (Source: QUCG-CENG-22/23-472).

The model of the QU campus includes detailed pedestrian route modeling through the BCR Corridors (part of the original masterplan) within the urban context of north Doha. This north Doha context extends east from the coastline, including The Pearl-Qatar, to the Doha Expressway in the west, and north from Meraijeel Street in Lusail City and Zekreet Street in Umm Salal Muhammed, and to Khalifa Street in the south, encompassing the West Bay Business District. We calibrate the color range for the measure of local integration (radius=3) so that the maximum (3.70) is 10 times the minimum (0.37), thereby highlighting the more significant local routes in the model (Figure 8, top left). The most locally integrated route on the QU campus is the one running northeast-southwest across the campus, connecting two entry points at the eastern and western perimeters. This route runs adjacent to the Main Library and effectively defines the

northern boundary of the original El-Kafrawi masterplan. The second most locally integrated route runs parallel to this primary route, one block (~360 m) north. There are also four locally integrated routes connecting and running perpendicular to the primary route, three of which enter the heart, and one that defines the western edge of the original masterplan.

The model of the Education City main campus is within the urban context of west Doha. Its urban context stretches from the Doha Expressway in the east to the western edges of the Metropolitan Doha. It incorporates the urban context from Al Rufaa Street in Umm Salal Muhammed in the north to Al Waab Street in the south, including Villagio Mall and Aspire Park. Again, we calibrate the color range for the measure of local integration so that the maximum (3.30) is 10 times the minimum (0.33), thereby highlighting the more significant local routes in the model (Figure 8, top right). It includes detailed pedestrian route modeling within the main campus and the northern campus of Education City. The most locally integrated route on the main campus of Education City is the simplified Green Spine, a single pedestrian space. However, unlike the most integrated route at the QU campus, this Green Spine is unrelated to any entry points (or Doha Metro stops) on the perimeter. It is contained wholly within the campus. In addition, the other locally integrated routes are associated with vehicular entry roads, distinctly marking Education City with an edge-in spatial structure. We can see the effect of this planning strategy in the Intelligibility scatter for QU and the Education City main campus within Metropolitan Doha 2020.

The original master plan of the QU campus has the potential to form a relatively well-defined, intelligible local area effect in the lower ranges of global integration (circled to the left of the scatter in Figure 8, bottom left). However, it currently hovers entirely above the correlation slope at the higher ranges of local integration. Its potential is undermined by the grid extensions to the new northern parts of the campus, which differentiate its entry roads by cardinal direction at the higher ranges of global integration. The same phenomenon occurs in the Education City main campus (Figure 8, bottom right). The only routes within Education City that possess any spatial logic for intelligibility are its entry roads. The rest of the layout in Education City exhibits unstructured vertical layering, with no discernible spatial logic. It indicates the poor planning strategies deployed in Education City over time. It also points to a concern that the planning of the QU campus may be trending in the same direction. It is due to the abandonment of small blocks and walkability within the original QU master plan. The emerging emphasis is on the entry roads and depth from the perimeter (Major et al., 2023). However, numerous remediation opportunities remain on the QU Campus. In the case of Education City, it is challenging to envision design and planning solutions to its poor planning that do not involve large-scale remediation and high costs, i.e., a complete rethink of the original master plan. It highlights the consequences of the different approaches to development in these campuses: from the center outward to the edges at the QU campus, and from the edge inward at the main campus of Education City. Nonetheless, the space syntax analysis also points the way for a deeper theoretical discussion about the nature of campuses in general.

Discussion: what is a campus?

Let us now return to the definitions of a campus outlined at the beginning of this paper. At this point, we can further refine it to a more generic statement: a campus is an abstract collection or the physical space of a specific land use, encompassing all the buildings and their associated land. This generic definition covers all types, including Da Silva's (2017) variations in educational institutions, non-educational variations that share similarities with her classifications, and the campuses of Education City and Qatar University. However, the latter also fall into the narrower definition of the physical space of an educational institution, typically a university, encompassing all the buildings and the surrounding land. This definition is fundamentally rooted in its American origins, likely deriving from the abundant lands of the New World during the Age of Enlightenment (Major, 2018). In a 1922 lecture, the British architect and urban planner Patrick

Abercrombie attempted to contrast the American-style campus with that of the Medieval cloistered environments of the Oxbridge colleges (Cambridge University and Oxford University in the UK), arguing that American formal enclosed quads with manicured grass contrasted with the park-like garden and trees to the side of buildings in the Oxbridge example. He further clarified that the campus planning method at the time encompassed all departmental buildings scattered across a landscape, e.g., a park filled with trees, as described by Abercrombie, in line with Modernist planning principles at the time (Le Corbusier, 1925; Gropius, 1965; Major, 2018; Chapman, 2006). We can interpret his clarification as an allowance for the already-expanding scale of what would become the twentieth-century campus. Abercrombie's description is useful. It allows us to identify three simplified, theoretical models of campus planning that encompass all variations and scales, if we accept the urbanscape within a broader definition of the landscape for contemporary urban campuses. We can describe these models as 1) enclosed, 2) edged, and 3) scattered.

Prototypical examples of the enclosed model include the first comprehensively planned campus in the USA, Joseph-Jacques Ramée's original plan (circa 1813) for Union College in Schenectady, New York (Turner, 1996). It also includes Thomas Jefferson's concurrent, more famous 1817 Academical Village masterplan for the University of Virginia in Charlottesville (Figure 9). Both master plans are informative. Ramée's plan for a central quad or lawn at Union College incorporates edged conditions at a large scale, if we define the (no longer existing) modulating ring road and parallel U-shaped watercourse as the campus's initial perimeter.

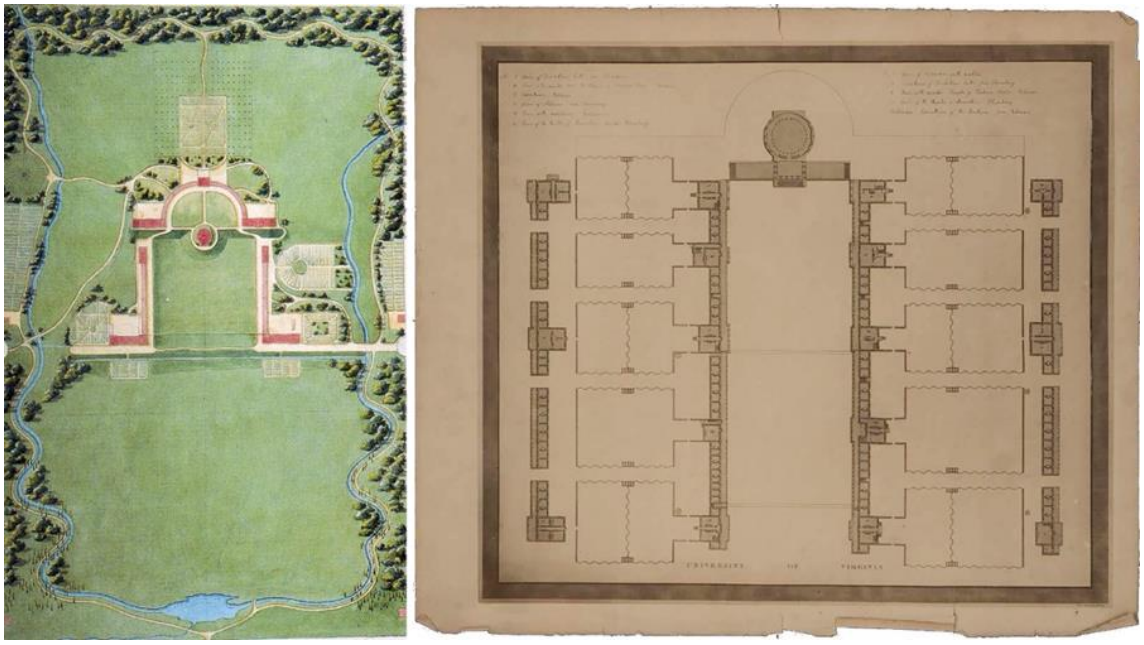

Figure 9. Joseph-Jacques Ramée's 1813 masterplan for Union College in Schenectady, New York (left) (Source: Wikipedia/Hedinger & Berger, 2003) (NOTE: Top of the drawing is southeast, true north is toward the left corner of the drawing) and the Maverick Plan of the University of Virginia, 1923 facsimile of 1822 engraving of the ground plot based on Thomas Jefferson's 1817 masterplan (right) (Source: Thomas Jefferson, architect; original designs in the collection of Thomas Jefferson Coolidge, Junior. E332.J48 1916, Special Collections, University of Virginia, Charlottesville, Virginia, USA) (NOTE: Drawing is oriented ~20 degrees off true north, which is towards the top right corner of the drawing).

In contrast, the University of Virginia's Maverick Plan demonstrates how Jefferson's Eastern and Western Gardens of the masterplan effectively serve as edge conditions for the central Lawn

and academic buildings. In this sense, Jefferson replicates the enclosed model, i.e., buildings surrounding a central green. The secondary gardens serve as an edged green for the central buildings and lawn, and the outer student housing (literally called hotels) serves as the edge for the enclosed gardens.

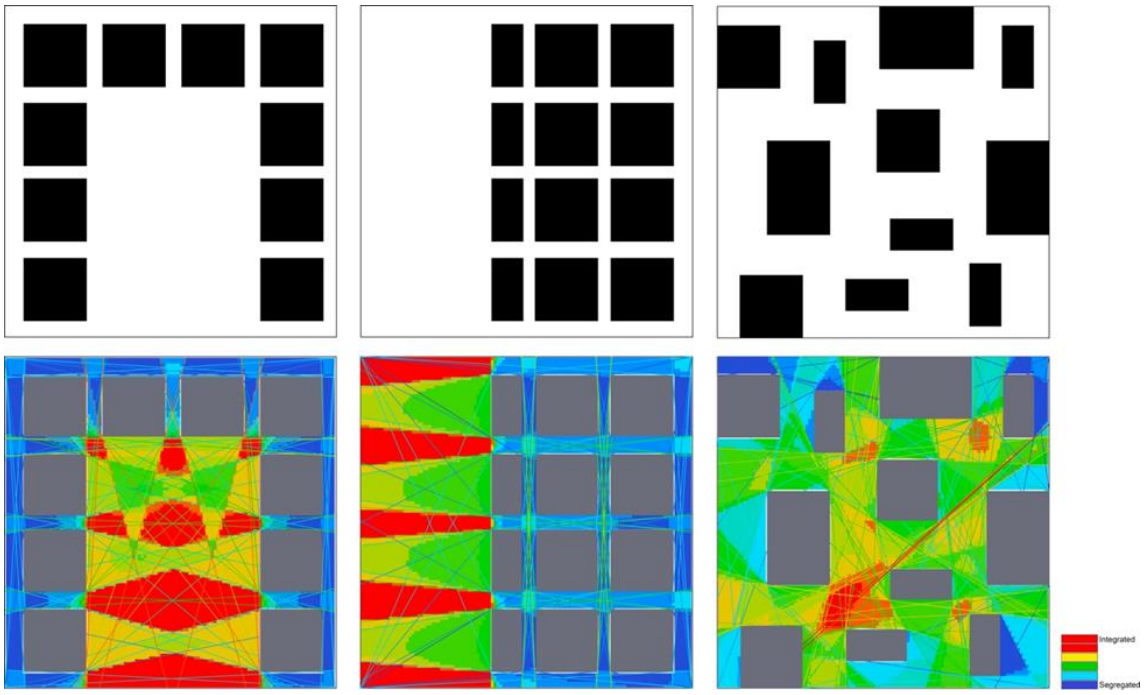

Figure 10. Simplified theoretical models for a (a) enclosed, (b) edged, and (c) scattered campus layouts using the same amount of building footprint area with a standard metric plot, with (bottom row) the all-line axial analysis overlaid on the visibility graph analysis (both for global integration, radius=n) (Source: Authors).

Our articulation of these simple, theoretical models – enclosed, edged, and scattered – for the campus, in combination with the morphological and spatial analysis of the QU and Education City campuses in the previous section, leads us, perhaps inevitably, towards the Hillierian concept of 'parts' and 'whole' in spatial layouts and how the parts might or might not intelligibly fit within that whole, especially with expanding scale of the campus itself during the twentieth century, as implied by Abercrombie (Hillier, 1996; Chapman, 2006; Major, 2018). Due to their large scale, we can see evidence of all three theoretical models at work in the spatial layout of Qatar University and Education City. For example, the Education City Club and course, as well as the Al Shaqab Equestrian Center grounds, form the edged conditions to the west and south of Education City. The availability of land for future expansion creates edge conditions on both campuses, particularly on the QU campus, in all directions, and to the east on the Education City campus. The piecemeal, phased development of buildings on both campuses incorporates aspects of the scattered model, at least temporarily over the years until they achieve full build-out. This is more obvious in Education City than on the QU campus, which originated as a centralized master plan within its land allocation. Indeed, the original El-Kafrawi masterplan for the QU campus explicitly incorporated small, centralized courtyards within its modular concept, supplemented by opportunities for cross circulation, representing a Middle Eastern variation of the enclosed American campus model. Similarly, the Green Spine at Education City features a central quad with opportunities for cross-circulation in the northern part of the main campus, aligning with the enclosed model. Oxygen Park does something similar for the western part of the main campus at Education City, at least in a formal sense. Its design is explicitly for recreational

uses, i.e., walking, running, etc., on-site rather than to ease cross-circulation in this part of the campus. Given that this is the case, what exactly do these enclosed, edged, and scattered campus models do for visibility and movement in spatial terms?

Discussion: theoretical models of campus morphology

We can construct a generic, theoretical layout for the enclosed, edged, and scattered campus models, controlling for a consistent plot size and overall building footprint area (Figure 10, top). All blocks are parallel or perpendicular to each other and the edge. The enclosed model comprises 10 square blocks, running parallel to the plot edges, to define a three-sided central quad space. The edged model contains a total of twelve blocks, consisting of eight square blocks and four downsized, rectangular ones (half the area of the square blocks), arranged in an orthogonal layout along one side of the plot, to form a large, open space at the edge, presumedly adjacent to a notable topographical feature, i.e., creek, river, etc. The scattered model consists of eleven blocks with three square blocks, three upsized rectangular blocks, and five downsized rectangular blocks. We align one block with each edge and randomize the layout as much as possible to avoid generating a spatially dominant central or edge space, or an orthogonal grid layout, like in the other theoretical models. In the scattered model, we assume the open space is a vegetated landscape with trees, grass, and paths. For an urban campus based on a scattered model, we can safely assume that the urban street network will form the primary spatial framework of the campus, regardless of its configuration at the micro- or macro-scale. We can overlay and analyze these generic layouts for their impact on visibility and movement using all-line axial analysis and Visibility Graph Analysis (VGA). The former autogenerates a linear spatial structure from the vertex of every building footprint to every other one in each layout (Dalton, 2001; Turner et al., 2001; van Nes & Yamu, 2021) (Figure 10, bottom). The latter draws the visual field from each grid element to every other visual field, which is based on a standardized grid. The color range for the VGA analysis is specific to each layout. We standardize the color range for the all-line axial analysis based on the most extensive range (14.14-3.31 of the scattered model). We accept as given that we designed these theoretical layouts to highlight key differences. Because they involve design, an underlying logic is at work. The enclosed and edged layouts are more formally geometric, incorporating a primary open space within an explicit orthogonal layout, whereas the scattered layout attempts to reduce formal geometry to a degree without losing the formal controls established from the outset, i.e., plot size, overall footprint area, and parallel/perpendicular relationships.

All three models generate an abundance of angular route choices, either across a nominal street space/segment or an open space. In the enclosed model, there is a notable increase in the number of angular route choices crisscrossing through the central quad compared to the edged model. In the enclosed and edged models, the high degree of visibility within the primary open space shifts the primary focus for linear movement to the nominally north-south routes (if we treat the top of the figure as true north). In the enclosed model, these routes pass through the geometric center or edge of the central quad. In the edge model, these occur primarily along the roads through the blocks. In the edged model, the most integrated areas for visibility (in red) are more clearly extensions of the street vistas opening through the open space towards the western perimeter. In the enclosed model, the most integrated areas for visibility (in red) are also extensions of street vistas. However, they ‘merge’ to define rounder convex shapes, six distinct ones to the north of the central quad, and two larger ones in the south of the space. There are also two distinctly defined, moderately integrated spaces for visibility (in green) in the north of this central quad. In the edged model, there are four moderately integrated spaces for visibility (in green) next to the blocks. These spaces are metrically larger than two similar areas in the enclosed version. In the edged model, there are larger, less integrated spaces for visibility (in light green) available at the western edge of the open space and overall plot. In both the enclosed and edged models, the orthogonal layout places more emphasis (moderately so) on the street intersections than the

segregated street segments, offering spatial variation along the facades in a typical urban fashion. In the scattered model, there are no distinctly defined street spaces, despite the parallel/perpendicular relationships of blocks. Therefore, the all-line axial analysis highlights the large number of angular routing choices throughout the layout.

In this sense, integration primarily derives from route length; hence, the most integrated one stretches from the eastern edge in the north to a block near the southwest corner of the layout. Four key locations within the layout are the most integrated for visibility (nominally defining quarters). However, they are significantly smaller in metric area than the most integrated areas for visibility in the enclosed or edged models. One in the southwest, through which the most integrated route passes, is larger than the others. There is much greater variation in the size and shape of integrated-to-segregated visibility in this scattered model than in the enclosed or edged ones. The scattered model tends to differentiate block facades, rather than along their length in the more traditional urban sense. In the scattered model, this would place greater emphasis on the location of doors to access blocks and how movement would navigate from block to block rather than pass by, thereby generating desire lines through the landscaped environment (Major et al, 2021). This model aligns with Atour's (2024) approach to describing, analyzing, and recommending urban permeability to enhance spatial navigation within the Education City campus.

What can we conclude from the experiment with these theoretical models? The enclosed model creates a focal point for visibility and static use within its central quad, emphasizing movement through and next to it, with the 'quieter' areas for visibility centrally found within that space, especially in the north of the quad. You can be seen but not disturbed, depending on your choice of location within its spatial variations. The edged model subtly differentiates the static use of its open space for visibility by marginally distancing from the primary movement routes passing through the blocks. The further you locate yourself in the open space away from the blocks, the less likely you are to be disturbed or seen. However, in both cases, the moment you cease static activity and begin to move, this is likely to change. Movement from the central quad in the enclosed model becomes multi-directional, i.e., towards blocks in three directions. This emphasizes the need for center-to-edge readability within the layout. We can see the effect of this in the potential for the intelligibility scatter of the original masterplan at the QU campus (refer to Figure 8, bottom left). However, as noted by Major et al. (2020), ground-level screening devices and multiple design interventions over decades in the building fabric of the BCR Corridors (forming a large part of the original QU masterplan) have led to the emergence of an 'edge-in' navigation experience and wayfinding problems.

Movement from the open space in the edged model is more likely to be unidirectional, i.e., towards the blocks in one direction. It emphasizes edge-to-edge readability within its layout. However, such edge-to-edge readability becomes compromised in the Education City masterplan, as its large open spaces along the western and southern edges (Doha Golf Club and Al Shaqab Equestrian Center) have limited public access. In the scattered model, visibility and axial integration become dispersed through the layout. This means that static use or movement can disperse in any direction or location. However, it does mean that the scattered model will tend to be more readable from an 'edge-in' perspective, since these plots will have a larger context. There is more variation across everything (parts, block sizes, visible integration, and angular route choices), which makes everything less clear. Spatially, more variation becomes less clear. There is evidence for this occurring in the intelligibility scatter for Education City, and an emerging possibility in the QU campus due to its recent expansions (Major & Tannous, 2024).

Conclusion

Based on morphological and space syntax analyses of Qatar University and Education City in Doha, the study concluded that these contemporary campuses constitute a distinct urban typology

characterized by extreme spatial scale, fragmented layouts, and compromised spatial intelligibility. Key findings reveal fundamental differences in development patterns. QU evolved centrifugally (center outward), preserving traces of its original enclosed modular design with courtyards. Education City developed centripetally (edges inward), resulting in a disjointed aggregation of parts around perimeter transit nodes and vehicular routes. Both campuses face critical challenges due to their vast footprints (average block sizes that are more than twice Doha's urban average), the dominance of freestanding buildings, and limited active frontages. Pedestrian shed analysis confirms prohibitive walking distances (up to 1,500 m from geometric centers), due to Doha's harsh climate, which forces reliance on vehicular and metro systems, reinforcing 'edge-in' accessibility but not integrating internal movement to a significant degree, more so in Education City than at Qatar University. Space syntax models further show poor spatial intelligibility in both campuses. Peripheral expansions have begun to erode QU's original intelligible structure (centered on the original master plan), prioritizing entry roads and disrupting center-to-edge readability. Education City's layout shows severe fragmentation: only the entry roads exhibit spatial logic, while internal routes lack coherence, suggesting ad hoc planning despite an overarching master plan. This manifests as unstructured vertical layering in the intelligibility scatter, undermining wayfinding and social interaction.

Theoretically, this paper advances a tripartite campus typology — enclosed, edged, and scattered models — to frame global campus morphologies. Visibility Graph Analysis (VGA) of these models shows their distinct socio-spatial impacts:

- Enclosed models (e.g., the American central quad campus model) can foster focal visibility and multi-directional movement but require center-to-edge coherence and ample cross-circulation opportunities.
- Edged models (e.g., the Oxbridge cloistered model) can emphasize edge-to-edge readability but risk underutilizing open spaces if limiting general access to such spaces or restricting such spaces for future expansions as vacant land.
- Scattered models end to disperse visibility and movement, increasing navigational ambiguity, though they can offer greater flexibility of developmental expansion, especially in intensely urban conditions, with the preexisting street layout providing a spatial framework.

In practice, both campuses in Doha amalgamate elements of all three models, yet their scale amplifies inefficiencies. QU's abandonment of small-block walkability and Education City's disconnected open spaces (e.g., Al Shaqab Equestrian Center, Doha Golf Club, Oxygen Park) highlight planning oversights. The implications for campus planning include prioritizing human-scale elements while integrating transit, theoretical hybridization, and climatic and cultural adaptation. Campuses must strike a balance between expansion and pedestrian-scaled blocks, active frontages, and cross-circulation pathways to mitigate scale barriers. Metro and tram systems should penetrate campus cores, not just perimeters, to unify access and internal circulation. Successful campuses must integrate enclosed centrality (social hubs), edged buffers (environmental/climatic adaptation), and controlled scattering (flexibility) without sacrificing intelligibility and readability for users. In arid regions, compact forms, sheltered walkways, and nighttime-activated frontages can be crucial for offsetting climate-driven spatial fragmentation. The research underscores that campuses, as 'cities within cities,' cannot thrive as mere abstract land-use zones. Their functionality depends on configurational clarity, i.e., the harmonious fitting of parts within a legible whole. Future planning must recenter on morphological principles to avoid self-isolating academic enclaves and ensure that campuses evolve into integrated, socially vibrant, and resilient urban ecosystems.

Disclosure statement

The authors declare no competing interests.

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BUILT FORM

Designing with Geomorphology: Adaptive Territorial Strategies for Regenerative Public Space in Southern Italy

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Abstract

The Albano Urbano Greenway, developed in Albano di Lucania (Basilicata, Italy), exemplifies a methodological approach to territorial regeneration in post-demographic contexts. Grounded in the concept of Reclaiming Without Antagonism, the project interprets emptiness not as loss but as a field of possibility, where memory, landscape, and metabolism intertwine. The methodology follows a three-phase structure- territorial reading, geomorphological translation, and regenerative implementation- tinking diagnostic tools, theoretical frameworks, and low-impact constructive solutions. Through the integration of biophilic design, biomimicry, and Nature-based Solutions (NbS), the project establishes adaptive infrastructures that restore ecological continuity and symbolic belonging. Key strategies include the activation of interrupted metabolic flows, the reinterpretation of curated voids, and post-populational participation models suited to low-density territories. While still under execution, expected impacts are framed through bio-physical, socio-ecological, and symbolic indicators, offering a replicable framework for fragile contexts. The Albano Urbano Greenway thus contributes to advancing design methodologies for sustainable, culturally grounded, and adaptive regeneration.

The site as a catalyst for regeneration

The inland territories of the Basilicata region, in southern Italy, constitute an emblematic case of systemic fragility in the Mediterranean European context. This condition is the result of interrelated processes of depopulation, demographic aging, agricultural abandonment, ecosystem degradation, and prolonged institutional marginality (D'Oronzio et al., 2018). Over the past century, and more markedly since the final decades of the twentieth century, many rural communities in Lucania have experienced a structural decline of their social, economic, and ecological fabric, as a consequence of internal and external migratory dynamics, as well as the mismatch between sectoral public policies and the specificities of the local territory (D'Oronzio et al., 2018). From an environmental perspective, various studies have documented phenomena

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of soil degradation, such as erosion, landslides, loss of organic matter, and reduction of biodiversity, particularly associated with the abandonment of traditional agroforestry practices (Santarsiero, 2023). These processes have been intensified by rising average temperatures, the frequency of extreme events, and water stress in submontane forest ecosystems (Costantini & Lorenzetti, 2013). At the same time, the unplanned implantation of energy infrastructures in ecologically sensitive areas has generated impacts on landscape quality and ecosystem services (Leo & Altamore, 2025).

To this condition of environmental vulnerability is added the progressive loss of human and cultural capital. Numerous municipalities, especially those distant from the metropolitan corridors of Potenza and Matera, record negative population growth rates, high dependency rates, and increasingly scarce basic services (CNRISMed, 2024). In response to this scenario, diverse revitalization strategies have emerged from regional governance, civil society, and the academic sphere. Pilot projects such as the ecological cultivation of saffron in marginal areas, the valorization of historic cultural routes, the reactivation of identity festivals such as the Maggio di Accettura, and the promotion of slow tourism linked to landscape and local culture represent examples of a regenerative approach that integrates economic development, environmental sustainability, and symbolic resilience. In contexts such as Albano di Lucania, what is claimed is not so much the restitution of usurped rights as the reactivation of a territory whose social and metabolic life has been interrupted (CNRISMed, 2024).

This article departs from the recognition of this void, not as a definitive loss, but as a field of projective and methodological possibility, to explore the potential of the concept Reclaiming Without Antagonism as a framework for action in post-demographic contexts. In contrast to the logic of antagonism, typical of urban contexts where re-appropriation often implies resistance to privatization or gentrification processes, here the design intervention is proposed as an act of care, listening, and symbolic activation of the territory (Edensor, 2018; García Grinda & Instituto Leonés de Cultura, 2006). Re-appropriation, in this case, does not seek to restore vanished ways of life but to configure new spatial ontologies from absence, integrating memory, landscape, and affectivity.

The Albano Urbano Greenway project, developed in 2025 in the Comune di Albano di Lucania, is proposed as a laboratory for this vision. It is an environmental requalification intervention in an urban soil context that articulates green infrastructure, biophilic design, and Nature-based Solutions (NbS) as means to restore metabolic and relational continuity in an interrupted territory. The design is conceived not as a formal imposition, but as a biomimetic territorial choreography, in which the system of paths, platforms, and terraces follows the geomorphological logic of the place and activates latent traces of the past. Within this framework, the research is organized around a guiding question: How can territorial design regenerate marginal landscapes through a geomorphological logic, integrating memory, landscape, and Nature-based Solutions? From a methodological standpoint, the article proposes an integrated reflection between professional practice and critical territorial thought. The conceptual framework of Reclaiming Without Antagonism is articulated here with the notion of territorial metabolism (Van Den Berghe, 2018; Wolman, 1965) and with categories such as the curatorship of the void (Didi-Huberman, 1997), desynchronized culture (Haesbaert, 2020), and post-populational participation. These concepts allow urban voids to be interpreted not as dysfunctional spaces, but as potential scenarios of slow reactivation, where nature, community, and memory intertwine to generate new forms of belonging.

The purpose of this article is to present the Albano Urbano Greenway project as a professional practice case that explores the non-antagonistic re-appropriation of urban space in post-demographic territories, through a methodological approach integrating territorial reading, adaptive design, and Nature-based Solutions. From my dual role as designer and researcher, the intervention is conceived not only as a technical solution but as a critical and situated exploration of new methodologies for the regeneration of marginal landscapes. The article is organized into

three main sections: (i) territorial reading as a project foundation, (ii) the design process as geomorphological translation, and (iii) technical implementation as an environmental and symbolic regeneration strategy.

Theoretical framework / background

From this point onward, the article develops its theoretical framework following a sequence that connects different layers of territorial reading. First, territorial metabolism is addressed as a critical tool to interpret the systemic interruptions that characterize post-demographic contexts. Second, the ontologies of void and absence are introduced as cultural and symbolic categories that allow for the re-signification of marginality and fragmentation. Finally, the need to rethink forms of participation and territorial agency from a projective perspective is proposed, recognizing that regeneration in depopulated territories requires sensitive, adaptive, and situated methodologies. This structure gives coherence to the conceptual framework, articulating a trajectory that moves from systemic diagnosis (A), to the cultural and symbolic dimension (B), and finally to projective and methodological agency (C).

Territorial metabolism as a critical tool

The concept of urban metabolism was introduced by Wolman (1965) to describe cities as systems that consume resources and produce waste, in a cycle analogous to biological metabolism. Subsequently, Van Den Berghe (2018) expanded this notion by situating the production of space within a historical and social logic, where material flows intertwine with cultural, economic, and political practices. These foundations have been taken up by urban ecology and ecological economics to propose multi-scalar analytical methodologies, such as the MuSIASEM approach (Giampietro, 2023), which integrates biophysical and socioeconomic dimensions in complex territories. In recent literature, urban and territorial metabolism has consolidated as a tool to diagnose the sustainability of socio-ecological systems (Kennedy et al., 2011, 2015).

In recent studies on insular and sensitive territories such as the Galápagos Islands, culture has emerged as a significant variable shaping the metabolic performance of human settlements, not merely as a contextual backdrop but as an active component influencing construction systems, economic logics, and resource flows (Perlaza Rodríguez et al., 2024). By analyzing how cultural patterns affect material cycles and urban dynamics, it becomes possible to trace structural tensions between tradition and transformation. Transposing this lens to post-demographic contexts like Basilicata, territorial metabolism can be reinterpreted as a critical diagnostic tool, not only to measure flows of water, energy, and materials, but also to detect interruptions in socio-cultural circuits. Here, the concept of interrupted metabolism allows us to frame demographic decline, infrastructural obsolescence, and symbolic fragmentation not merely as symptoms of crisis, but as generative conditions for projective thinking. Rather than restoring a lost past, the project proposes to work with the fragments, to rearticulate dormant flows and reweave disrupted relations between land, memory, and collective life.

Ontologies of the void and absence

The second theoretical strand focuses on understanding emptiness, ruin, and the unfinished as spaces of possibility. From an aesthetic and philosophical perspective, Didi-Huberman (1997) proposes the notion of the curatorship of the void, understood as the work of revealing suspended memories in seemingly uninhabited spaces. This idea resonates with Haesbaert's (2011) proposal on desynchronized culture, which describes how territorial marginality manifests in discontinuous times, where cultural and socioeconomic practices lose synchrony with metropolitan and global rhythms. In the field of urbanism, introduced the category of terrain vague to refer to vacant, obsolete, or marginal spaces that hold creative potential precisely because of their indeterminate

condition García Grinda and Instituto Leonés de Cultura (2006) expanded this reading by studying industrial ruins and unfinished landscapes as scenarios where new cultural and affective practices emerge.

Recent research further demonstrates that subjective perceptions of neighborhoods can outweigh objective physical conditions in shaping urban wellbeing. Heylen et al. (2025) shows that cohesion, aesthetics, and symbolic attachment have stronger associations with loneliness than measurable factors such as green space or walkability. This finding reinforces the importance of latent cultural and affective dimensions in territorial regeneration, supporting the categories of curated voids (Didi-Huberman, 1997) and interrupted metabolism as methodological tools for design.

On this basis, the concept of Reclaiming Without Antagonism, adopted as a projective approach, proposes a re-appropriation of territory not in terms of confrontation, as often occurs in contexts of resistance to privatization or gentrification, but as an act of care, listening, and re-signification. Emptiness, far from being an absolute absence, thus becomes a methodological and projective field, where memory, landscape, and affectivity intertwine to generate new possibilities of belonging.

New forms of participation and territorial agency

A third theoretical axis concerns the redefinition of participation in contexts where human capital has been drastically reduced. Jim (2015) has proposed the notion of post-populational participation, which challenges classical models of community co-design and opens reflection on how to activate territories with low demographic density. This perspective is crucial for the inland municipalities of Basilicata, where interventions must be conceived beyond the idea of a dense and organized community. Within this framework, projective practice assumes a role of sensitive mediation, in which the designer engages in acts of care and symbolic activation through reversible, adaptive, and biophilic designs. These strategies resonate with the growing approach of Nature-based Solutions (NbS), defined by Dunlop et al. (2024) and further developed by Nesshöver et al. (2017), which not only address environmental objectives (climate adaptation, enhancement of ecosystem services) but also cultural and social dimensions. Recent studies have emphasized the importance of integrating co-creation and territorial justice into the implementation of NbS (Oetken, 2025; Hien et al., 2005), which directly connects with the vision of sensitive and situated interventions in post-demographic contexts. In this way, projective agency is understood as an exercise that transcends the production of physical infrastructure: it entails constructing methodologies of listening, activating suspended memories, and establishing new metabolic relationships between nature, community, and territory.

These three categories, the territorial metabolism as a diagnostic and generative tool, the ontologies of the void as methodological spaces of possibility, and post-populational participation as an exercise of symbolic agency, configure the operative theoretical framework of the Albano Urbano Greenway project. From this basis, design is conceived as a critical practice that not only responds to biophysical and social flows but also reinterprets and reactivates them. What follows is an overview of the main theoretical and empirical contributions that have helped consolidate these approaches within the fields of urbanism, territorial ecology, and regenerative design.

State of the art: regeneration practices in marginal territories

In Mediterranean Europe, various experiences have sought to reverse depopulation and territorial fragmentation through strategies that combine culture, heritage, and sustainability. The case of Urueña, Spain, transformed into the first Villa del Libro with barely 182 inhabitants, demonstrates how cultural innovation can slow depopulation and revitalize local economies through museums, festivals, and identity-based tourism (Azuara-Grande, 2015). Similarly, Italy's National Strategy

for Inner Areas (SNAI) has promoted projects in peripheral municipalities through investment in basic services, enhancement of local resources, and slow tourism, although critical studies point to the need for better integration of symbolic and ecological dimensions in its implementation (Khodaparast, 2025). These precedents highlight that rural regeneration requires integral models that articulate cultural heritage, territorial cohesion, and environmental sustainability.

In parallel, projects based on Nature-based Solutions (NbS) and biophilic design have gained prominence in the regeneration of rural and urban environments. A notable case is the river renaturalization in Albufeira, Portugal, where a canalized watercourse was transformed into a blue-green corridor combining sustainable drainage, native vegetation, and symbolic elements, achieving benefits in health, social cohesion, and climate adaptation (Blau & Panagopoulos, 2018). Complementarily, biomimicry has provided a methodological framework to inspire resilient designs from natural processes and ecosystems (Leila & Naima, 2016; Baczyńska & Lorenc, 2012; Canzonieri, 2007). These strategies validate the relevance of the approach adopted in Albano, where green infrastructure and traditional low-impact techniques are combined with bio-inspired solutions to restore ecological continuity and territorial memory.

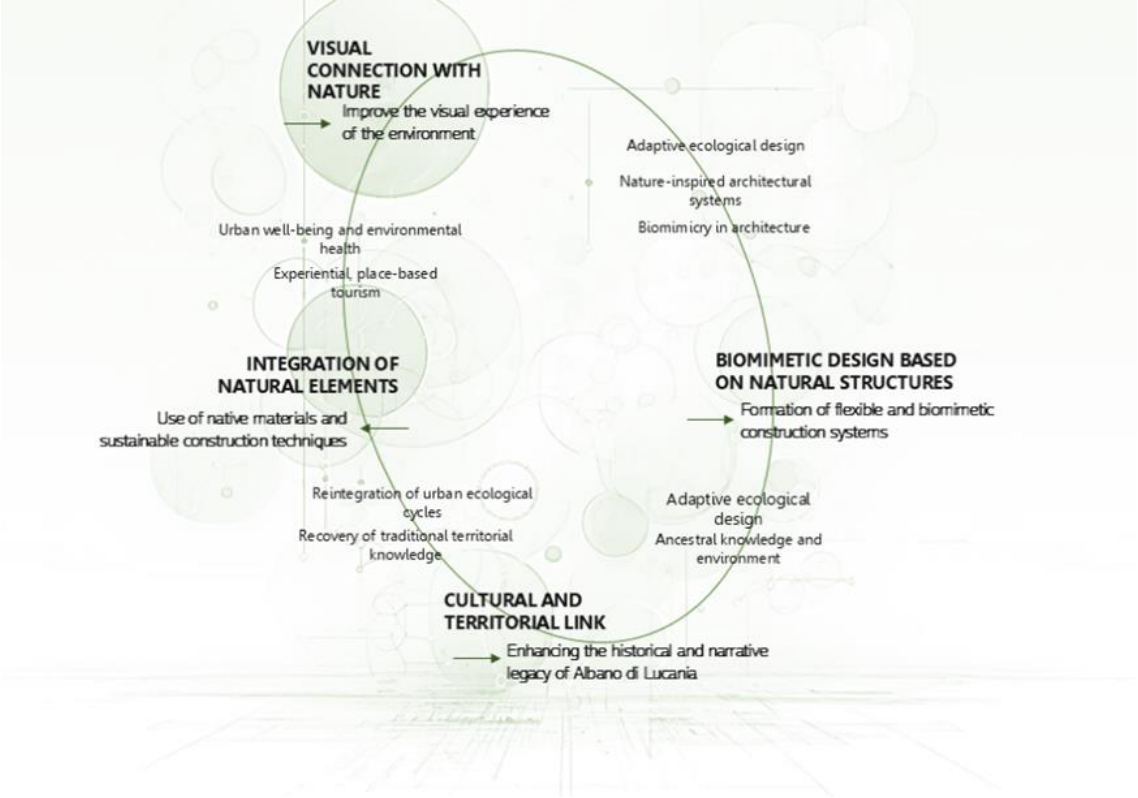


Figure 1. Dimensiones conceptuales y operativas del proyecto Albano Urbano Greenway (Author´s own elaboration)

Finally, international experiences reinforce the idea of slow reactivation as a long-term process. The Eden Project in Cornwall (United Kingdom) transformed a quarry into an environmental and educational center, generating more than £150 million annually in regional benefits, showing how anchor projects can reconfigure local economies and revalorize identities (Baczyńska & Lorenc, 2012). In Latin America, initiatives such as the Neltume eco-park in Chile have combined ecological conservation, community tourism, and the recovery of Mapuche culture, evidencing the importance of integrating symbolic and ecological dimensions in territorial regeneration. Within this panorama, the Albano Urbano Greenway project positions itself as a methodological laboratory that combines lessons from these references -identity-based

cultural tourism, NbS, biomimicry, and curatorial participation- to generate a replicable model of regeneration in post-demographic territories.

The articulation between territorial metabolism, ontologies of the void, and new forms of participation translates into an operative framework that guides project practice. This framework is organized around four interdependent dimensions: visual connection with nature, which enhances environmental experience and supports wellbeing; the integration of natural elements, through the use of native materials, sustainable techniques, and the reintegration of ecological cycles; biomimetic design based on natural structures, which inspires flexible and adaptive constructive systems; and the cultural and territorial link, which reinforces the historical and narrative legacy of Albano di Lucania.

As summarized in Figure 1, these dimensions act in a complementary way and constitute the methodological basis upon which the intervention phases presented in the following section are developed.

Methods / approach

The methodological approach of the Albano Urbano Greenway is structured around the logic of research by design, where design is not conceived as a finished formal result but as an iterative process of exploration, diagnosis, and proposition (Lenzholzer & Duchhart, 2016). The methodology articulates territorial analysis, theoretical references, and adaptive design decisions, with the aim of transforming conditions of fragility into opportunities for regeneration. This process is organized into three interdependent phases: territorial reading, geomorphological translation into design, and technical implementation as a regeneration strategy.

Territorial reading as a project foundation

The first phase of the project consisted of a comprehensive reading of the territory, understood as a simultaneous exercise of diagnosis and listening. Through historical cartographies, geomorphological analyses, topographic surveys, and transect walks, dynamics of erosion, agricultural abandonment, and ecological fragmentation affecting the urban area of Albano di Lucania were identified. This reading included both biophysical dimensions and cultural traces and suspended memories, interpreted through the lens of the curatorship of the void (Didi-Huberman, 1997). From the perspective of territorial metabolism, interruptions in material and symbolic flows, water, soil, agroforestry practices, festivals, were recognized, configuring emptiness not as a deficiency but as a structural and generative condition. On this basis, the design was conceived not as a sum of isolated elements, but as a living infrastructure: a continuous and adaptive system that rearticulates connections between people, landscape, and memory. Guided by the terrain's morphology and the narrative logic of place, the project defines paths, terraces, and resting areas that follow contour lines, water flows, and topographic transitions. Rather than imposing exogenous forms, the intervention recovers latent spatial identities through non-invasive, subtle, and low-impact gestures. Each component, panoramic platforms, play areas, permaculture terraces, forms part of a broader ecological and experiential sequence that interprets the site and projects it toward new inhabitable possibilities.

This initial phase relied on advanced tools of territorial analysis, such as drone surveys and the generation of high-resolution point clouds, which allowed for precise modeling of Albano di Lucania's complex topography (Corner, 2011). These images, shown in Figure 2, reveal the drainage lines, slopes, and soil transitions that guided the layout of paths, terraces, and platforms. The use of geospatial data not only ensured the technical adequacy of the intervention but also reinforced its coherence with the geomorphological logic of the site.

Design process as geomorphological translation

The second phase of the design process consisted of the direct translation of the physical and environmental conditions of Albano di Lucania into landscape and ecological design strategies (Kellert & Calabrese, 2001). The intervention area is characterized by highly erodible clay soils, medium slopes ranging between 8% and 18%, and mixed vegetation zones with high tree density, particularly in the areas adjacent to the Bosco Cupolicchio. The presence of disused rural paths, irregularly compacted soils, and uncontrolled surface runoff created conditions of geomorphological fragility and functional fragmentation. Designing a network of paths, terraces, and platforms in this context required following the logic of contour lines, avoiding terrain cuts, and favoring a progressive and reversible implementation, as in the case of the AIA del Tempo. Stabilized-earth surfaces and modular permeable pavements were adopted to facilitate water infiltration and reduce runoff in the areas of paths and planters surrounding recreational spaces. The muri a secco, which form part of the site's architectural landscape, not only stabilized slopes for pathways but also enabled the creation of agricultural and ecological micro-terraces that reactivate productive functions and support vegetative retention.

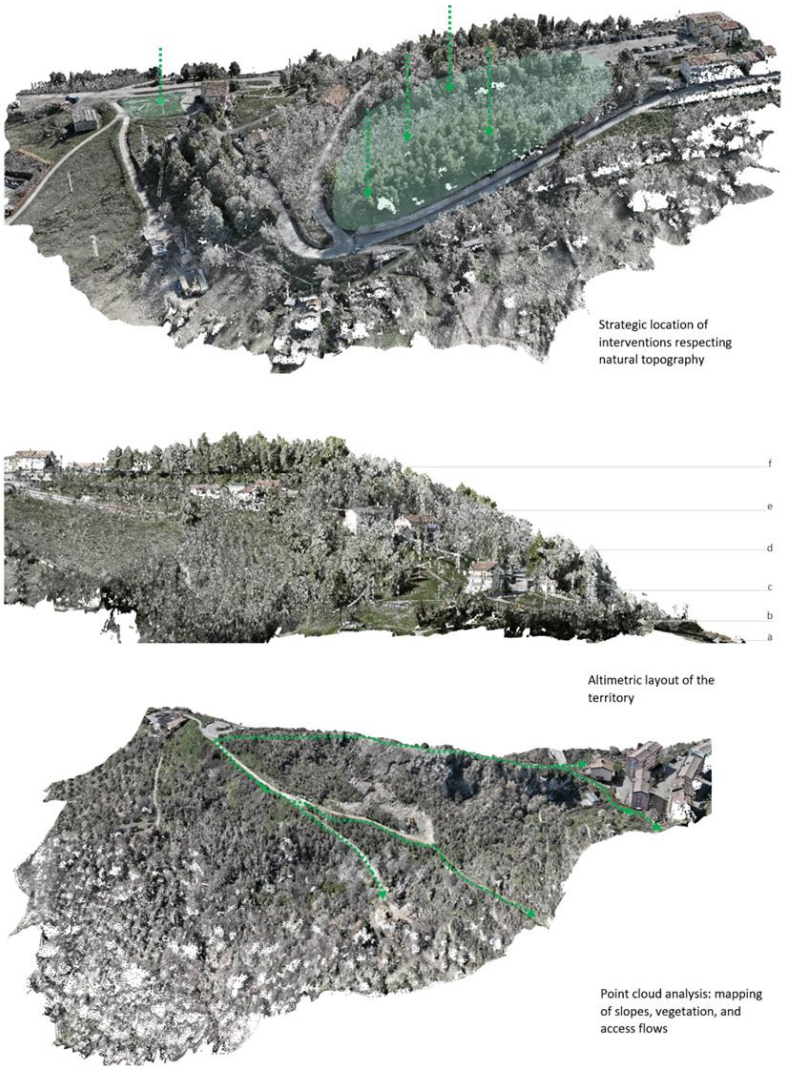
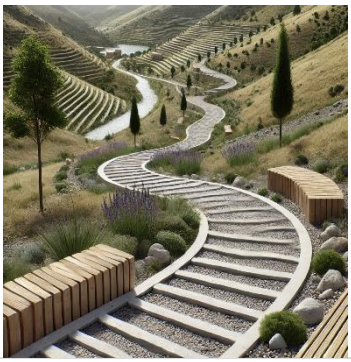


Figure 2. Territorial reading through high-resolution point clouds (Author´s own elaboration)

Table 1. Operational dimensions of the Albano Urbano Greenway (Author´s own elaboration)

Operational Dimension	Applications	Examples	Render
Visual Connection with Nature	Urban Observatory, Belvedere *'Il Volo del Nibbio'*	• Telescope in *Piazza Salvo D'Acquisto*, not only for astronomical observation but also for reading the surrounding topography. • Panoramic bench in stone/wood to maximize valley views. • Strategic planting of native vegetation to frame resting areas, providing shade and aromas without blocking vistas.	
Integration of Natural Elements	Ecological pavements, *Recinzione Ecologica*, *Aia del Tempo*	• Permeable pavements with natural stone, compacted gravel, or recycled wood. • Green fences made of hedgerows of native shrubs and trees instead of artificial barriers. • Expansion of agricultural memory in the *Aia del Tempo* with olives, almonds, and medicinal plants tied to local traditions.	
Design Inspired by Natural Forms and Patterns	*Landscape Integration Stairs*	• Stairs designed with organic, non-linear forms imitating natural paths. • Fractal patterns embedded in pavements and urban furniture. • Tree canopies creating dynamic light and shadow effects, evoking forest atmospheres.	
Cultural and Territorial Link	Narrative signage, wooden sculptures, *Aia del Tempo*	• Wooden panels with inscriptions narrating local agricultural history. • Sculptures in wood honoring traditional rural crafts. • Interactive circuit with QR codes and sound narratives about ancestral resource management practices.	

The use of local materials and techniques, such as limestone collected on site and chestnut wood from surrounding forests, not only ensured aesthetic and cultural coherence but also reduced the logistical and environmental impact of the construction process. Instead of imposing external forms, the design reinterpreted the topography, incorporating light and adaptive structures that engage in dialogue with the landscape and allow for its future evolution (McLaughlin, 1991).

The application of Nature-based Solutions (NbS) was translated into concrete operations: stabilized natural soils and permeable paving in areas of water accumulation, planting of native species to reinforce biodiversity, integration of natural shading through the preservation of existing tree cover, and the creation of unadorned contemplative spaces such as the Belvedere Volo del Nibbio. These actions made it possible to recompose ecological continuity and enable new forms of habitability that combine wellbeing, community use, and environmental care.

Finally, a series of conceptual renderings developed through artificial intelligence tools served as instruments of anticipatory verification, visualizing how the projected elements -paths, belvedere, terraces, educational platforms- responded not only to the conceptual framework but also to the site's specific conditions. The conceptual visualizations and operational guidelines guided the design in order to achieve compatibility with the territory's geomorphology and to overcome the technical challenges that arose.

Technical implementation as a regeneration strategy

The third phase corresponded to the definition of constructive and ecological solutions aimed at restoring the metabolic and relational continuity of the territory. The design was developed through a multi-scalar approach, integrating principles of biophilia, Nature-based Solutions (NbS), and low-impact strategies. The proposed solutions include permeable surfaces, infiltration terraces, vegetated muri a secco, and micro-green infrastructures, all conceived to promote water infiltration, reduce erosion, and stabilize slopes. Although the project is currently under execution, the proposed devices can be considered consistent with the adopted conceptual framework. The selection of local materials (stone, chestnut wood, stabilized soils) and reversible construction techniques reinforces the morphological, ecological, and cultural continuity of the territory. The design does not impose itself on the topography but interprets it, aligning with the principles of biomimicry (Leila & Naima, 2016; Naghibi et al., 2021) and with the Reclaiming Without Antagonism approach, which frames intervention as a sensitive, adaptive, and care-oriented practice.

This dual orientation, technical resilience and symbolic regeneration were articulated through specific design elements summarized in Table 2.

The methodological logic adopted in the Albano Urbano Greenway was not conceived as a linear process, but as a system of interdependent layers that interact dynamically. As synthesized in Figure 3, the project pathway unfolds from the initial territorial reading to the realization of a living infrastructure, integrating geomorphological, cultural, and ecological dimensions at each stage (Waldheim, 2006). This visualization reinforces the understanding of the method as an iterative cycle, where each phase feeds back into the others.

Figure 3 presents a conceptual sketch that illustrates the methodological framework guiding the design process in Albano di Lucania. It visualizes a four-tiered translation from territorial analysis to architectural expression. The process begins with territorial reading, which involves interpreting hydrological, topographic, and geomorphological features that shape the site. It then moves to symbolic interpretation, focused on revealing cultural and historical layers tied to local memory and landscape identity. The third level, ecosystem composition, integrates native vegetation, ecological linkages, and soil-water dynamics. Finally, the design culminates in living infrastructure, a spatial configuration of low-impact interventions that synthesize ecological, spatial, and symbolic dimensions. Rather than imposing form, the design emerges through a

progressive and sensitive reading of the territory, grounded in biomimetic and regenerative design principles (Spirn, 2022).

Table 2. Technical implementation of Albano Urbano Greenway (Author´s own elaboration)

Design Element	Function	Materials	Construction Technique
Ecological pavement	Ecological connection surface	Modular permeable paving, grass 57%	Installed over a draining sub-base, compacted and leveled
Stabilized natural surface	Integrated pedestrian path	Stabilized soil, sand, natural binders	Layered application, compaction, surface finishing
Dry-stone wall	Soil stabilization	Local stone, soil	Manual assembly, dry interlocking, natural drainage
Landscape integration stairs	Connection between levels	Natural stone, chestnut wood	Stone step assembly, natural anchoring
Panoramic bench (Panchina gigante)	Rest and contemplation	Solid wood, galvanized steel supports	On-site assembly, fixed to a natural base
Sports fields	Recreational and sports area	Synthetic grass, rubber, steel	Prefabricated installation over prepared foundations
Ecological terraces (Aia del Tempo)	Agricultural and environmental regeneration	Local stone, raw earth, native vegetation	Manual construction, terracing on slopes, planting
Pet area	Space for domestic animals	Light mesh fencing, natural ground	Minimal installation anchored on soil
Signage	Informative and orientation element	Galvanized metal, wood, UV-resistant graphics	Installed on posts or frames, weather-resistant

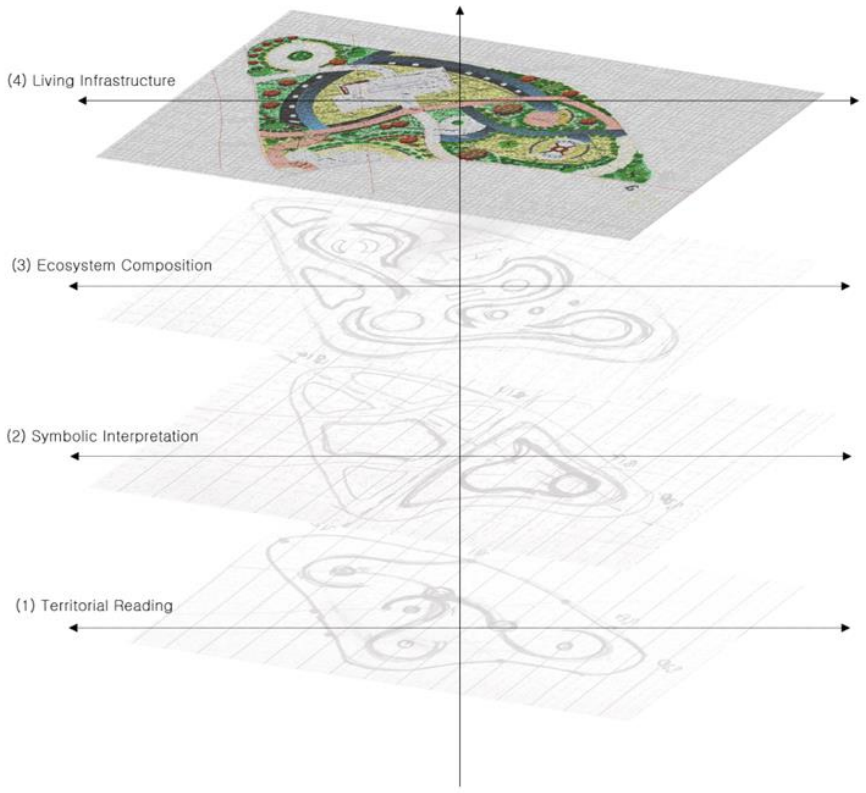


Figure 3. Conceptual layering of design logic based on geomorphological interpretation (Author´s own elaboration)

Practice: territorial devices and constructive strategies

Albano Urbano Greenway is a territorial and urban regeneration project located in the Comune di Albano di Lucania (Basilicata, Italy), a mountain village at 899 m a.s.l. nestled in the Dolomiti Lucane, within the Zona Speciale di Conservazione (ZSC) Bosco Cupolicchio of the Natura 2000 network. The area is characterized by geomorphological fragility (landslides, calanchi, erosion), progressive depopulation, and ecological fragmentation, yet it holds remarkable landscape and cultural value. The project emerges as a response to these critical conditions, aiming to reconnect community and territory through a multifunctional, adaptive, and symbolic green infrastructure. Developed in 2025 with funding from the Regione Basilicata (€499,410) and commissioned by the Municipality, the design was led under the concept of living infrastructure, not a set of isolated interventions, but a continuous system activating geomorphological, ecological, and cultural traces.

The project integrates advanced territorial technologies (drones, point clouds) with community-based participatory processes (transect walks, memory mapping), bridging local knowledge with technical criteria to ensure landscape coherence.

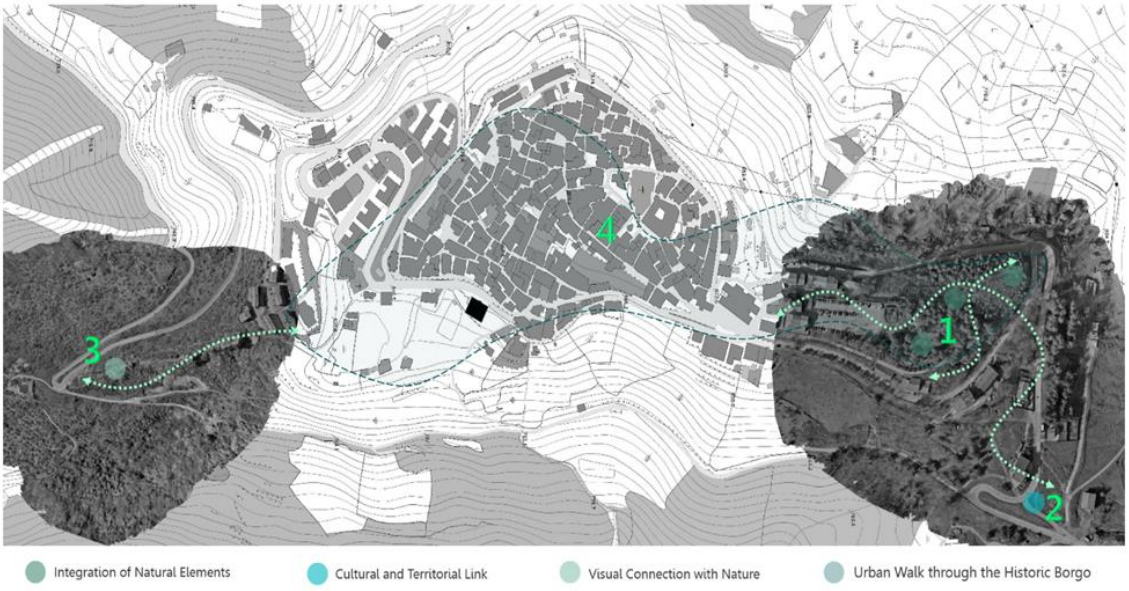


Figure 4. Site plan with location of intervention zones (Author´s own elaboration)

This figure illustrates the spatial distribution of the main intervention areas within the urban and peri-urban context of Albano di Lucania. The numbers indicate:

- 1 –Recreational node: including the Paddle Tennis Court, Children's Playground, Pet Area, and Eco-Fitness Trail. Subzones a, b, and c correspond to specific micro-infrastructures placed to enhance ecological connectivity and low-impact habitability.
- 2 – AIA del Tempo: a linear path that reconnects symbolic and ecological layers through an immersive, interpretive itinerary.
- 3 – Il Volo del Nibbio Viewpoint: located at the western edge, this elevated overlook offers panoramic views and anchors the ecological trail that loops through the hillside.

The combination of topographic data, aerial imagery, and programmatic notation provides a synthetic yet detailed reading of the intervention's geomorphological and cultural integration.

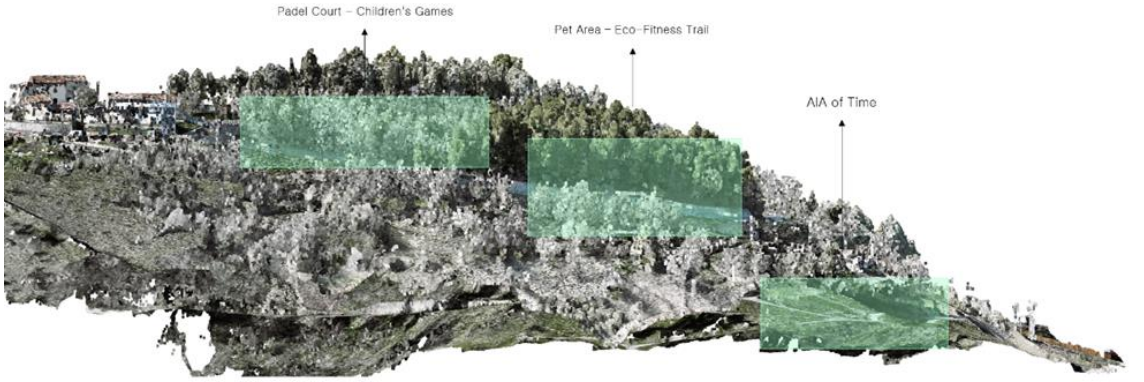


Figure 5. Topographic section showing the location of low-impact landscape interventions (Author´s own elaboration)

This geomorphological model, derived from a high-resolution point cloud, shows the distribution of proposed nature-based micro-infrastructures across the eastern slope of Albano di Lucania. The white rectangles identify three main intervention areas:

- Padel Court – Children's Games: located on a leveled clearing near the inhabited area, adapted to existing slope conditions.
- Pet Area – Eco-Fitness Trail: positioned within a dense pine forest, with minimal intervention to preserve the vegetative cover.
- AlA of Time: a cultural trail that follows the historical and symbolic continuity of the landscape.

Each intervention was conceived with a biomimetic approach, respecting the terrain's morphology and ecological potential. This section illustrates how topography actively informed the spatial and functional arrangement of the design.

Figure 6. Morphological integration of the periurban belvedere and transhumance path (Author´s own elaboration)

3D point cloud of the periurban slope showing the elevation difference between the provincial road and the panoramic platform. The intervention reactivates a traditional transhumance route and inserts a low-impact structure aligned with the terrain.

Four strategic areas of intervention

The project was structured around four strategic areas of intervention, each conceived as a territorial device linking ecological, cultural, and social dimensions. Their specific functions and components are summarized in Table 3, which outlines the operative framework guiding the design. The following images illustrate how these areas were translated into spatial configurations, materials, and constructive solutions within the Albano Urbano Greenway.

Table 3. Strategic areas of the Albano Urbano Greenway (Author´s own elaboration)

Area	Function	Main Components	Objectives / Expected Outcomes
Villa Comunale	Urban social node	Padel court (310 m²); under-13 sports field with anti-shock flooring (88 m²); stabilized-earth fitness trail (386 m²); fenced pet area (314 m²); ecological paving; native landscaping.	Strengthen social interaction; integrate sport and recreation; improve urban biodiversity and comfort.
Belvedere 'Il Volo del Nibbio'	Contemplative and symbolic space	Wooden and stone panoramic platform; giant bench; optical viewer.	Reinforce landscape identity; connect community with topography and local fauna; promote slow tourism.
AIA del Tempo	Urban permaculture and educational device	Ecological terraces; natural drainage (green drain); didactic amphitheater; landscape agora; memory and sensory garden.	Support environmental education; valorize agricultural memory; promote biodiversity and cultural continuity.
Ecological Connectivity	Landscape integration and slow mobility	Pathways; landscape integration stairs, aligned with contour lines and water flow.	Ensure ecological continuity; enable slow mobility; increase territorial legibility and accessibility.

Figure 7. Integration of programmatic interventions along the geomorphological section (Author´s own elaboration)

Figure 7 synthesizes two complementary readings of the intervention area in Albano di Lucania. The base of the diagram presents a longitudinal section generated from a topographic point cloud survey, illustrating the altimetric configuration of the site and the spatial relationship between key programmatic elements, from the lower provincial road to the elevated communal garden. This geomorphological visualization was essential for designing adaptive micro-interventions that respond to the terrain's natural morphology. Overlaid on this section are rectangular frames that highlight specific zones of intervention: a paddle tennis court and children's play area, a pet zone with an eco-fitness trail, and interpretive installations along the 'AIA del Tempo' route. Within each frame, photorealistic renderings depict how these low-impact infrastructures integrate with the topography and native vegetation. The upper strip of the diagram presents contextual images that illustrate the ecological and cultural gradient of the surroundings, ranging from the inhabited centre to rural landscapes. Together, these layers reveal a design logic based on terrain adaptation and nature-based strategies, aimed at creating an ecological and cultural corridor with minimal intervention.

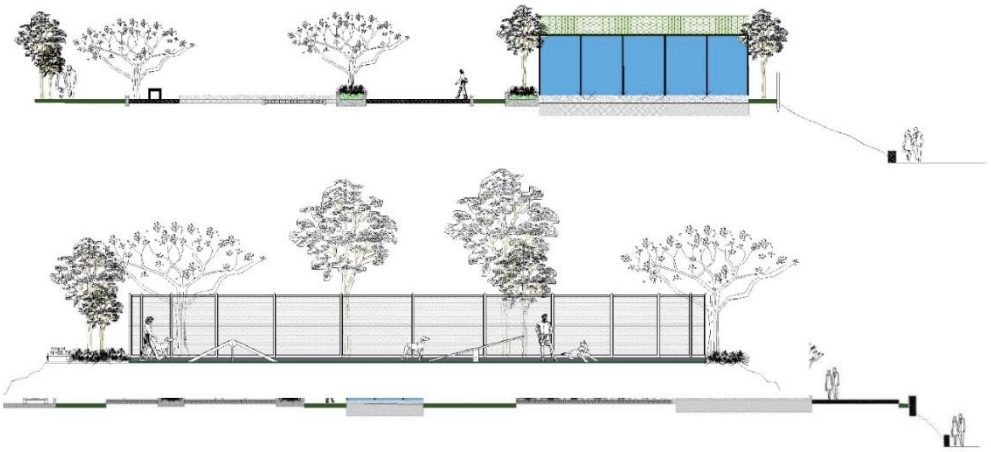


Figure 8. Schematic and technical sections of the Villa Comunale intervention (Author´s own elaboration)

These sections illustrate the integration between nature, sociality, and micro-infrastructure.

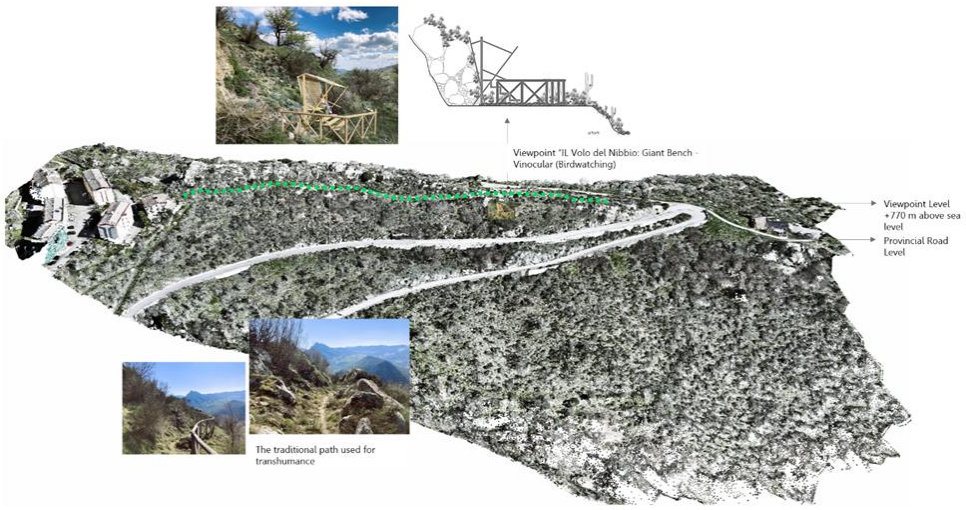


Figure 9. Panoramic viewpoint as symbolic infrastructure (Author´s own elaboration)

It reinforces the notion of affective reconnection with the territory and observation as a projective act.

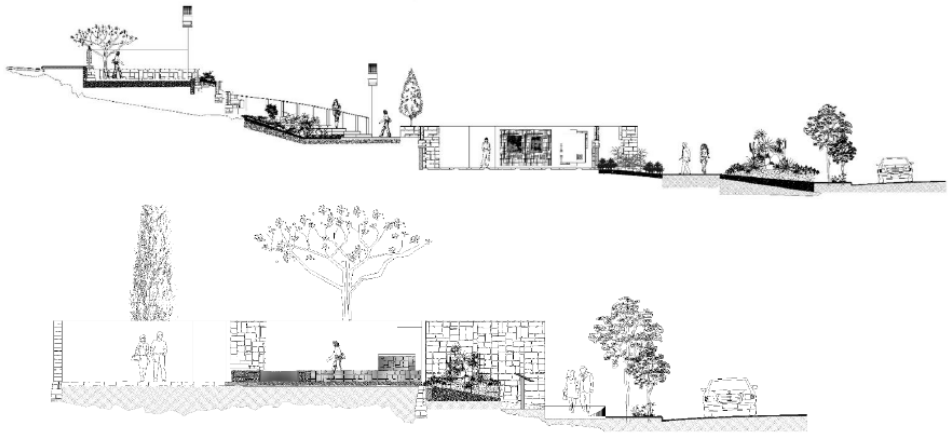


Figure 10. Agro-educational space for climate resilience and cultural transmission (Author´s own elaboration)

The ‘AIA del Tempo’ is conceived as a micro-infrastructure that adapts sensitively to the natural slope of the terrain, transforming vertical discontinuities into spatial opportunities. As shown in the sectional drawings, the design leverages topographic variation to articulate a sequence of platforms, thresholds, and transitions that accommodate distinct uses, such as contemplative areas, interpretive signage, and rest zones, without altering the geomorphology. Each level supports a differentiated experience while maintaining visual and ecological continuity. The stepped configuration not only ensures universal accessibility through gradual paths and ramps but also enhances environmental integration by preserving existing trees and minimizing soil movement. This strategy exemplifies the project's broader aim to regenerate public space through low-impact, site-responsive interventions rooted in geomorphological logic.

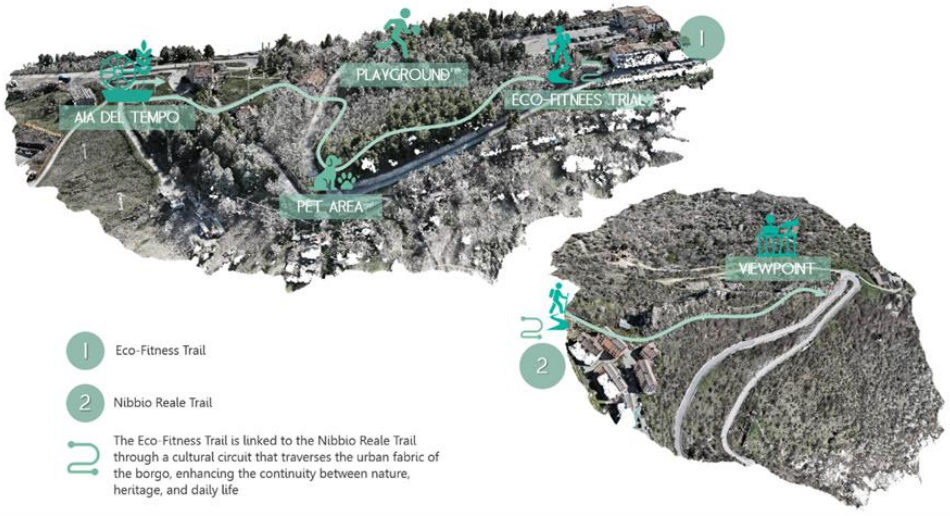


Figure 11. Diagram showing the spatial articulation of the project area based on the point cloud survey (Author´s own elaboration)

Key low-impact interventions, such as the Eco-Fitness Trail, Pet Area, Playground, Aia del Tempo, and Viewpoint, are geolocated and connected through a continuous cultural and

ecological route. This system integrates nature-based infrastructure with the urban fabric, creating a regenerative landscape framework grounded in topography and local identity.

Conclusions

The *Albano Urbano Greenway* project represents a concrete application of the Reclaiming Without Antagonism approach, understanding territorial regeneration not as a formal imposition or mere ecological remediation, but as an act of care, listening, and symbolic rearticulation. From this perspective, emptiness is recognized not as absence but as a field of possibility where memory, landscape, and territorial metabolism intertwine. The methodology developed does not limit itself to describing the territory or applying theoretical references in an abstract way. On the contrary, it integrates multi-scalar diagnosis, critical conceptual frameworks, and adaptive design strategies to intervene under conditions of fragility. This approach made it possible to identify specific metabolic interruptions in the flows of water, energy, memory, and land use, and to translate them into design decisions coherent with the topography, local ecology, and symbolic structure of the site. Thus, the project does not simply respond to a degraded context but activates its regenerative potential through a situated logic.

A particularly revealing finding emerged during the initial phases of execution in the *Villa Comunale*. The replacement of degraded vegetation to enable an area for active wellbeing, a technically justified action and consistent with the principles of biophilic design, provoked an immediate emotional reaction from some inhabitants. Although the space had not been frequented for years, this response revealed a form of latent curatorship of the void: a symbolic presence that only manifested once the space was altered. This experience highlights the importance of considering invisible presences -those not expressed in active use but embodying memory and affectivity- as part of the interrupted territorial metabolism.

Although still under execution, the project has defined, since its conception, a series of indicators that will allow its impact to be assessed in the short and medium term. These indicators are organized into three key dimensions, biophysical, symbolic, and socio-ecological, and will be the subject of post-intervention evaluation through specific technical sheets. To systematize and evaluate the project's impact, monitoring indicators have been defined that will be implemented in a post-intervention monitoring phase. These metrics will allow the regenerative scope to be quantified across three key scales:

Table 4. Expected impact indicators and monitoring metrics (Author´s own elaboration)

Dimension	Expected Indicator	Planned Evaluation Method
Biophysical	Increase in soil permeability index	GIS comparison of permeable surface before and after the intervention
Symbolic	Reintegration of spaces into local collective narratives	Qualitative analysis through interviews and community media
Socio-ecological	Emergence of new community uses of public space	Direct observation and monitoring of activities
Ecological	Increase in plant diversity through reintroduction of native species	Recording of planted species and monitoring at 12 months

The Albano Urbano Greenway project contributes to the field of territorial planning and design in three specific ways. First, it validates a three-phase workflow, territorial diagnosis, geomorphological design, and regenerative implementation that links biophysical analysis, theoretical frameworks, and low-impact constructive solutions, offering a replicable methodology for regeneration projects in fragile contexts. Second, it introduces ex-ante evaluation instruments through the definition of expected impact indicators, such as permeability, biodiversity, community appropriation, and new social uses, making them an integral part of the design and

anticipating monitoring and verification criteria that are often absent in small-scale urban projects. Third, it advances a multi-scalar articulation in governance by proposing a curatorial role for local administrations, showing how synergies between inhabitants, collectives, and authorities can be coordinated in low-density territories, and how these experiences may inform top-down policies oriented toward adaptive regeneration in Europe and Latin America. Taken together, the project is offered as a methodological basis for regeneration in post-demographic contexts, transferable to territorial planning programs and public policies that aim to integrate ecological continuity, cultural memory, and social resilience within a single operative framework.

Disclosure statement

The author reports there are no competing interests to declare.

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Teaching Architecture Through Film: An Interdisciplinary Approach

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Practice article

Abstract

Architecture is central to understanding the built environment. The most common threshold for people to appreciate architecture is through sensual experience. In college, non-architecture students typically are exposed to architecture in a historical survey course as a series of styles. Survey courses are derived from art history as it catalogues styles. An alternative to the architectural style survey is an interdisciplinary course developed by architecture and cinema faculty that uses the students' own architectural experiences. Through the medium of film, architecture is understood through six experiential elements: Space/Scale; Style/Ornament; Light/Shadow; Color; Sound; Landscape. The course is a weekly seminar showing 14 films in which architecture plays a key role. Each week a film is screened, with readings supporting class discussions. Students use a 'Notes Worksheet' to focus on the architectural experience in the film, then complete a 'Critique Assignment' that emphasizes architecture's experiential aspects. Students build connections between what they learn about architecture through viewing, discussing, and critiquing each film, and their own personal experiences and memories of architecture. Student evaluations of the course indicate that this interdisciplinary course helps non-architecture students to formulate a greater awareness of architecture and appreciation for it, as well as a deeper understanding of the art of film.

Introduction

The built environment, whether carefully designed or ad hoc and haphazard, shapes the way we experience the world at large. The discipline of architecture is central to this understanding of the built environment. The most common threshold for any individual to appreciate the way that architecture shapes one's world view is through the senses--the experience of the built environment as it is seen, heard, felt, even smelt and tasted. It is through our phenomenological engagement with architecture that it becomes most accessible and we become most fully ourselves. As Juhani Pallasmaa writes in his book, *The Eyes of the Skin*: 'Every touching

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experience of architecture is multi-sensory; qualities of space, matter, and scale are measured equally by eye, ear, nose, skin, tongue, skeleton, and muscle. Architecture strengthens the existential experience, one's sense of being in the world, and this is essentially a strengthened experience of self.' (Pallasmaa, 2014, p. 41) (Through these haptic experiences, human beings can make sense of the built world, through which memories are made. This is central to human socialization, wellbeing, and fulfillment.

Exposure to and instruction in the discipline of architecture and design in higher education is primarily grounded in pre-professional and professional degree programs devised to train individuals who seek careers in architecture, interior design, environmental design, and other fields related to the built environment. Colleges and universities offer courses surveying the history of art and architecture for undergraduates who must fulfill general education requirements through liberal arts electives. In such courses of study, architecture and the built environment is typically presented from an historical perspective—primarily the development of architectural styles through successive periods, tied to cultural and technological contexts. The structure of such survey courses is derived from the field of art history as it catalogues the visual arts through periods of styles.

The goal here was the development of a course about architecture for non-architecture majors that does not rely on the format of the history survey course, but instead on how architecture is experienced, and how such experiences shape one's understanding and appreciation of architecture. Such a course would focus on how the built environment can be understood through its experiential characteristics: its spatial and scalar qualities, its ornament and style, its aural dimension, the effect of color, the power of light and dark, the perception of materials, its setting in the landscape (either designed or natural). These are experiential aspects of architecture shared between human beings, shaped through personal history (namely, memories).

An interdisciplinary course

A few years ago the university where I am on the faculty of architecture solicited proposals for interdisciplinary courses that would be open to all university undergraduates. The university had years earlier instituted an undergraduate elective course curriculum (known as the 'All-University Curriculum') that was open to every undergraduate in order to fulfill required courses across disciplines. In recent years the All-University Curriculum evolved into the University Interdisciplinary Studies (UIS) program, in which courses would be developed across disciplinary lines. As part of their requirements for their baccalaureate degrees, students are required to take at least four UIS courses, which cover four areas: 'Artistic and Creative Expression'; 'Cultural and Historical Interpretation'; 'Social Context and Change'; 'Natural, Scientific, and Technological Exploration' (University of Hartford, n.d.). According to the university, these areas of study are integrated in interdisciplinary courses in which students '…examine in-depth problems, ideas, and issues from multiple perspectives. Since faculty from all schools and colleges of the university create these courses, the curriculum takes full advantage of the diverse resources of the institution' (University of Hartford, n.d.).

The call for new UIS courses asked faculty to collaborate across disciplines to propose courses that would combine aspects of each discipline in a hybrid form. A course about architecture for non-architecture majors would perhaps best be structured as one that focused on architecture's experiential aspects, to which virtually any undergraduate in any discipline has access to. Film studies presented a second discipline—outside of architecture—that would serve as the medium for exploring architecture's experiential characteristics.

The course proposed by a prolific film scholar at the university and myself, 'Architecture in Film,' is structured as a weekly seminar that would allow undergraduates to view a curated series of 14 films in which architecture plays a key role. Each week is dedicated to a single film, with readings supporting the viewing of the film and discussions before and after the screening.

Following each weekly screening, students complete a film critique that focuses on the experiential aspects of architecture as portrayed in the film. It's important to note that this course was proposed in the category of 'Artistic and Creative Expression,' not 'Natural, Scientific, and Technological Exploration.' The former category allows both cinema studies and architecture to coexist as interdisciplinary equals. In this way, both architecture and cinema fulfill the goals of the interdisciplinary category. According to the UIS program: 'These courses examine how individuals and cultures express themselves and provide opportunities for students to actively engage in the creative process.' The focus would be how both architecture and film are creative outlets of expression, according to the UIS program: 'Knowledge of architecture, art, dance, drama, literature, and music opens channels of communication and leads to a realization of the complexities and interrelationships of human society' (University of Hartford, n.d.). The course was approved by the UIS curriculum review board in the Spring 2017 semester, and first offered as a three-credit course in Fall 2017. It has been offered every semester since then and met enrollment targets every semester.

Pedagogy and course content

A course about architecture and film for non-architecture students must strike a balance between the two disciplines. Film allows an access point for non-architecture students to experience architecture as a character within the narrative of the film. Film directors and architects operate in similar ways: they marshal the talents and expertise of large groups of people and bring them together to create an environment to be experienced. In film, of course, architecture is once removed from actual experience. Architecture within the film is most often the product of exacting set design (unless on-site locations are used, but even in such cases the director commands control over what is in the scene. In this way, the director's creation of the experience of architecture (*mise en scene*—literally, what is in the frame of the scene) is very similar to the architect's efforts to shape human experience in the built environment. In architecture, it is the three-dimensional experience of space over time, the places in which people act out their lives. The cinematic experience offers non-architecture majors a way to access architecture in a visceral way: how and what do we experience in the built environment, what does it mean, how is it symbolic, how does it affect our wellbeing? Within film, the architectural experience approaches a state that one could argue is closest to the architect's reasons for being drawn to the profession: to create places that are memorable, symbolic, freighted with human aspirations and emotions—in a word, environments that are 'transcendent.'

In Juhani Pallasmaa's landmark study of film, *The Architecture of Image: Existential Space in Cinema*, he describes the use of architecture in film and the structure of film itself as 'amplifiers' to transport the viewer into transcendent experiences. Pallasmaa writes: 'Cinematic architecture evokes and sustains specific mental states; the architecture of film is an architecture of terror, anguish, suspense, boredom, alienation, melancholy, happiness or ecstasy, depending on the essence of the particular cinematic narrative and the director's intention. Space and architectural imagery are the amplifiers of specific emotions.' (Pallasmaa, 2001, p. 7) Here, Pallasmaa's description of the director's use of architecture in film echoes the goals of architects who emphasize the phenomenological in their architecture.

Echoing Pallasmaa, the cinematic and architectural scholar François Penz contrasts cinema and architecture in their ability to tell stories about human life across space and time. For Penz, architecture's spatial quality is at its most powerful when rendered on the screen, allowing it to further the narrative of the film. He points to an example in Jean-Pierre Melville's film *Le Samourai*, where a twisting, confining staircase mirrors the inner turmoil of a character's own life as he climbs the stairs. (Penz, 2018, p. 189)

For the non-architecture student, it is essential to frame the discussion, screening, and critique of the films shown in the course by focusing on their own personal experiences of architecture.

This is a common human threshold of access to architecture no matter the personal or academic background of the student. The course guides the students in their understanding and critique of each film according to six 'Experiential Elements' of architecture: Space/Scale; Style/Ornament; Light/Shadow; Color; Sound; Landscape (see course handout at end of paper). Each of these elements is discussed at the beginning of the course, in the shared context of their importance in experiencing architecture and also in appreciating cinema—in the architect's creation of the built environment, and in the director's creation of the world within the film. Although the elements are presented as equally weighted regarding their importance in architecture and film, one might argue that the three elements of Space/Scale, Light/Shadow, and Sound are more important to one's experience in both architecture and film; Style/Ornament, Color, and Landscape might be assessed as less so.

It is critical in the course that the student maintains focus on these six elements; this can be a challenge for non-architecture majors. A handout explains each of these elements in the initial class meeting. Examples are shown and discussed, both from the built environment and from some of the films that will be screened in the course. For example, Space/Scale is discussed in the context of the emotional states one might experience in vast spaces, compared to very confined spaces. The symbolic importance of this experiential element is noted—it often denotes the communal value of the architecture, or the financial resources of the people who caused it to be built. In film, it can demonstrate the importance or power of people who command large spaces, such as the character Charles Foster Kane in Orson Welles's film Citizen Kane (1941), who lives in a vast mansion, Xanadu. But Space/Scale in film can also signify the emotional relationships between film characters. Kane and his second wife, Susan, must shout at each other in the cathedral-like cavern of Xanadu's living room just to have a conversation (Figure 1). The size and scale of the architecture they co-habit tells the film viewer about the wide emotional gulf that now exists between them.

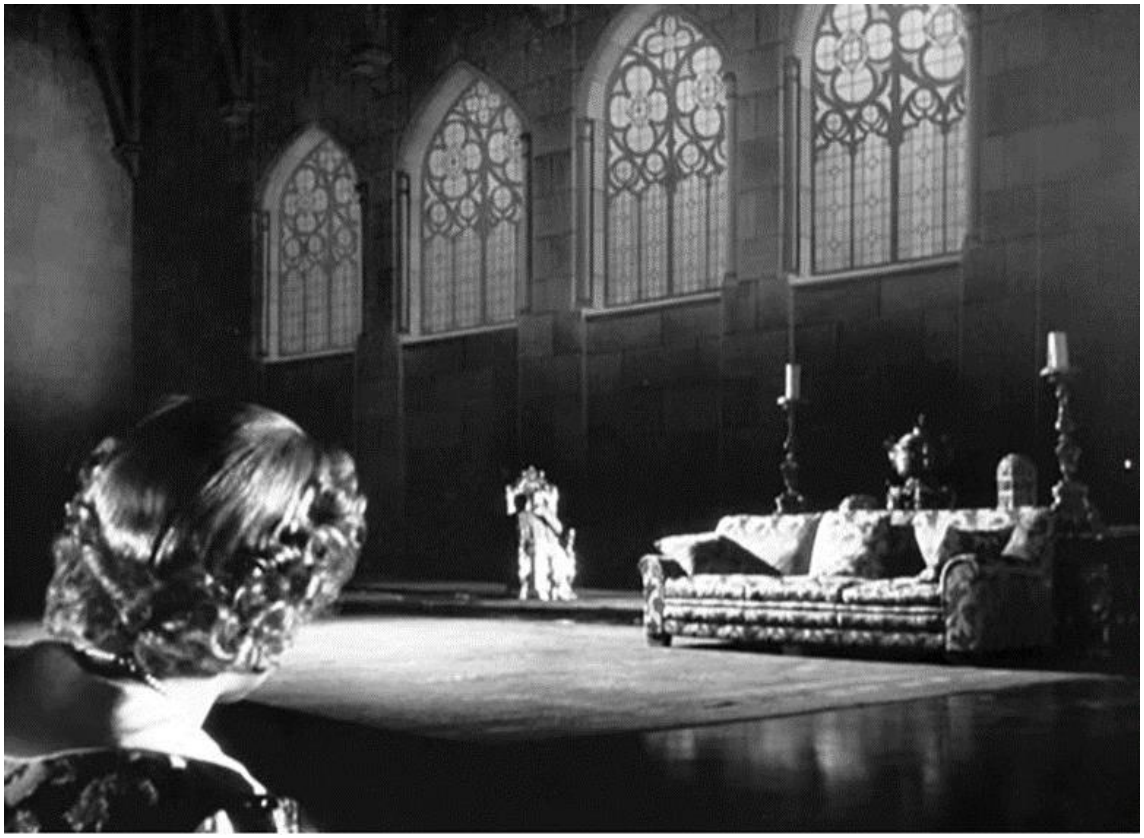

Figure 1. The vast spaces of Charles Foster Kane's mansion Xanadu in Orson Welles's Citizen Kane (1941) symbolize the emotional gulf between Kane and his second wife, Susan.

In similar way, Light/Shadow is explained as a crucial element in the experience of architecture, which is, according to Le Corbusier, '…the masterly, correct and magnificent play of masses brought together in light.' (Le Corbusier, p. 29) Within film, light and shadow can telegraph the mental state of a character, trapped in the shadows of a scene. In a film such as Fritz Lang's Metropolis (1927), light and shadow are used to symbolize social and economic standing in this utopian/dystopian city of the future (Figure 2).

Figure 2. In Fritz Lang's Metropolis (1927) the realms of utopia and dystopia are distinguished primarily through the abundance or absence of illumination: the elites live in light-filled towers, while the workers inhabit a dark world beneath the surface of the city.

Those characters who are powerful are surrounded by light (and light colors), while those who live in subservience are continually in shadow, living and working beneath the surface of the earth. Often within film, combinations of architecture's experiential elements are used by the director and set designers to reinforce the developing narrative. An example of this is seen in Stanley Kubrick's *The Shining* (1985), where the deteriorating mental breakdown of one of the characters, hotel caretaker Jack Torrance, is suggested through the assertive, lurid carpet patterns of the Overlook Hotel, which echo the internal spatial tangles of the hotel's hedge maze--part of its landscape (Figure 3).

Figure 3. Jack Torrance, the protagonist of Stanley Kubrick's The Shining (1980), surveys a model of the maze at the Overlook Hotel, which mirrors the spatial tangle of his own declining mental state.

In total, the 14 films screened are paired in one of seven themes throughout the semester: Utopia/Dystopia: *Metropolis* (1927) and Brazil (1985); The Director Was an Architect: *Rear Window* (1954) and *Citizen Kane* (1941); Haunted Architecture: *The Haunting* (1963) and *The Shining* (1980); Architecture East/West: *Equinox Flower* (1958) and *Code 46* (2003); The Architecture of the Super Hero: *Doctor Strange* (2016) and *Batman* (1989); Architecture, Space, Gender: *A Room With a View* (1985) and *Light in the Piazza* (1962); The Architect was a Real Character: *The Fountainhead* (1949) and *The Belly of An Architect* (1990).

Readings in the course are assigned to help students to think about the connections between the architecture in the film, its symbolism, and the larger narrative elements. Pallasmaa's Pallasmaa's The Architecture of Image is particularly valuable in how it explores these connections, as well as such texts as Steven Jacobs' 'Architecture of the Gaze' (Jacobs) which interrogates the set design of Alfred Hitchcock's Rear Window (1954); the 'Epilogue' of Donald Albrecht's Designing Dreams, (Albrecht) in which the death knell of mid-century Modern architecture as set design is signaled in King Vidor's The Fountainhead (1949); and Marc Augé's non-places: introduction to an anthropology of supermodernity (Augé) as a context for the non-places depicted in Michael Winterbottom's Code 46 (2004). Additional readings on film history, production, and critique are drawn from *Film Art: An Introduction* (Bordwell, M. and Thompson, K).

Critical interdisciplinary focus

All 14 films are screened in class, which allows for critical group discussion before and after a film is viewed. Course support materials are designed to assist students in taking notes during the film screening, which are then used to write a 450-word critique on architecture's role in the film. Because these students are learning the language of experiential architecture, they typically need guidance on what experiential details should be noted while watching the film. A 'Notes Worksheet' (see example of course handout) for each film helps the student on what she should pay particular attention to during the screening. One side of the handout is a 'Notes Worksheet'

that provides a prompt for notes to be taken in response to each one of the six Experiential Elements of Architecture as they relate to the film being screened. For example, for Rear Window, students are asked: 'What is the role of architectural style/ornament in the film?' Or: 'How do lighting effects, including the absence of light, feature the role of architecture in the film?' In regard to sound: 'How are sound effects used to convey architecture's size/scale in the film?'

The 'Notes Worksheet' is accompanied with the 'Critique Assignment' in which the students are asked to write about architecture's role in the film, based on the notes they have taken. But they also need to build a bridge between their experience of architecture in the film, and their own personal experiences of architecture. For the film Rear Window, students are asked not only to critique the role of architectural style/ornament, but also: 'How would describe the style/ornament based on your own experiences of architecture?' When assessing the use of sound in the setting of the film's 'built environment,' they are asked to speculate on 'How might the courtyard in the film *Rear Window* affect sound?' In responding to the critique question about the use of light, or its absence, in the film, students are required to: 'Describe a personal experience with light and shadow in architecture.'

A key element and goal of the course is to help students in disciplines other than architecture to build connections between what they learn about architecture through viewing, discussing, and critiquing each film, and their own personal experiences with architecture. Among the course's objectives are that students will learn about: architecture's narrative power in film; the elements of architecture that are used in film; and (most importantly) that students will 'integrate their own experiences of architecture with those experienced through film, and describe the connections.'

Conclusion

Student course evaluations have shown that 'Architecture in Film' has helped non-architecture students to form a greater awareness of architecture, an appreciation for it, through the medium of film. Student Course Evaluations for the university's UIS courses are graded on a 5-point scale. One survey question asks students if in the course they '…integrated material from outside (for example, from real-world situations, life experiences) and inside (for example, course readings and lectures).' Over six semesters, student respondents have been between 9 to 12n per semester. The average value of the course mean for responses to this question is 4.41, while the average mean for all UIS courses for responses to this question is 4.28. Among student comments regarding the impact of the course on their understanding and awareness of architecture, one student offered: 'It allowed me to look at films and the world I had never thought of before as I am not an architecture student,' while another wrote that the course '…expands student knowledge of historic films and ways to think about architecture' (student comments are anonymous; disclosure/ethics statement was not required).

Because many of today's undergraduates have grown up on a steady diet of videos, animation, and film, cinema arts are ideal 'delivery devices' for architectural content that students might in the past have ignored or been oblivious to. Architecture as the content of film invites students to see the built environment around them in new ways that are potentially symbolic and allegorical (as they often are in film). The course's interdisciplinary nature allows students to appreciate cinema from a different perspective, introducing them to films that they have not had prior experience with. Likewise, film can create a new awareness of architecture as a character, often playing the starring role.

Disclosure statement

The author reports there are no competing interests to declare.

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Appendices – description of the courses

University of Hartford, University Interdisciplinary Studies

UISA 155: Architecture in Film (3 credits) [CRN 43644]	Office: Harry Jack Gray Center, Room W205A
ADT 485: Architecture in Film (3 credits) [CRN 43664]	Phone: 860-768-4755 (office); 860-575-4702 (cell, text only)
Fall Semester 2025	Email: crosbie@hartford.edu
Instructor: Dr. Michael J. Crosbie (Architecture)	Guest Lecturer: Dr. Theodore Sawruk (Architecture)
	Meeting time: Wednesdays, 9:55-12:35, Harry Jack Gray Center, East 305

UIS mission

The University Interdisciplinary Studies (formerly known as the All University Curriculum) general education courses are designed to provide shared learning experiences for students in baccalaureate programs at the University of Hartford through a core of common studies. Since faculty from all schools and colleges of the University teach these courses, the curriculum takes full advantage of the diverse resources of the institution. In addition to providing students breadth of knowledge in their liberal education, the UIS makes clear the relationships among disciplinary areas of knowledge through integrative, cross-disciplinary courses.

Course description

This interdisciplinary course bridges the arts of architecture and cinema by exploring the connections between them. Architecture, the built environment, expresses cultural values. Film often uses architecture to create a setting for action and narrative expression. Through film critiques, viewing films, and discussing their interpretation, students learn how architecture becomes a "character" in film, employing the experiential elements of architecture.

Course focus

Architecture is the art of creating the built environment as an expression of cultural and personal values. The art of cinema requires the creation of environments within the film as settings for action and narrative expression. Architecture and film converge in the creation of a cinematic setting (the "mise-en-scene") as a narrative device: what the film shows us to tell the story. This course will expose students to 14 films from over a span of nearly a century in which architecture plays an important narrative "role" as a "character" in the film. Architecture has a sensory presence, expressed through elements such as space/scale, style/ornament, light/shadow, color, sound, and landscape. Students will learn about architecture's narrative power in film through these six "experiential elements" and how they are used in cinema. Students are required to complete reading assignments related to the films shown, to participate in discussions of the films, to take notes while watching the film, and to write critically about architecture's role in the films using six Experiential Elements of Architecture (see handout). The course will culminate with a take-home final exam. Course materials will be distributed on Blackboard and completed assignments will be submitted on Blackboard.

Student learning outcomes (SLOs)

By the end of the semester, students who have successfully completed all activities and requirements will:

- Learn about architecture's narrative power in film by studying how architecture's experiential elements are used in cinema.
- Learn about the history of architecture in film.
- Learn about the experiential elements of architecture that are used in film.
- Integrate their own experiences of architecture and the built environment to those experienced in films shown during the course, and describe the connections.

Suggested texts

Required readings will be provided, but here are some texts that might be helpful:

Albrecht, Donald. Designing Dreams: Modern Architecture in the Movies. Santa Monica, CA: Hennessey + Ingalls, 2000.

AlSayyad, Nezar. Cinematic Urbanism: A History of the Modern from Reel to Real. New York and London: Routledge, 2006.

Bordwell, David, and Thompson, Kristin. Film Art: An Introduction, Eighth Edition. New York: McGraw Hill, 2008.

Clarke, David (editor). The Cinematic City. London and New York: Routledge, 1997.

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Lamster, Mark (editor). Architecture and Film. New York: Princeton Architectural Press, 2000.

Neumann, Dietrich (editor). Film Architecture: Set Designs from Metropolis to Blade Runner. New York: Prestel Verlag, 1999.

Pallasmaa, Juhani. The Architecture of Image: Existential Space in Cinema. Helsinki: Rakennustieto Oy, 2001.

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Course grading breakdown

Letter grade on a 0-4 scale (A=4, F=0) with a pass/no pass option. Final grade is weighted according to student performance in the following course requirements: short written film critiques: 70% (one per film, 5% each, 14 total,); take-home final exam: 20%; informed contributions to discussion: 10%. Grade breaks are as follows: A: 4.0-3.8; A-: 3.79-3.67; B+: 3.66-3.34; B: 3.33-3.0; B-: 2.99-2.67; C+: 2.66-2.34; C: 2.33-2; C-: 1.99-1.67; D+: 1.66-1.34; D: 1.33-1; D-: 0.99-0.67; F: 0.66-0.

Late work deadline

Late/missing critique assignments will not be accepted after November 19, 2025.

Student code of academic conduct

Your work as a student at the University of Hartford is governed by the Student Code of Academic Conduct found in "The Source," the student guidebook distributed by the university. There is a section in "The Source" that articulates the Student Code of Academic Conduct and the Academic Honesty Policy. It can be found at this link:

https://www.hartford.edu/current-students/_files/6.5_current_students_student_handbook.pdf#page=39

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AI policy

The use of Generative AI (GenAI) tools is strictly forbidden in this course. All assignments, including weekly film critiques and the Final Exam, must be completed without the assistance of Al-generated content. This policy is in place to ensure that the work submitted is authentically yours and reflects your personal understanding and capabilities. Violations of this policy will be considered academic dishonesty and will be subject to disciplinary actions as outlined in the university's academic honesty policy (see above).

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As your professor, I am required to report any incidents of sexual misconduct and harassment that are directly reported to me or of which I am somehow made aware. See the University of Hartford Title IX Sexual Harassment/Sexual Assault Policy at this link: https://www.hartford.edu/about/policies/_files/title_ix_policies-3-24-2023.pdf

To learn more about Title IX on campus, go to: https://www.hartford.edu/about/policies/title-ix/

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University of Hartford mental health and wellbeing statement

Mental Health is an important aspect of students' wellbeing and integral to positive academic experience and success. If during the semester you experience difficulties and would like support, consider contacting the University of Hartford's Counseling and Psychological Services (CAPS). CAPS offers a range of short-term counseling services available to full-time undergraduate students and graduate students at no additional cost, and to part-time undergraduates for a small fee. CAPS is located in the Gengras Student Union, room 313, and can also be reached by calling 860.768.4482 or emailing Dr. Jeffrey Burda; burda@hartford.edu. Office hours are Monday through Friday, 8:30 a.m. - 4:30 p.m.

Course outline

- 8/27: Theme: "Utopias and Dystopias"; Film: Metropolis (1927); writing/discussion. Assignment: Short film critique; readings in film criticism ("Mise-en-Scene" and "Lighting")
- 9/3: Theme: "Utopias and Dystopias"; Film: Brazil (1985); writing/discussion.
- Assignment: Short film critique; readings in film criticism ("Rear Window")
- 9/10: Theme: "The Director was an Architect"; Film: Rear Window (1954); writing/discussion. Assignment: Short film critique; readings in film criticism ("Citizen Kane")
- 9/17: Theme: "The Director was an Architect"; Film: Citizen Kane (1941); writing/discussion. Assignment: Short film critique
- 9/24: Theme: "Architecture of Suburbia"; Film: Radiant City (2006); writing/discussion. Assignment: Short film critique
- 10/1: Theme: "Architecture of Suburbia"; Film: The Truman Show (1998); writing/discussion. Assignment: Short film critique
- 10/8: Theme: "Architecture of the Super Hero"; Film: Batman (1989); writing/discussion with Guest Lecturer Theodore Sawruk. Assignment: Short film critique
- 10/15: Theme: "Architecture of the Super Hero"; Film: Dr. Strange (2016); writing/discussion with Guest Lecturer Theodore Sawruk. Assignment: Short film critique/readings in film criticism ("Haunted Houses")
- 10/22: Theme: "Haunted Architecture"; Film: The Haunting (1963); writing/discussion. Assignment: Short film critique; readings in film criticism ("Shining")
- 10/29: Theme: "Haunted Architecture"; Film: The Shining (1980); writing/discussion. Assignment: Short film critique
- 11/5: Theme: "Architecture, Space, Gender"; Film: A Room with A View (1985); writing/discussion. Assignment: Short film critique
- 11/12: Theme: "Architecture, Space, Gender"; Film: Light in the Piazza (1962); writing/discussion. Assignment: Short film critique
- 11/19: Theme: "The Architect Was Quite a Character"; Film: The Fountainhead (1949); writing/discussion. Assignment: Short film critique; last day to submit late assignments
- 12/3: Theme: "The Architect Was Quite a Character"; Film: The Belly of an Architect (1990); in-class writing/discussion. Assignment: Short film critique; Take-Home Final Exam
- 12/10: Critique of The Belly of an Architect and Take-Home Final Exam due

Experiential elements of architecture

Space/Scale

Space and scale are the most elemental aspects of architecture. It is what we see and what we experience with our bodies. The vastness of architectural space can make us, as individuals, feel exalted. When we are with other people, large architectural spaces can also make us seem small, as if we are insignificant in comparison to the architecture. A constricted space, like a small room, can make us feel confined—some people react to such confined spaces as psychologically threatening. A great sense of space can be understood with scale elements, such as life-sized statues or windows, or the front of a home, where we understand the size of a brick, a window, or a door. Scale often conveys the size of the architecture in relation to our own bodies. Some buildings lack scale because we cannot relate ourselves to the size of windows or doors. In film, space and scale are often used to communicate the wealth of a character, or perhaps how someone is being threatened or coerced. A great sense of space and large architectural scale can communicate emotional distance between characters. As you watch the films, note how space and scale are used to convey architecture's presence and power in the film and its characters.

Style/ornament

Style and ornament are related to scale. Style can also communicate whether a character is wealthy or poor, depending on the style used. Sometimes style can create a sense of foreboding, perhaps if it is over-scaled and seems more suitable to the needs of the state or a corporation, instead of individual human beings. As you watch the films, note the role of architectural style/ornament. How might the style and ornament reflect your own experience with architecture?

Light/shadow

We experience architecture primarily as the "play of forms under light," as the Swiss architect Le Corbusier described it. We experience and understand architecture by the way it manipulates, and in turn is manipulated by light. In film, lighting can be used to highlight the architecture, making it more prominent. The lack of lighting (shades and shadows) can also create a sense of mystery, sometimes foreboding. For example, if a character is in pain or is lonely, the film might portray them in shadow, reflecting the way they feel. As you watch the films, note how lighting effects feature the role of architecture, in conveying the narrative, or the emotional relationships between characters.

Color

Architecture is often enlivened through the use of color. Colors can attract our attention, and make the architecture more intense. Bright colors might communicate a lighter mood, while darker colors might convey a sense of danger. In film, color can be used sarcastically, as it might appear to brighten up architecture that is threatening looking. In some films, muted colors can communicate a sense of blandness in the environment as a metaphor of the relationship between characters. In black and white films, the lack of color can provide an entirely different experience of the film, compared to whether it was shot in color. Films that lack color are often seen as being more "artistic," because we focus more on the director's composure of solid forms and shadows on the screen. As you watch the films, note how color (or the lack of color) is used in the architecture to support the film's storytelling.

Sound

Sound in architecture can give us an idea of how big a space might be (which also tells us something about its scale). The behavior of sound also conveys what the materials of the architecture might be: hard materials (such as stone) create echoes, while softer or more porous materials (like fabrics and screens) deaden echoes and make the space seem less vast. In films that are not silent, sound is often used to convey the size of the architecture and its materials. As you watch the films, note how sound is used to convey architecture's role in the film.

Landscape

Landscape may include such elements as plants, flowers, trees, water, pathways, garden furniture. Landscape architecture involves the shaping of nature by the designer to communicate ideas about places where one might feel calmness in tune with living things. Houses set amid nature, integrated with the landscape, can feel organic, part of the natural world, instead of imposed upon it. However, landscape design is used often to tell us about the people who shape the landscape, and how much power they have over nature to bend it to their will. Highly regulated landscapes, such as formal gardens, tell us that this place is the creation of someone with great resources to control nature to this degree. Such designs communicate a person's sense of power that might extend through the landscape as far as the eye can see. In film, landscape design can provide clues about the wealth and power of the characters who inhabit the landscape. The landscape can also convey a sense of being in the natural world. Natural landscapes can prompt characters to behave in ways they would not normally behave. They can be swept up by nature and the landscape and surrender their emotions to it. As you watch the films, note how the landscape setting supports architecture's film role and furthers the film's narrative.

Notes on film screening

Student Name:

Class meeting 9/10: Rear Window (Alfred Hitchcock, 1954, 112 min.)

1. Space/Scale (how are space and scale used to convey the type of people who live in the apartment complex?)

2. Style/Ornament (what is the role architectural style/ornament in the film?)

3. Light/Shadow (how does the architecture feature lighting, including absence of light, to further the film's narrative?)

4. Color (how is color used in the architecture to support the film's storytelling?)

5. Sound (how is sound used to convey the shared architectural space in the film?)

6. Landscape (how does the limited amount of landscape support the film's storytelling?)

Assignment

Film Critique of Rear Window (Alfred Hitchcock, 1954, 112 min.)

Based on your notes taken during the film screening and your own experiences of architecture and the built environment, complete a film critique considering the 6 following issues (each of the 6 responses should be 75 words max; format your critique as 6 separate numbered paragraphs). Answer the critique questions completely. Support your critique by describing an example (scene from the film). Submit completed assignment as a Word Document on Blackboard before next class meeting.

- Space/Scale (how are space and scale used to convey the type of people, socioeconomically, who live there? Describe a similar space you have experienced.)
- Style/Ornament (what is the role architectural style/ornament in the film? How would you describe the style/ornament based on your own experiences with architecture?)
- Light/Shadow (how does the architecture use lighting, including the absence of light, to further the film's narrative? Describe a personal experience with the absence of light in architecture.)
- Color (how is color used in the architecture to support the film's storytelling? Describe an example of color used similarly in a building you've experienced.)
- Sound (how is sound used to convey the shared architectural space in the film? Based on your experiences, how might the courtyard of Rear Window affect sound?)
- Landscape (How does the limited amount of landscape support the film's storytelling; what importance does landscape play in this film that suggests your own experience with architecture and landscape?)

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A Pioneering LISP Framework for Diachronic Urban Analysis

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Abstract

This paper describes a pioneering methodological innovation bridging computational tools and traditional urban morphology by introducing a LISP-based scripting framework for morphological and typological analysis of historical city formation. Developed in 2020 as part of the author Elham K. Hassani's Ph.D. dissertation at Sapienza University of Rome and grounded in the Italian school of urban morphology—particularly the work of Caniggia and Muratori—it provides a replicable method to read and classify urban transformations over time. This was the first application of LISP programming to automate identifying and categorizing urban elements—plot structure, route alignment, and building typology—across multiple historical phases. The methodology integrates qualitative morphological principles with quantitative computational processes, enabling a deeper understanding of urban form evolution and building type variation within a diachronic framework. Using Kashan, a traditional Iranian city, as a case study, the method reconstructs historical phases of urban growth, revealing their spatial logic, typological patterns, and morphological shifts. This dual-level analysis moves the field beyond static visual mapping toward rule-based interpretive systems, contributing to current efforts to apply AI to resilient city-making. Its significance is shown by its integration into Sapienza's curriculum.

Introduction

Urban morphology investigates the formation and transformation of cities over time, scrutinizing the physical structure of the built environment and the socio-cultural processes that influence it (Moudon, 1997). The Italian school of urban morphology is one of the most important theoretical schools in this field. Its founders, Muratori and Caniggia & Maffei, came up with a typological method for understanding how urban form and building types have changed over time. Their approach regards the city as a living entity, interpretable through the analysis of plots, routes, and architectural typologies (Cataldi, Maffei, & Vaccaro, 2002).

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While these founding concepts still hold for the Italian school, its analytical practice has largely depended on qualitative interpretation and fixed cartographic representation (Carlotti, 2016). However, steady improvements in computational methods now make it possible to improve morphological analysis with algorithmic accuracy. Programming languages and automated spatial procedures can manage extensive historical and geographical datasets, providing a degree of reproducibility and precision that is unavailable using traditional manual methods (Karimi, 1998). Still, only a few studies have successfully combined the Italian school's typological tradition's depth of interpretation with the speed of computational analysis (Neglia, 2019).

Recent studies in computational modeling and resilience assessment similarly demonstrate the potential of algorithmic frameworks for structural analysis and urban-scale interpretation. Bakhshandeh, for example, presented a comprehensive review of monitoring techniques for the condition of bridges, showing how sensor networks, machine learning, and data-driven analysis can enhance the analysis of structural behavior (Bakhshandeh, 2024). Bakhshandeh and his colleagues also integrated probabilistic modeling into urban risk assessment, a step that closely aligns with Hassani's earlier, successful effort to translate complex morphological theories into programmable and replicable analytical systems (Bakhshandeh et al., 2025a; Bakhshandeh et al., 2025b).

The current study, conducted as part of Dr. Hassani's dissertation research at Sapienza University of Rome (Hassani, 2022a), is an early, pioneering example of incorporating a LISP-based scripting framework into the Italian school's analytical process. This framework automates the identification and categorization of fundamental urban components—plot structure, route alignments, and building types—across successive historical phases. The resulting method of analysis combines the qualitative principles of the Italian school of urban morphology with quantitative computational methods to provide a more accurate way to read and classify how the urban fabric changes over time, accomplished with far less time and effort than the qualitative methods it replaces.

The Italian school of urban morphology: origins and development

The Italian school of urban morphology, also known as the Muratorian school, arose from the teaching and theoretical work of Saverio Muratori (1910-1973), who aimed to reconnect architectural design with historical continuity. Muratori rejected the positivist and technocratic approaches to early twentieth-century urban planning, arguing that a systematic comprehension of historical urban processes was required for meaningful architectural practice.

Muratori's approach, referred to as "operative history," viewed cities as dynamic entities influenced by societal cultural factors. He proposed the fundamental analytical notions of type, fabric, and organism as instruments to analyze the evolution of urban form across time in his groundbreaking works, including *Studi per una operante storia urbana di Venezia* (1959) and Studi per una operante storia urbana di Roma (1963). To maintain continuity between the past and present, his work highlighted the necessity for architectural design to emerge from the logic of existing urban structures. His assistants, especially Gianfranco Caniggia, Paolo Maretto, Renato and Sergio Bollati, Sandro Giannini, and Guido Marinucci, developed Muratori's ideas after his death. Caniggia organized Muratori's principles into a thorough typological approach, highlighting the connection between specialized and fundamental structures as well as the gradual nature of urban transformation. His work with Gian Luigi Maffei produced important manuals that spread these theories around the world, including *Composizione architettonica e tipologia edilizia* (1979, 1984) (Caniggia, 1979; Caniggia & Maffei, 1984).

Later, the school's geographical dispersion led to the emergence of institutions in Reggio Calabria, Genoa, Florence, and Rome, where academics carried on refining typological concepts in both historical and contemporary contexts. Organizations like the 1981-founded Centro

Internazionale per lo Studio dei Processi Urbani e Territoriali (CISPUT) were essential in maintaining Muratorian ideas and promoting multidisciplinary discussion. By the 1990s, the movement's impact had spread beyond Italy, helping to launch the journal Urban Morphology and the International Seminar on Urban Form (ISUF) (Cataldi et al., 2002).

Today, the Italian school is still fundamental to the study of urban morphology, providing a historically based framework that connects architecture, planning, and cultural geography. Its enduring contribution is to consider urban form as an evolving cultural product in which the built environment is transformed via both material and historical processes.

Principal case study: the historic city of Kashan, Iran

The Middle East's historic cities, especially those in Iran, offer an appropriate setting for integrating strategies to read the historical layers of the formation of the cities. A complex fabric of spatial logics and construction traditions may be seen in urban fabrics like Kashan, which show several layers of development from pre-Islamic settlements to Islamic and contemporary times (Gaube et al., 2018). Successive periods of Kashan's urban expansion are reconstructed and related to its spatial logic, typological patterns, and morphological alterations (Carlotti, 2020).

Figure 1. The Kashan Map was edited in 1995 by Shar o Khaneh Consulting Engineers based on a 1966 map. Evidence shows the traction of the anti-wall and the bazaar in the zone northeast of the city (Hassani, 2022a).

Though most evaluations are descriptive and rely on static mapping, prior research has recorded the city's compact layout, its complicated residential sections, and the prominent location of its bazaar. Because of its intricately interconnected urban fabric and the abundance of reliable

historical records, Kashan was selected. There is an obvious need for techniques that preserve the theoretical complexity of typological analysis while encoding morphological principles into programmable frameworks (Hassani, 2023a).

In order to address that requirement, this study presents a scripting framework based on LISP that automates the identification and classification of important urban components, including building types, route alignments, and plot structures, across different historical periods. The study bridges the gap between qualitative and quantitative analysis by operationalizing the Italian school's principles in a computational setting. Thus, it supports the preservation of cultural heritage, the teaching of urban design, and the creation of resilient urban regeneration plans, demonstrating how classical morphological theory may influence computational tools of the twenty-first century.

Testing a diachronic and computationally assisted morphological technique is made possible by the city's progression from pre-Islamic settlements through medieval Islamic development and current transformations. Its mix of a central bazaar spine, complicated residential sections, and compact urban shape offers a typical scenario for analyzing how well the suggested framework may record intricate urban transitions (Hassani, 2024).

Research gap and objectives

Even if both modern computer analysis and traditional urban morphology have advanced dramatically in recent decades, there is still a clear disconnect between the quantitative rigor of algorithmic approaches and the qualitative typological ideas of the Italian school. Researchers have independently investigated computational techniques for modeling complex urban networks (Karimi, 2002 & 2012) and shown the significance of typological analysis for comprehending the diachronic development of urban form (Muratori, 1980; Caniggia & Maffei, 2001). However, only a small number of studies have been able to combine these strategies to create a strategy that is computationally replicable and theoretically viable. By implementing a LISP-based scripting system that incorporates the Italian typological tradition's interpretative guidelines into an automated analytical environment, this study fills that gap (Hassani, 2023a). Three primary goals are pursued by the research through a diachronic analysis of Kashan, a historic Iranian city with a densely layered urban fabric (Hassani, 2022b).

i. Demonstrating typological concepts in a computational framework without losing theoretical depth.
ii. Reconstructing historical phases of Kashan's urban growth using a repeatable and rule-based methodology.
iii. Providing a tool for urban design education and heritage management that improves the analytical power of morphological studies.

By defining this research gap and expressing these aims, the study lays the conceptual groundwork for the methodology outlined in the next section.

Methodological framework

This research uses a methodological framework that combines the interpretative principles of the Italian school of urban morphology with the computational capabilities of LISP scripting (Hassani, 2023b). The study's conceptual framework is based on the Italian school's emphasis on diachronic analysis and typological change. The study's goal is to demonstrate how classical morphological theory may be made reproducible and scalable for substantial historical datasets by converting these qualitative principles into programmable rules. The design employs a single, comprehensive case study technique, concentrating on the Iranian city of Kashan. This method enables a thorough, context-sensitive study while simultaneously evaluating the suggested computational framework's transferability to various urban environments.

Data sources and preparation

To rebuild Kashan's historical evolution, a wide range of resources was gathered. Among these were historical maps covering the city's development throughout several time periods, from pre-Islamic times to the Safavid and Qajar dynasties; current field surveys that recorded existing street networks, building footprints, and typological features; and historical materials like cadastral records and old photographs.

Encoding morphological principles

Formalizing the main typological concepts of the Italian school into computational rules was the next step. Algorithmic conditions were used to convey concepts like the recognition of permanent urban features, the idea of successive building types, and the differentiation between basic and specialist structures. For example, criteria were created to categorize route alignments based on their persistence or change over time, and to identify plot structures based on parcel boundaries.

Development of the LISP scripting framework

To automate these principles, an original programming environment based on LISP was created.

Because of its adaptability in working with geographical data and its established connection to design and architecture software environments, LISP was chosen. The scripts could import georeferenced datasets; perform morphological classification; and create layered representations of urban components for each historical epoch. Each script was modular, allowing for incremental development as new insights were acquired during the research.

Automated classification and validation

To maintain the interpretive richness of traditional morphology, these outputs were cross-checked against historical narratives and field observations. Where discrepancies emerged, the rules were adjusted and the scripts rerun, ensuring an iterative process that combined computational precision with qualitative understanding. After the criteria were encoded, the scripts automatically discovered and classified urban components on the digitized historical maps. The outputs included a timeline of plot structure modifications; transformations in route alignments; and persistence and variety in building types.

A LISP-based computational framework for morphological and typological analysis

The LISP-based framework enables the encoding of morphological transformation rules and the simulation of diachronic urban change. While this study focuses on diachronic urban analysis through computational modeling in LISP, it has methodological affinities to the fields of engineering and simulation. For example, similar computational reasoning can be observed in structural engineering research, where numerical models are developed to simulate the dynamic behavior of complex systems under external loads (Bakhshandeh & Mahboubi Niazmandi, 2023). Although applied at a different scale, both approaches share a common logic of translating physical or spatial phenomena into parametric and rule-based computational frameworks.

Following the Italian school of urban morphology, the study views the city as a palimpsest of structural logics visible in the built form. To operationalize this theory in a modern, repeatable manner, the study combines manual morphological reading with computer automation, producing a unique LISP scripting framework for urban form analysis. Three phases comprise the method's development.

Phase 1: data acquisition and field investigation

In the first phase, a wide range of qualitative and quantitative data was gathered. Documentary surveys and literature reviews were combined with fieldwork and GIS-based mapping to create an accurate database for morphological reading. Historical maps, cadastral documents, and aerial pictures from 1955 to 2000 were studied with modern cartography to track the progression of urban development. Approximately forty schools in Kashan were investigated during field research in 2018 and 2019, undergoing in-depth analysis at both urban and architectural levels. Interviews with school principals, neighborhood residents, and municipal officials shed light on the social component of urban development and schools' potential role as community anchors in urban regeneration strategies (Hassani, 2020).

Phase 2: diachronic morphological reading and computational analysis

In the second step, data analysis, the study used a diachronic reading approach based on the morphological tradition of the Italian school. The investigation began by meticulously eliminating modern layers to rebuild the city's previous morphological forms, revealing how spatial elements like streets, plots, and building types changed and interacted throughout time.

The study used accurate superimposition of digital and historical maps to trace Kashan's morphological history during significant historical eras, from pre-Islamic to Islamic, Buyid, Safavid, Qajar, and Pahlavi. A key innovation of the study was its use of the LISP programming language in the AutoCAD environment to apply a computational method to morphological analyses. This was the first time that LISP was used in urban morphological research, automating procedures that had previously involved a great deal of manual interpretation.

Two primary analytical stages of the computational approach were created to improve accuracy and speed up the reading of morphological layers.

Stage 1 - the first LISP phase: alignment detection (macro scale)

Step 1: Make the decimal layers (0 to 10, 10 to 20, etc.)

```
(setq i -1)
(setq li nil)
(repeat 18
(setq i (1+ i))
(setq an1 (* i 10))
(setq an2 (* (1+ i) 10))
(setq t1 (itoa an1))
(cond ((< an1 100) (setq t1 (strcat "0" t1))))
(cond ((< an1 100) (setq t1 (strcat "0" t1))))
(setq t2 (itoa an2))
(cond ((< an2 10) (setq t2 (strcat "0" t2))))
(cond ((< an2 100) (setq t2 (strcat "0" t2))))
(setq la (strcat "Angle -- " t1 " - " t2))
(make-layer la an2)
(setq li (append li (list (list an1 an2)))))
```

This stage centered on determining the residual alignments and directional logic of the city's structural framework, namely street orientations and urban expansion axes. The LISP script was created to analyze each line of the digitized urban fabric and automatically categorize it based on its angular orientation, which is separated into 10-degree intervals spanning from 0° to 180°. Each range was allocated its own color code, resulting in a chromatic map that graphically reflected the orientation patterns of Kashan's street network over history. This procedure made it possible to find morphological alignments that had persisted through several changes—traces of previous structural logics embedded in more recent urban layers. The study might determine the creation

of new urban centers, the reconfiguration of spatial hierarchies, and the continuity or division of historical routes by employing this color-coded rotational approach. In addition to speeding up the reading process, this automated detection added an objective visual layer to the morphological process, which was previously merely interpretive.

Step 2: the layers of the lines should be changed to correspond to the target layers

```
(setq ss (ssget '((0 . "line"))))
(setq n (sslength ss))
(setq k -1)
(repeat n
(setq k (1+ k))
(setq s (ssname ss k))
(setq en (entget s))
(setq po1 (cdr (assoc 10 en)))
(setq po2 (cdr (assoc 11 en)))
(setq ang (angle po1 po2))
(cond ((> ang pi) (setq ang (- ang pi))))
(cond ((equal ang pi 0.001) (setq ang 0.0)))
(setq ang (* ang (/ 180.0 pi)))
(foreach a li
(setq an1 (car a))
(setq an2 (cadr a))
(cond
((<= an1 ang an2)
(setq t1 (itoa an1))
(cond ((< an1 10) (setq t1 (strcat "0" t1))))
(cond ((< an1 100) (setq t1 (strcat "0" t1))))
(setq t2 (itoa an2))
(cond ((< an2 10) (setq t2 (strcat "0" t2))))
(cond ((< an2 100) (setq t2 (strcat "0" t2))))
(setq la (strcat "Angle -- " t1 " - " t2)))))
(setq en (subst (cons 8 la) (assoc 8 en) en))
(entmod en))
```

Figure 2. Reading the alignments of the morphological layers of Kashan's urban fabric, set at every 10 degrees from 0 to 180, using the LISP program (Hassani, 2022a)

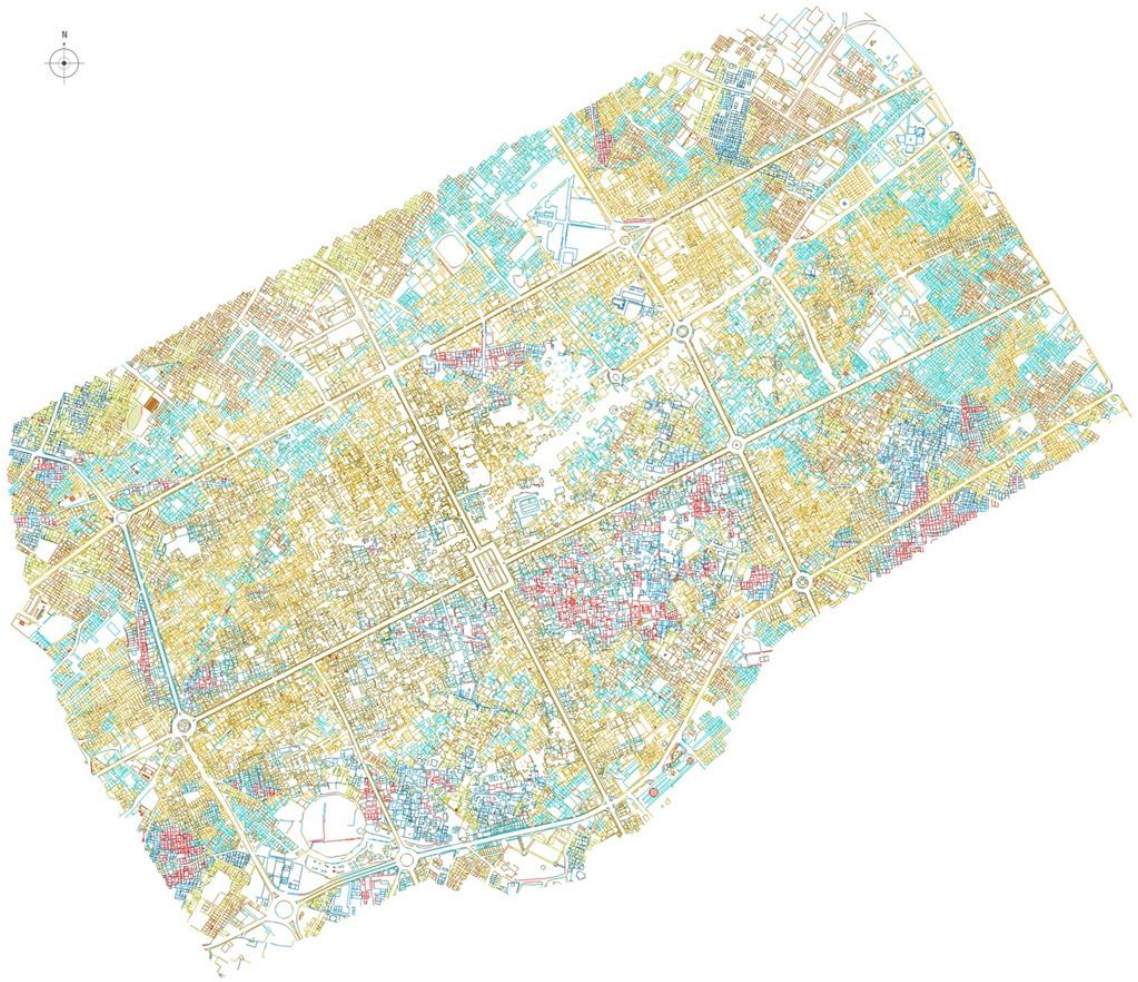

Figure 3. Reading the alignments of the morphological layers of Kashan's urban fabric using the LISP program produces this final result (Hassani, 2022a)

Stage 2 - the second LISP phase: plot regularity and pattern recognition (micro scale)

The micro-scale—the geometry and arrangement of urban plots—was the focus of the second phase of the computational methodology. In order to evaluate geometric proportions, the LISP method was created to examine each plot as a polyline form and compute characteristics like area, perimeter, and bounding rectangles. The script determined a "rotation ratio," which is the connection between the size of the bounding rectangle and the actual area of the plot, by rotating each plot through a series of angles (usually 100 rotations over 360 degrees). This ratio functioned as a quantifiable indicator of morphological regularity; the more irregular and bigger the plot, the greater the ratio.

A gradient color scheme, which ranges from pastel colors (high regularity) to dark tones (high irregularity), was added to each plot to illustrate this study (Figure 4). This resulted in an interpretive map that presented both visual and quantitative data at the same time, showing how the regularity and size of the building types changed over time. The algorithmic procedure successfully converted the qualitative concept of "urban irregularity and size" into quantifiable information, offering an original computational perspective for assessing the historical fabric of the city's spatial coherence.

Here is a summary of the formulas of the written program:

```
(setq ss (ssget '((0 . "*polyline"))))
(setq n (sslength ss))
(setq k -1)
(repeat n
(setq k (1+ k))
(setq s (ssname ss k))
(setq en (entget s))
(setq la (cdr (assoc 8 en)))
(setq pli (plinevertex s))
(setq bbox (acet-ent-geomextents s))
(setq p1 (car bbox))
(setq p2 (cadr bbox))
(setq cen (mid p1 p2))
(command "area" "object" s)
(setq le (getvar "perimeter"))
(setq ar (getvar "area"))
(setq li1 nil)
```

```
(setq totang 360.0)
(setq i -1)
(repeat 100
(setq i (1+ i))
(command "rotate" s "" cen (/ totang 100))
(setq bbox (acet-ent-geomextents s))
(setq p1 (car bbox))
(setq p2 (cadr bbox))
(setq dx (- (car p2) (car p1)))
(setq dy (- (cadr p2) (cadr p1)))
(setq zarib (/ (* dx dy) ar))
(setq li (append li (list zarib))))
(setq li (vl-sort li (function (lambda (e1 e2) (< e1 e2)))))
(setq zarib (car li))
(command "hatch" "solid" s "")
(command "chprop" "last" "" "color" "truecolor" color ""))
```

Together, these visuals form a morphological narrative. The alignment maps reveal how the street logic evolves, while the plot regularity and size maps reveal micro-scale coherence or disruption. The interpretive strength lies in combining both scales, associating macro-structural alignments with micro typological stability or transformation.

Phase 3: synthesis and urban regeneration guidelines

The findings from the typological and morphological studies were combined in the third phase of the study to create design and planning guidelines for the revitalization of Kashan's historic neighborhoods. This synthesis shows how computational scripting can improve the Italian School's morphological methods' interpretative rigor and make them more applicable to current urban issues, including social sustainability, historical preservation, and resilient city-making.

Results of the analyses

Reconstruction of historical phases

Applying LISP scripts to the geo-referenced historical maps revealed five main stages of Kashan's expansion from its earliest pre-Islamic settlement to the present. Distinct developments in street networks, plot configurations, and building types were characteristics of each era.

- Early settlement: A compact settlement pattern centered on defensive buildings and natural water sources was visible in the earliest identifiable phase.
- Medieval Islamic expansion: As long-distance trade and religious institutions grew, a more complicated street hierarchy and a bazaar spine developed.
- Safavid consolidation: Building typologies varied, with imposing religious complexes supporting the central bazaar axis.

— Qajar adaptations: While preserving the core city's typological logic, residential areas grew outward.
— Modern interventions: New street alignments created by 20-century infrastructure partially destroyed the ancient fabric while preserving important typological features.

Plot structure dynamics

Plot configuration changes were identified by the scripting framework during these stages, showing a slow transition from large, regular parcels to a more complex subdivision pattern. The constancy of the basic spatial logics outlined in the Italian typological tradition was demonstrated by the persistence of some major plot borders despite these transformations.

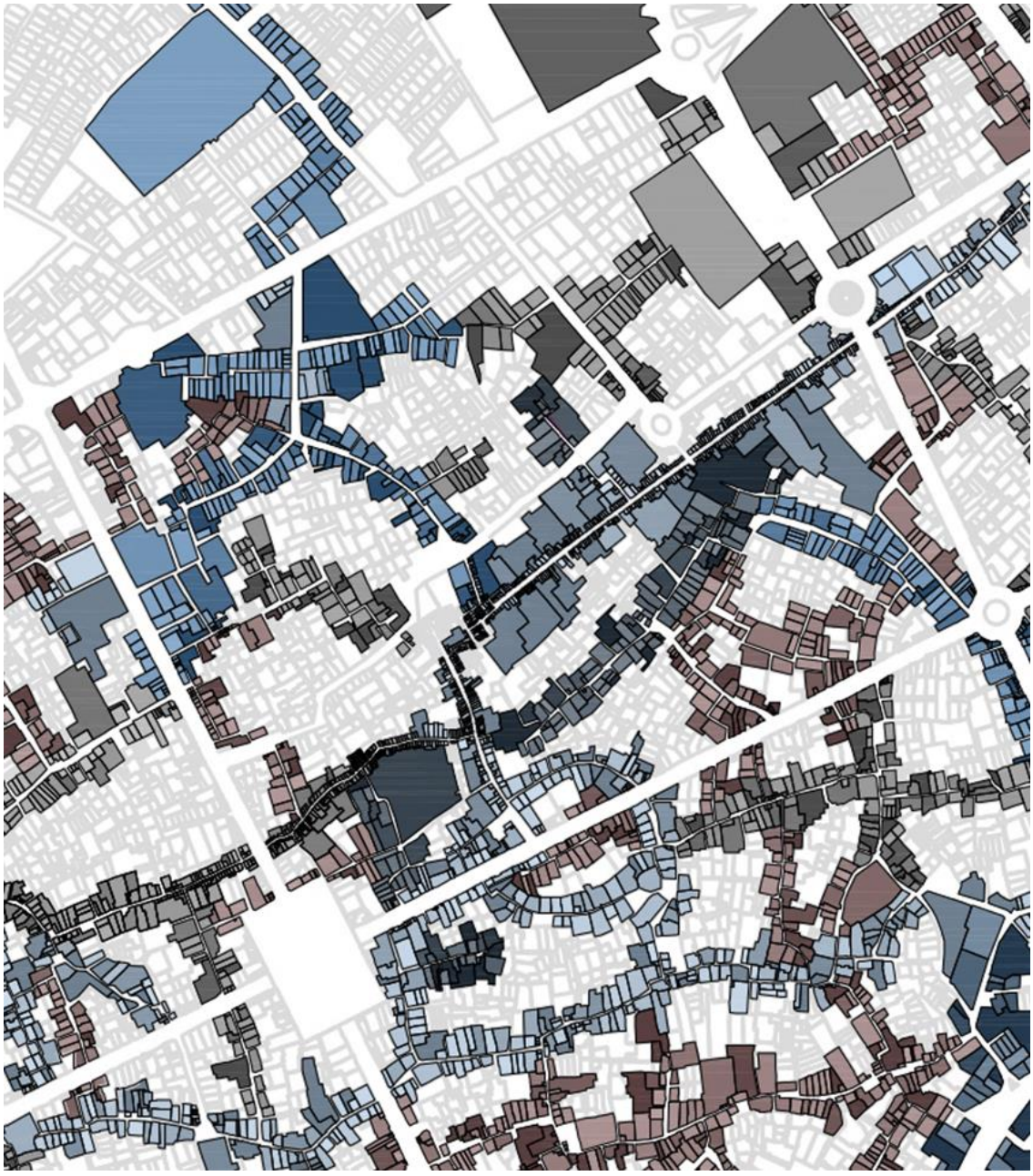

Figure 4. Analyzing plots in the urban fabric in terms of regularity and size, using the LISP program (Hassani, 2022a)

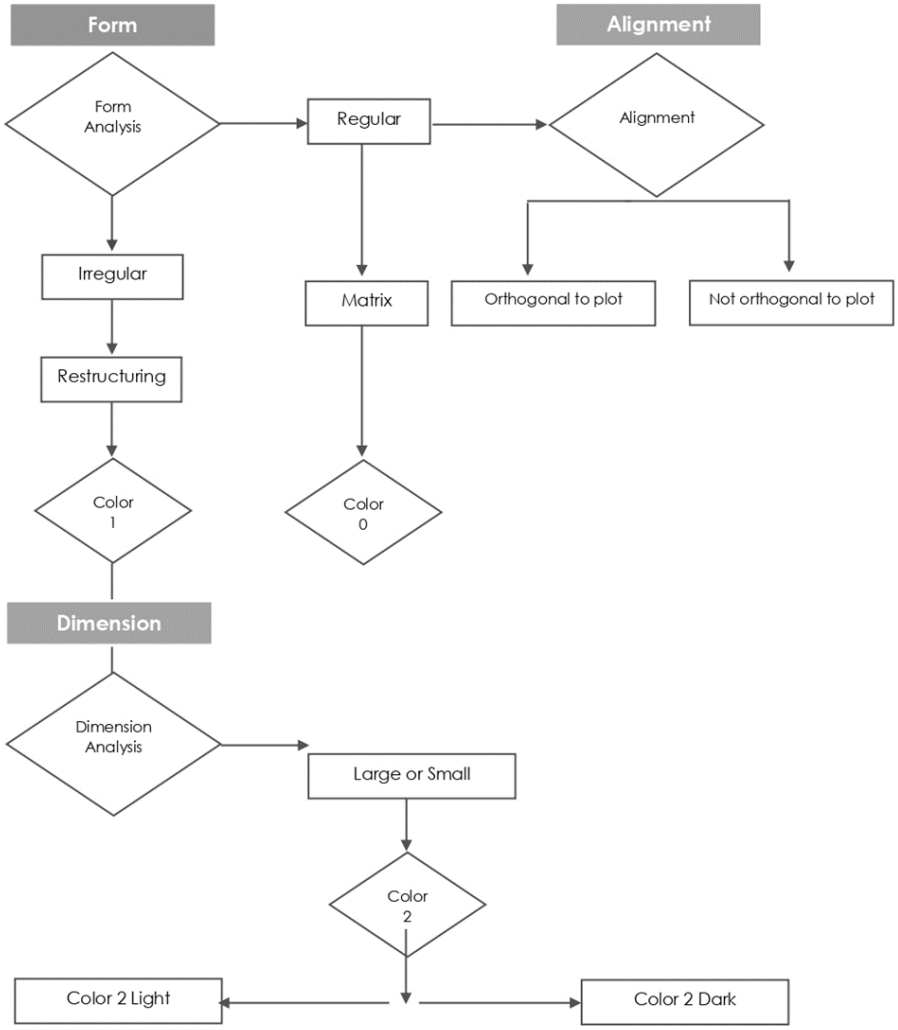

Figure 5. The algorithm of plot pattern analysis was utilized by the LISP Program in the second phase (Hassani, 2022a)

Route alignment and network persistence

Several important axes, especially those connected to the bazaar and important mosques, stayed constant across centuries, according to an analysis of route alignments. This continuity is consistent with theoretical ideas of permanent features in urban morphology and supports previous interpretations of Kashan's urban resilience.

Building typology evolution

Both persistence and transformation in building types were identified using the LISP-based categorization. While specialized buildings like caravanserais and religious complexes developed to adapt to varying socioeconomic situations, basic residential shapes demonstrated long-term stability. These results support the significance of the basic-specialized type difference made by the Italian school in describing the morphological development of Kashan.

Validation of the computational approach

The automated results were cross-checked against field surveys and historical documents to ensure the computational method's correctness and repeatability. The continual process of modifying the scripts guaranteed that the final findings were theoretically coherent and empirically sound.

Discussion of the findings

Integrating typological theory and computational practice

The findings show that the interpretative guidelines of the Italian school of urban morphology may be effectively encoded using a scripting framework based on LISP. The technique adds a degree of repeatability to typological research that has been mostly lacking from traditional morphological investigations by automating the detection of consistent route alignments, plot borders, and building types. This reinforces requests in the area for approaches that connect quantitative modeling with qualitative theory.

Implications for heritage conservation

The example of Kashan shows how the management of ancient urban environments might benefit from the use of computational technologies. The approach offers a foundation for identifying regions of high morphological significance that require particular conservation consideration by exposing whatever aspects of the city's structure have survived for generations. These findings may influence measures meant to preserve the city's cultural identity and shape municipal planning regulations.

Contributions to urban design education

As a pedagogical result of this new strategy, the technique has been implemented in Sapienza University's architecture for urban regeneration and urban design studios, as well as during the author’s visiting appointments at universities in Sweden (Lund, Malmö) and Uzbekistan (Tashkent University of Architecture and Civil Engineering) (Hassani et al., 2024).

Contributing to AI-supported urban regeneration

This scripting framework was an important, early example of incorporating artificial intelligence into morphological analysis. As computational models advance, merging typological theory and machine learning will enable real-time evaluations of urban change and support strategies for resilient urban regeneration. This is consistent to make urban morphology actionable in city-making, as espoused by pioneers like Giancarlo De Carlo and Jaime Lerner.

Limitations and future work

Although the case study illustrates the approach's feasibility, more investigation is required to evaluate the framework in other geographical and cultural contexts. To improve the model's predictive capability, future research may include other data sources, such as socioeconomic indicators or climate-related constraints.

Conclusion

The concepts of the Italian school of urban morphology may be operationalized within a computational scripting framework, as this study has shown. The research demonstrates that

traditional morphological theory may be made both replicable and scalable by encoding typological concepts—such as the transformation of specialized forms and the persistence of fundamental building types—into a LISP-based environment.

The particular case of Kashan, with its intricately layered urban history, demonstrated that the technique can recreate consecutive stages of expansion and show the structural logic of route alignments, plot boundaries, and architectural typologies. As a result, it gives essential knowledge for historic preservation, allowing planners and policymakers to identify morphologically significant aspects.

The approach offers educational value in addition to cultural significance. Students may interact with computational methods and the interpretative depth of typological theory at the same time. The analytical component of urban design education is enhanced by this dual focus, which also equips aspiring professionals to operate at the nexus of theory and practice.

More importantly, the scripting framework provides a foundation for morphological analysis's use of AI. Long-standing goals in the field to make urban morphology actionable in the practice of city-making may be realized as computational models develop and typological theory and machine learning are combined to support resilient urban regeneration strategies and allow real-time assessments of urban change. Note that while Bill Hillier’s Space Syntax also uses computational analysis, its focus is diagnostic, considering aspects of urban regeneration such as walkability and the relative complexity of underlying urban patterns (Froy, 2025).

The evolution of AI and parallel developments in computational data analytics have brought us to the point when the application of AI to resilient urban regeneration as a practice is feasible.

Four aspects of urban regeneration are particularly ripe for application:

i. Understanding context: AI can serve as a 'community memory' for a city's evolution, making histories and visual documentation accessible to all participants in layperson's terms and exportable to planning processes for analyzing changes in form, pattern, density, and resilience.
ii. Incorporating urban data: AI with computational analytics can rapidly integrate and analyze GIS data, making implications widely available while testing how reliably AI can interpret findings for broader community access.
iii. Supporting intervention: AI can visualize urban interventions, generate and evaluate options against different criteria, and support area plans through consensus-building on rezoning and design guidelines. As a 'co-intelligence,' AI transforms planning into an ongoing, interactive dialogue (Mollick, 2024).
iv. Supporting local engagement: AI can track and summarize community group discourse about their districts and potential interventions, serving as a collective memory for typically voluntary and ephemeral groups.

As this suggests, we are on the cusp of realizing the ambitions of pioneers like De Carlo and Lerner to transform how we make our cities, realizing urban morphology’s intent to address the social as well as the physical factors that shape cities’ growth over time. The Kashan study’s use of LISP to speed its analyses was an important, early step in that direction, showing one aspect of AI’s revolutionary capabilities (Hassani et al., 2025).

Disclosure statement

The author reports there are no competing interests to declare.

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BUILT FORM

Assessing E-Motor Bikes Adoption: Challenges and Opportunities, The Case of Nyarugenge District

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Abstract

Electric mobility offers a sustainable solution to transportation-related environmental and socioeconomic challenges. This study assesses the adoption of electric motorbikes (e-motorbikes) in Kigali City, with a focus on Nyarugenge District. Using mixed methods literature review, GIS mapping, field observation, surveys, and stakeholder interviews. we evaluate user awareness, infrastructure, technical feasibility, and policy readiness. Despite high awareness (98%) and usage (97%), adoption remains low due to battery limitations, poor service access, and regulatory delays. However, respondents support e-motorbikes' environmental benefits and would adopt them with incentives. The study recommends expanding infrastructure, improving batteries, and fostering multisector collaboration to advance Rwanda's sustainable urban transport goals.

Introduction

Transportation is a fundamental driver of social and economic development, enabling mobility and facilitating trade, yet it is also one of the largest contributors to environmental degradation. Globally, the sector accounts for nearly a quarter of energy-related greenhouse gas (GHG) emissions, with road transport responsible for most of this output (Farahani et al., 2013). Emissions from vehicles, including carbon monoxide (CO) and nitrogen oxides (NOx), contribute

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significantly to urban air quality deterioration (Schuetzle et al., 1994). This underscores the urgent need to transition toward sustainable transport systems. Among the modes of transport, motorcycles are increasingly important in many developing regions because of their affordability, low operating costs, and efficiency (Bakker, 2019). However, their reliance on internal combustion engines (ICEs) exacerbates air pollution, noise, and fossil fuel dependency. Promoting the shift from traditional motorcycles to electric motorbikes (e-motos) has thus become a central strategy in sustainable urban mobility (Nguyen-Phuoc, 2023).

Globally, the motorcycle industry is expanding rapidly. In Asia, particularly in ASEAN countries, motorcycles account for more than 25% of the global market. By 2019, Indonesia had 106 million registered motorcycles, Vietnam 62 million, and Thailand 21 million (Nguyen-Phuoc et al., 2023). In Europe, 12% of vehicles are motorcycles, while in Africa they make up approximately 20% of the global registered motorcycle population. In Burkina Faso, motorcycles represent 85% of vehicles, and in Uganda they account for 70% (Ayetor et al., 2023a). This widespread reliance reflects both socioeconomic accessibility and mobility needs, but also highlights growing environmental concerns. To address these, countries worldwide are prioritizing e-mobility. China leads electric motorbike sales, with approximately 30 million units and a stock of 250 million, followed by Europe with 2.3 million, and other regions with around 1 million (Bakker, 2019). Aligned with the UN Sustainable Development Goals, many nations—including Denmark, France, India, and the UK—are working to phase out fuel-based motorcycles by 2030–2040 (Zainol et al., 2019).

In 2015, electric motorcycles were more dominant in various countries, including China (7%), Denmark, the Netherlands, and Japan (2-4%). China is leading electric Motorbike sales with approximately 30 million and a stock of 250 million, followed by Europe with 2.3 million, and the rest of the globe with about 1 million (Bakker, 2019).

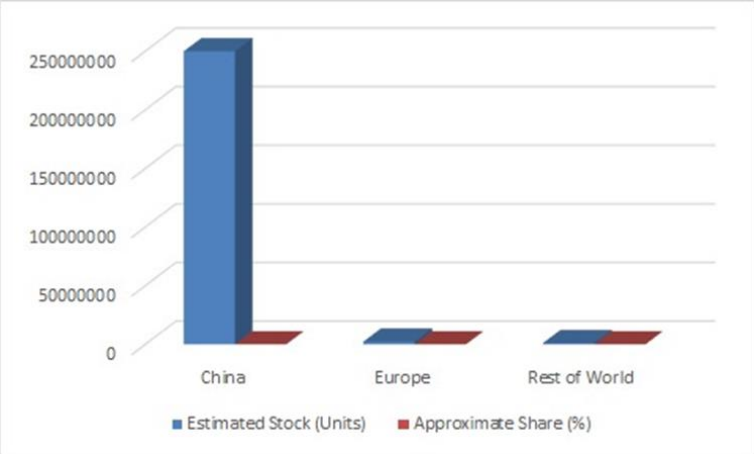

Figure 1. Global Electric Motorbike Stock Distribution (2015), (Bakker, 2019)

The figure above shows the status of 2015, electric motorcycles were more dominant in various countries, including China (7%), Denmark, the Netherlands, and Japan (2-4%). China is leading electric Motorbike sales with approximately 30 million and a stock of 250 million, followed by Europe with 2.3 million, and the rest of the globe with about 1 million (Bakker, 2019).

In Rwanda, motorcycles dominate the transport sector, accounting for 52% of the 221,000 registered vehicles in Kigali, with the fleet growing at nearly 12% annually (Umutoni et al., 2024). While they provide essential mobility, their proliferation raises concern over deteriorating air quality and increasing reliance on fuel imports, which account for 12% of the country's total import bill (Bajpai & Bower, 2020). In August 2019, the Government of Rwanda (GoR)

announced an ambitious plan to phase out ICE motorcycles and replace them with electric ones (Kalisa et al., 2021). The Ministry of Infrastructure (MININFRA) and the International Growth Centre (IGC) have since spearheaded e-mobility initiatives, while companies such as Ampersand, Spiro, and Gorilla have introduced e-motorbikes in Kigali. Government incentives, including zero VAT on electric vehicle equipment, tax exemptions on imports, and provision of land for charging stations, have been introduced to encourage adoption (MININFRA, 2021). Studies further show that e-motorbikes reduce emissions and improve driver income compared to conventional motorcycles (Niyonsaba et al., 2021).

Despite these initiatives, adoption remains low. According to RURA statistics, by 2025 only 1,016 electric motorbikes were registered in Nyarugenge District compared to 12,361 fuel-powered motorcycles. Barriers include limited charging infrastructure (Nshimiyimana, 2025), range anxiety (Wahab & Jiang, 2019), high upfront costs (Bajpai & Bower, 2020), long charging times (Vanitha et al., 2024), expensive spare parts, poor product quality, and inadequate mechanical services. Regulatory constraints and delivery delays also discourage potential users. These challenges have created a gap between government ambition and practical adoption on the ground.

Existing research highlights both the opportunities and barriers associated with e-mobility. The diffusion of innovation theory (Rogers, 2011) has been applied to explain adoption patterns, emphasizing comparative advantage, compatibility, complexity, trialability, and observability (Weil, 2018). The sustainable mobility framework highlights integration with broader social and environmental goals, including inclusivity and equity (Holden et al., 2019; World Bank, 2017). The circular economy emphasizes resource efficiency, recycling, and long-term sustainability (Potting et al., 2017; Malooly & Daphne, 2023). While these frameworks provide useful perspectives, there is limited empirical research applying them to Rwanda's e-mobility context. Most studies emphasize environmental benefits or high-level policies (Bajpai & Bower, 2020; Khan et al., 2022), but little attention has been given to user perceptions, infrastructural readiness, or the role of cultural and behavioral factors. Few studies have integrated GIS to analyze charging infrastructure distribution, and robust cost–benefit modeling for e-moto users is also lacking.

This study addresses these gaps by assessing e-motorbike adoption in Nyarugenge District of Kigali City through the following objectives: (1) assess the current awareness and use of electric motorbikes among motorcycle users and (2) Examine the major challenges hindering the widespread adoption of electric motorbikes as well as (3) identify the key opportunities in promoting the use of electric motorbikes in Nyarugenge district.

This comprehensive analysis seeks to provide evidence-based insights to guide Rwanda's transition toward sustainable mobility and to contribute to the global discourse on e-mobility adoption in low- and middle-income contexts.

Method and material

Study area description

One of Kigali's three districts is Nyarugenge. It consists 47 Cells, and 10 Sectors (Gitega, Kanyinya, Kigali, Kimisagara, Mageragere, Muhima, Nyakabanda, Nyamirambo, Nyarugenge, and Rwezamenyo). The Nyabarongo River forms the District's border and flows along practically its whole western and southern borders (Ministry of Education, 2017).

Moreover Nyarugenge District is located in the west of the city and occupies 134.2 km² (Nyiransabimana et al., 2019), 374,319 people, mostly men, lived in Nyarugenge District, accounting for 21.4% of the total population of the City of Kigali, according to the 5th Rwanda Population and Housing Census (PHC5)(Asiva Noor Rachmayani, 2015).

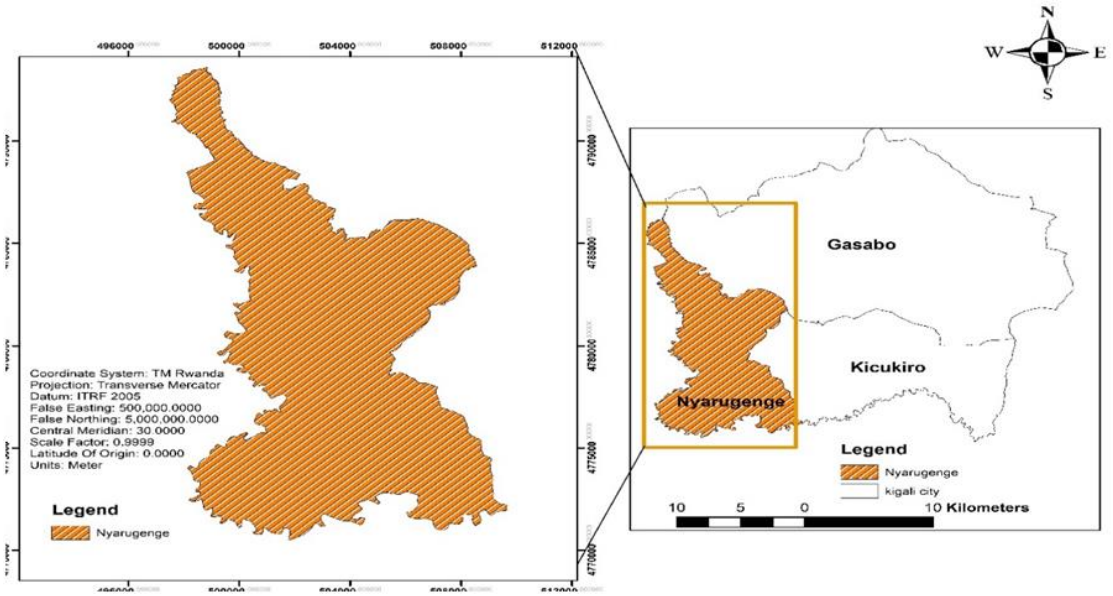

Figure 2. Administrative Map of Nyarugenge District (Prepared by the authors 2025)

During the initial stage of the study, the secondary data were used to gather information about an overview of electric e-motorbikes, their adoption, which gives us a solid foundation for any further analysis

Library research

In this section of library research, a survey of literature from requisite textbooks and articles from learned journals reveals important insights into the technologies relevant to electric vehicles, their environmental advantages and challenges, as well as relevant theses that provide local context.

Moreover, existing and planned Government policy documents were analyzed to review existing policies and regulations to determine what obstacles are present regarding the adoption of e-motorbikes and what supporting infrastructure, such as charging stations, would be required.

Moreover, this method provided with us insight on the role of governments in the adoption of electric vehicles through the analysis of financial incentives such as subsidies and tax incentives, in addition to public awareness campaigns.

Primary data collection

In the phase of primary data collection, information has been gathered using interviews, surveys as well as field observations. This provided a reasonable understanding of the various stakeholders' experiences, perceptions, and attitudes towards e-motorbikes

Interview

The interview was used to know the viewpoint of different people by assessing the challenge and opportunity adoption in Nyarugenge District, were we interviewed various interviewees among them were motorists who daily use that motorcycle of various companies, moreover we have also interviewed governmental officials, including CoK, MININFRA, RURA, RSB Furthermore we interviewed company representatives of Motorcycles, including Ampersand, Gorilla as well as Spiro.

The interview was conducted on 14th June and 16 June 2025.we have interviewed 100 motorists either in Nyarugenge district, we have also interviewed 300 passengers from Nyarugenge district some of them live in Nyarugenge district while others are not residents of Nyarugenge district.

Qualitative information regarding the experience of e-motorbike use has been collected from motorcycle taxi operators and users as well as government official. The interviews were guided by the following broad areas:

— Interview with motorist
The interview with motorist was mainly carried out around parking area, charging facilities Those motorists have shared with us the insight on general operation of electric motorbike along with challenge they face in their daily working, furthermore they provide information about company representative about the service effectiveness and also information about quality for that motorcycle provided by those representative company.

— Interview with Motorcycle Commuter
The study of Nyarugenge district's electric motorcycle commuters has enabled gaining insight into the awareness of the public on electric motorbikes, the problems faced by commuters day-to-day while using electric motorbikes, opportunities brought by electric motorbikes compared to traditional ICE. It has enabled us to know what suggestion, if any, the commuter has about this adoption. Interview with Government Officials
This part enabled us to discuss with government officials such as CoK, RURA, MININFRA, RSB which give us insight on how the government utilizes electric mobility, especially electric motorbikes, how they are contributing to its widespread adoption, challenges they face, and opportunities, furthermore provided with the existing or planned policies and strategies for adoption. Thus, the paragraph discusses the details of how the interview went through each institution.

— Interview with E-Motorbike Company Representatives
This interview has helped us to gain insight into the technical and operational perspective of electric motor bikes, such as battery lifespan, range, charging time, safety measures, as well as social-economic aspects. Moreover, we will also be looking analyzing infrastructure development, the point of transition to electric motorbikes, challenges in electric motorbikes, their opportunities, and strategies to advance.

Additionally, these company representatives were selected for this study based on analysis from charging stations available in Nyarugenge District where we found that only those three company representatives have charging facilities in our case studies. Generally, during the interview, both structured and semi-structured approaches incorporate a well-prepared question for interviewer as well as unplanned questions, but regarding our scope.

Survey

The surveys use a closed questions and open designed to collect respondents' perspective and opinion regarding electric motorbikes. Their understanding about e-motorbikes and its features will be evaluated along with the benefits of lower operating cost, environmental concern, and noiseless operation. Other barriers to adoption like high initial investment, lack of charging stations, and issues with battery lifespan will also be looked into.

In addition to that, the surveys assess respondents' readiness to adopt e-motorbikes as well as identify What factors were the most important in influencing their decisions, thus measuring their willingness to adopt. The collected data can assist researchers in looking for underlying themes and patterns that pertain to the barriers to adoption and develop plans to facilitate the adoption of e-motorbikes into the local transportation framework.

Field observation

Field observation has been done for the purpose of understanding the research problem as it has provided as with insights about the challenges and opportunities of electric motorbike adoption. Some data collected in Nyarugenge district through 10 Sectors (Gitega, Kanyinya, Kigali, Kimisagara, Mageragere, Muhima, Nyakabanda, Nyamirambo, Nyarugenge, and Rwezamenyo with the aim of observing charging station facilities, operational as well as challenges associated with them. During our field observation we have observed different companies and their motorist, the company which is mainly engaged in the road of Nyarugenge those are Ampersand, Spiro, Gorilla limited, moreover we observed different service they provide in terms of the period they take to charge or to switch batteries as well as distance between the charging facilities.

Application of GIS technology

GIS software has utilized to provide a location and map of our study area which helped us to describe research case study for further analysis, moreover the software was used to analyze and present data and information related to electric motorbike adoption, data such as road network used by e-motorbike, main motorcycle parking area, and charging facilities were mapped, moreover GPS device was used to capture the coordinates at every charging station in Nyarugenge District.This analysis has provided us with solid information for general understanding the adoption with associated physical as well as socioeconomic challenges and opportunities.

Table 1. The map with data type, their source as well as output

Product/Map	Data Type	Attribute	Data Source
Map of Nyarugenge District	Polygon	Administrative boundaries	DIVA_GIS
Map showing charging Station distribution	Point	Charging infrastructures coordinate	UTM_GPS
Map showing served sector in Nyarugenge District	Point, polygon	Charging infrastructures coordinate, Sector data	DIVA_GIS,UTM_gps
Charging Infrastructure Coverage for Electric Motorbikes (Service Area Analysis)	Point, polygon, polyline	Charging station buffered	All sources above

Techniques

We have employed various techniques such as a questionnaire, recording verbally, as well as sampling techniques as detailed in part below.

Questionnaire

This technique was used as a guiding interview for chosen government officials, a selected sample of motorist as well as motorcycle commuters the main objectives it was to gather general information on current adoption of electric motorbikes with barriers, opportunities as well as suggestions for improvement from a representative point of view additionally the questionnaire consisted of close-ended, semi-open, and open-ended questions.

Questionnaire Structure Depending on huge number of expected responder, most question were close ended ,First section was designed to welcome responder and introduce them about the electric motorbike adoption, questionnaire were formed in way that it not record the responder email, name or contact number ,we have choose this way because we want responder to feel free in providing their opinion, moreover question was made of seven section which was designed in

way that we can achieve all 3 objective as mentioned in 1.3 subpart of this document, moreover it was designed in google document to allow efficiency in data collection.

Appendix (6) shows a sample of the General guiding questionnaire

Recording

This technique also helped us to store information gathered through some interviews in case the questionnaire seems inappropriate, moreover, helped us for store information for further analysis. Additionally, recording techniques were among the most motorists as well as some of motorcycle commuters since they had limited time.

Sampling design and rationale

The research final decision represents the whole individual or organization, however in reality, only a representative sample is chosen. As a segment of the wider population, it requires less money, time, and labor(references).

During data collection in our research, sampling techniques were also applied among electric motorcycle motorist, commuter, government officials concerned with e-mobility as well as company representatives that seems to operate most in Nyarugenge district. For motorist and motorcycle commuter simple random sampling type used by which the population must be homogeneous and every element contain same kind of characteristic that meet the described criteria, in addition to that since the motorists was unevenly distributed and time was limited; thus, random electric motorists were interviewed.

The sample size was calculated using Yamane formula (Naing, 2003)

(Yamane's):

$$n = \frac{\mathbf{N}}{\mathbf{1+N(e)^2}}$$

Where:

n = sample size

N = population (motorist)

e = margin of error (e.g., 5% or 0.05)

Thus, the Nyarugenge population according to recent population survey (nisr, 2023)

As follow:374,319

$$n = \frac{\mathbf{374319}}{\mathbf{1+374319(e)^2}} \approx 399.5 = 400$$

On other hand, Government official and company representatives were sampled based on purposive sampling were, this sampling technique was found appropriate since the government officials to be interviewed were chosen based on criteria such as the type of data needed and those with a high interest in our research as well as electric motorbike company representative since they have chosen based on condition thus, Only those with a charging station located in Nyarugenge district were interviewed. See table for motorist and motorcycle commuter.

Table 2. The sample population for motorcycle commuters and motorists

Occupation	Total population	sample	Sample by occupation
Motorist	374,319	400	100
Commuter			300

Table 1. Summary of the sample for government officials and company representatives

Occupation	Sample size
Government officials	4
Company representatives	3

Methodological framework

The Methodological framework summarizes the methods, techniques and sampling design that used in assessing the adoption of electric motorbike challenges and opportunities in Nyarugenge sector (see Figure 3).

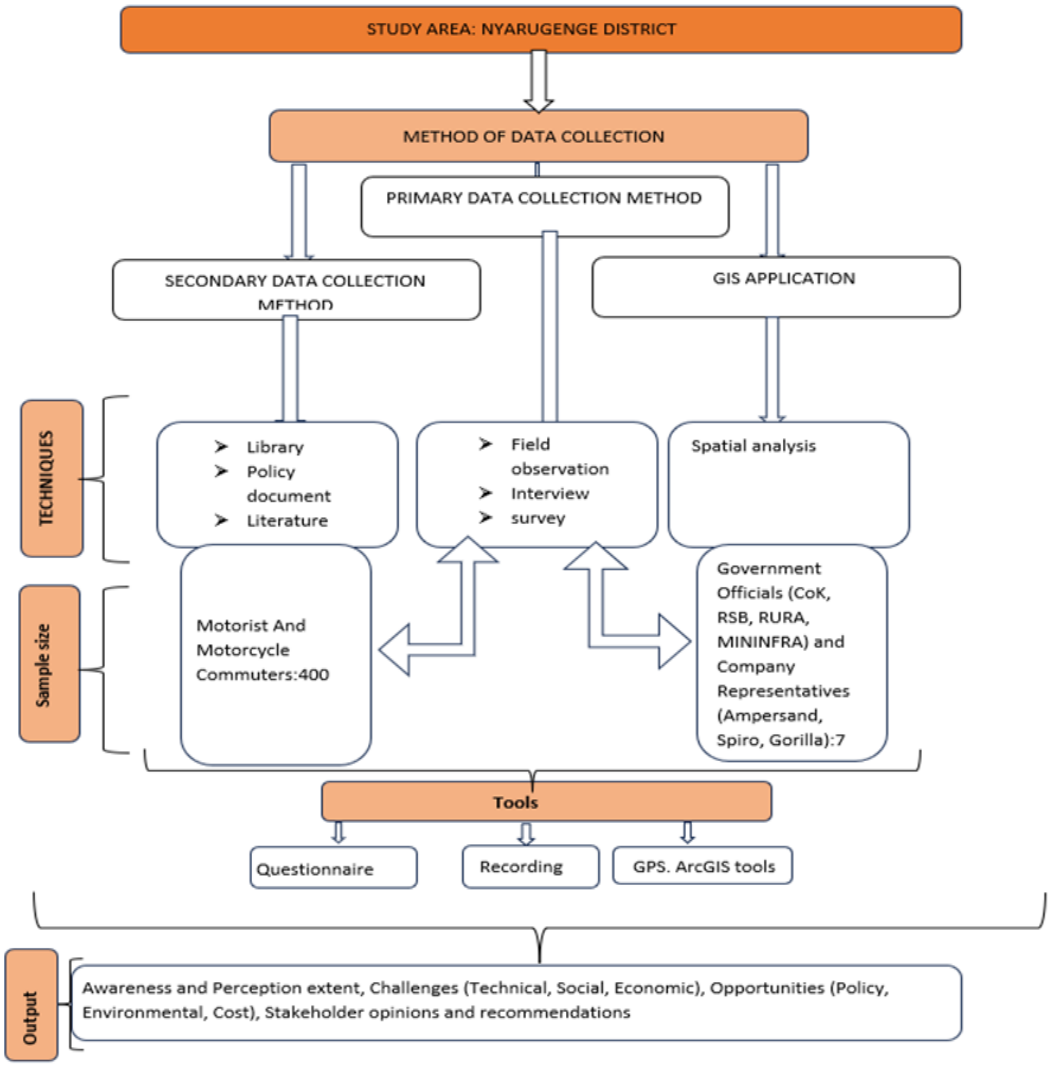

Figure 3. Methodological workflow

Results

This part presents the findings from the overall data collected. Moreover, it provides results of the analysis as well as interpretations. In this chapter, the objectives and research questions are discussed. It includes finding about current awareness and use of electric motorbikes among motorcycle users, the significant challenges hindering the widespread adoption of electric motorbikes as well as key opportunities in promoting the use of electric motorbikes in Nyarugenge district and what it implies.

General information

This section gives an overview of participants' age, gender, occupation as well as whether they live in Nyarugenge district or not, Moreover the number of respondents stated in methodology were asked, among 401 Responses 44% were between 18_25 age Groupe, only 2% were above 50 years as shown on figure(4) , participant 49% were male while 43% as shown on figure(4),Moreover most of them reside in Nyarugenge district see figure working most in occupation such as Student, motorist, self-employed ,Passenger, Driver, Business, unemployed, technician, engineer (see Figure 5).

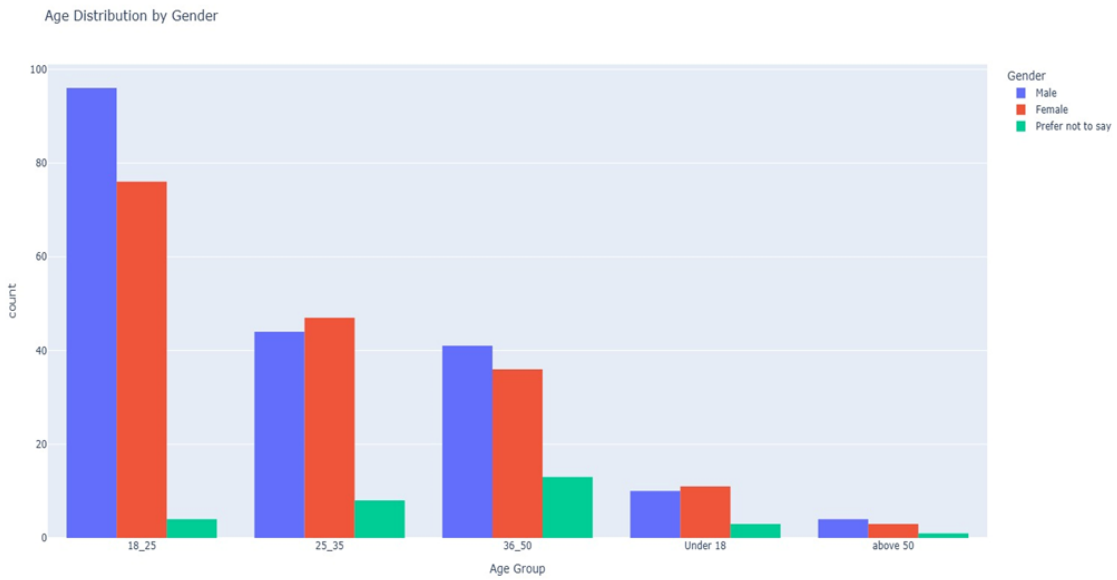

Figure 4. Age distribution of respondents showing that most participants were aged 18–25, followed by 25–35 and 36–50 with gender characteristics

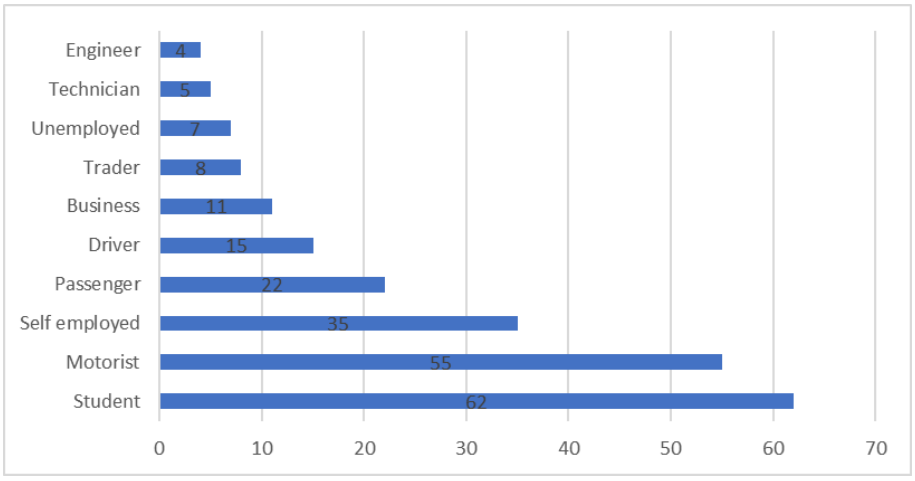

Figure 5. The occupation frequencies among participants

Awareness and usage of e-motos

The data collected indicated that familiarity and usage among Nyarugenge district participant are very high at extent of 98% of those heard about electric motorbike and 97% experienced it as commuter or even motorist (see Figure 6).

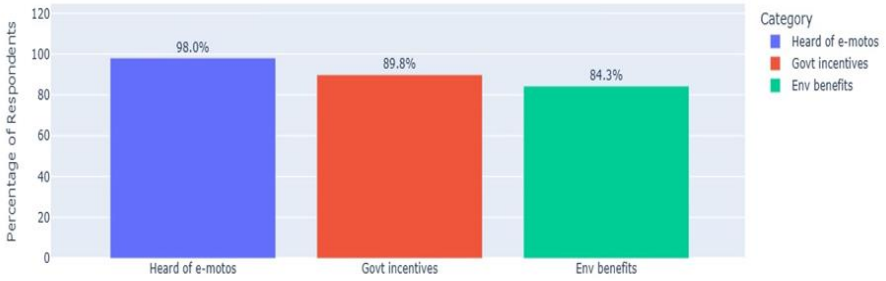

Figure 5. Awareness levels of respondents, showing that most have heard of e-motos, fewer know about government incentives, and many believe in environmental benefits.

Figure 6. Satisfaction levels of respondents who have used e-motos, with most reporting positive experiences.

Apart from that, the perception of using electric motorbikes shows that 65% of users shared a satisfaction level of 4 or 5 out of 5, which is very good. On the other hand, a very small percentage of 2.5% showed negative satisfaction, as shown in the figure 6. above. This result shows that the public awareness and engagement with electric mobility approach as already improving but also there is battle is not yet over, those 2.5% means something and need to be targeted. Moreover,

registered electric motorcycle is still low compared to fuel motorcycle in Kigali city, especially in Nyarugenge district, according to RURA the registered fuel motorbike was 53,347 while electric motorbike in Kigali city 14,792, on other hand Nyarugenge as case studies registered fuel motorbike are 12,361 while electric motorbike is 1,016, see figure (7) from 2023_2025. This huge gap indicates that although awareness which is high in Nyarugenge District, but the high awareness does not mean high yet it is still at lower stage in overall usage among communities.

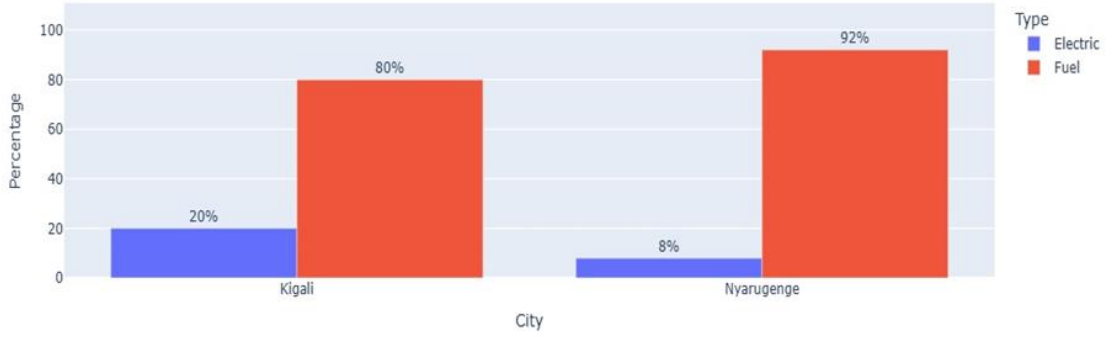

Figure 7. Comparison of motorbike usage between Kigali City and Nyarugenge District.

Motorbike usage in Kigali City, where 20% of motorbikes are electric and 80% fuel-powered.

Motorbike usage in Nyarugenge District, where only 8% are electric while 92% remain fuel-powered.

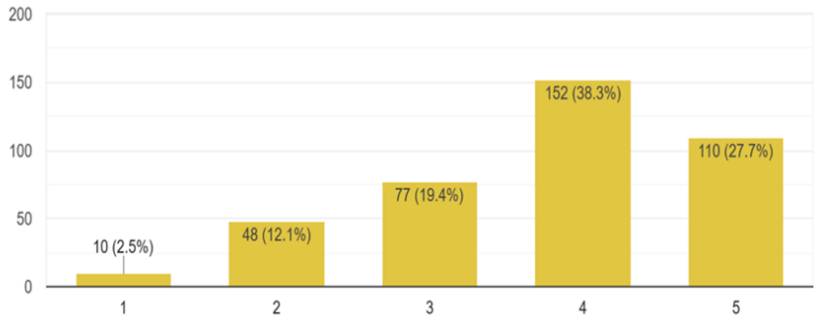

Figure 8. The level of experience with electric motorbikes by percentage

Barriers to adoption

Although electric motorbike awareness seems to be high, this technology still faces several barriers noted in our research; generally, the barriers for electric motorbikes worldwide are almost the same in our context. Both Situational, technical AND socioeconomic limitation are most prevalent in Nyarugenge district. Limitations such as a few charging stations, range anxiety and unreliability, long charging time, the expense of spare parts for electric motorbikes, low standard product quality, regulatory gaps, slow delivery of electric motorbikes purchased, as well as financial gaps are most reported by both interview and respondents in the adoption of electric motorbikes.

Charging station gap

More than 41% of respondent reported that lack of charging station in area is the main reason that make them unwilling to use electric motorbike, in addition to that spatial analysis in Nyarugenge district by with data collected using GPS on charging station show that only Nyamirambo, Muhima, Kimisagara, Nyarugenge, Rwezamenyo, Kigali, Gitega as well as Nyakabanda sector are only one with charging station among 10 sectors of Nyarugenge district thus, this highlights the limitedness of charging station see figure(9) where even if many sector seems to be covered put those charging station are concentered in one region.

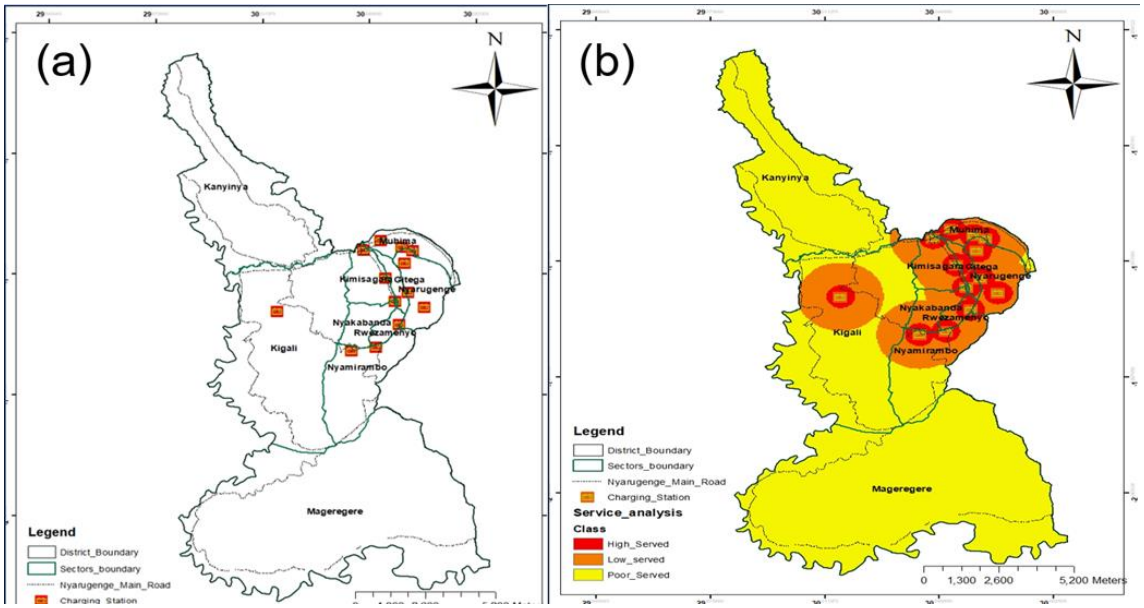

Figure 9. Charging station availability and service coverage in Nyarugenge District. (a) Spatial distribution of charging points across the district. (b) Service coverage analysis showing high-, low-, and poorly-served sectors

Moreover, few charging station also is challenge because sometime one charging station may have unexpected issues such as lack of electricity, for instance during interview charging station of ampersand located in Nyamirambo were out of electricity that day, thus many motorists were not working that time. Additionally, it is critical that motorcycle can operate in one district so limitedness of charging station in other part of countries make electric motorbike less preferred.

Range anxiety and reliability

Report from responder shows that apart from 41 % of charging station over 27% are afraid to use electric motorbike due to low range of battery mostly between 50_90km per charge depend on company, this make electric motorbike user limiter to some trip where they are afraid that battery may run off before reaching their destination or going back to origin.

Among interview most of them talked about unreliability of battery technology by which battery may switch of unexpectedly, non-uniform range for full battery are concern confirmed by respondent and interviewer. Additionally, concern of battery life is other most prevalent, unfamiliarity with technology as new trend, preferences on fuel motorbike, lack of trust make up about 7%.

Product quality

Another concern raised by motorist is strength of electric motorbike parts, interviewee showed that his electric motorbike has started to show sign of deteriorating only in not more than 2 years usage, unlike his other owner who uses fuel motorbike that lasted over 12 years Thus, this highlight barrier to adopt this kind of motorbike because many motorists are afraid of risk, maintenance.

Poor mechanical services

This led financial burden since most of motorcycle company over charge the owner by not considering the challenges for example: motorist my spend days or week with mechanical issues searching for either for spare part waiting or poor service given by company and he/she is obliged to pay a given amount,

Inappropriate rules and regulation

This also most issues highlighted by motorist for instance electric motorbike cannot go beyond three days not working and it is only allowed to be used by owner which become serious issues when user faces unexpected circumstance such sickness, family situation and other put them on pressure so that limit other to use them.

Long charging time

Electric motorbike, such as gorilla, can be charged up to 30 minutes, make motorist limited to work whole day, and this lead to long waiting for charging station.

Insufficiency and high price for electric motorbike spare parts

This makes it also less preferred by which only company representative of electric motorbike is the one that can sell spare part this make it few on market, not only that their price is high compared to those of fuel motorbike one piece of Sprocket which cost more than 5000frw while one fuel is 1000frw. For that sprocket of electric motorbike is frequently insufficient on market sometime, which led some to fabricate them and this can lead to risk of accident. other technical challenges such hand brake, by which many motorists are not satisfied by taking brake using hand which limit user to perform another task that need hand usage such as transaction on steep road become difficult. Moreover, late in deliver of electric motorbike is still issues, by which the client waits for over 4 months after paying electric motorbike, most interview raised concern

Table 4. The challenges and their frequencies among motorists

Challenges	Frequency level
Lack of charging station	High
Low range	Very high
Poor battery performance	Moderately
Poor regulation by motorbike company owner	Very high
Poor maintenance services	Moderately
Poor standard quality	Moderately

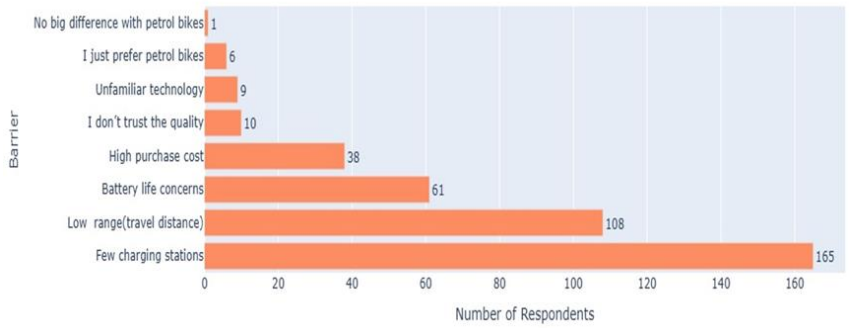

Figure 10. Challenges facing electric motorbike adoption

Figure 10 shows that lack of charging station, low range, battery life concern and lack of trust for quality are the most issues raised my respondent

Opportunities for adoption

The results provide strong evidence supporting the adoption of electric motorbikes. A large majority of respondents (85.6%) indicated that electric motorbikes help reduce air pollution, suggesting that users associate their adoption with environmental benefits. Significant cost differences between fuel and electric motorbikes is highlighted, with replacement parts such as tyres and mirrors being consistently cheaper for electric motorbikes. For example, the rear tyre for a fuel motorbike costs 50,000 RWF, while the same part for an electric motorbike is only 15,264 RWF. This indicates that the adoption of electric motorbikes reduces the financial burden of maintenance. In addition, users experience noticeable fuel savings is significant, with the largest proportion (40.9%) saving between 1,000–5,000 RWF per trip, while others reported even greater savings of over 10,000 RWF. These results demonstrate that both economic and environmental advantages are recognized by users, underscoring the favorable conditions for wider adoption of electric motorbikes.

Figure 11. Encouragement factors for adopting e-motos

Moreover, opportunities such as increasing charging station as well as battery range, more government subsides, more swap options, campaign about awareness, free or low maintenance cost highlighted as preferred an opportunity that can encourage electric motorbikes as indicated on Figure 11. In addition to that interview with informed the City of Kigali informed us that hosts e-mobility stakeholder engagements at City Hall, using these platforms to communicate developments and collect feedback. These awareness efforts target e-mobility in general, not specifically electric motorcycles. Other incentives such as lowering price on standard product to electric vehicle demand is the one tool that Rwanda Standard Board uses. Collaboration between

government officials such as COK, MININFRA, MINEMA, RSB are at highly level as well as those of company representatives.

Government incentives and support for electric vehicles, such as tax exemptions, free parking, and direct financial assistance to electric vehicle show the can positively affect the willingness of user at more than 81% as shown on Figure 12.

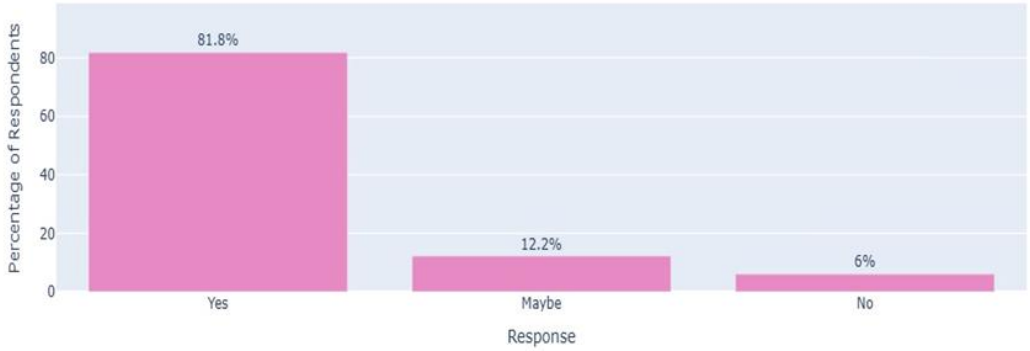

Figure 12. Willingness to switch if the government offers an incentive

Discussion

A major issue identified is the high upfront cost of e-motorbikes, compounded by limited financing options. Respondents consistently noted that although e-motorbikes offer fuel savings, the initial purchase price remains unaffordable for many riders whose income depends on daily motorcycle transport. This finding aligns with global research showing that affordability is a decisive factor in low- and middle-income countries (Priya Uteng & Turner, 2019). In such markets, cost barriers often outweigh long-term operational savings.

Another important obstacle that surfaced was infrastructure. According to GIS data, many areas of the district are underserved, as battery-swapping and charging outlets are concentrated in a few sectors. When going outside these locations, riders expressed concerns about range restrictions. The International Energy Agency (IEA) indicates that one of the biggest obstacles to the global adoption of electric two-wheelers is inadequate and unevenly distributed charging infrastructure (Selva, 2024). This scenario is consistent with larger international findings.

However, several opportunities were identified. The claim that electric mobility aligns with Rwanda's low-emission development objectives is supported by respondents' emphasis on fuel savings, reduced maintenance, and environmental benefits as primary motivators. According to (Aidam et al., 2025) from 2023, Sub-Saharan Africa can quickly decarbonize its transportation sector by electrifying motorcycle vehicles, given its lead in urban mobility.

Battery performance and charging time present another difficulty. Respondents raised concerns about battery longevity and the potential for revenue loss from extended charging times. These operational issues are consistent with research from other developing nations where commercial riders are deterred by battery dependability, range anxiety, and slow charging (Simwaba & Qutieshat, n.d.). In line with worldwide evidence that markets with little local manufacturing frequently face lengthy supply chains and maintenance issues, riders also reported delays in acquiring new units, a lack of spare parts, and unclear servicing procedures.

These results are further contextualized through international comparisons. For example, China's high adoption rates show how strong government incentives, local manufacturing, and dense charging networks hasten the uptake of electric two-wheelers (Kim et al., 2025). In the meantime, Southeast Asian nations like Vietnam and Indonesia show how battery-swapping

models benefit commercial riders by lowering downtime (Anuchitchanchai et al., 2025). These worldwide trends support the significance of the difficulties seen in Nyarugenge and point to possible solutions.

According to the study's overall findings, Nyarugenge District is still in the early stages of e-motorcycle adoption. Although adoption is hampered primarily by cost, uneven infrastructure availability, battery-related issues, and policy gaps, awareness is high and potential benefits are widely acknowledged. Scaling e-motorbike usage in the district will require addressing these obstacles through focused funding programs, infrastructure development, technical standards, and well-coordinated public-private partnerships.

Conclusion and recommendations

This study examined the adoption of electric motorbikes in Nyarugenge District and revealed that uptake is influenced by both opportunities and barriers. Awareness is remarkably high, with over 98% of respondents having heard of e-motorbikes and 97% having tried them at least once. However, ownership and consistent use remain low compared to internal combustion engine (ICE) motorcycles.

Several key challenges limit adoption: limited charging stations, range anxiety, long charging times, high costs of spare parts, declining product quality, regulatory gaps, and delays in the delivery of purchased e-motorbikes. These challenges are critical in Nyarugenge, where motorbike transport is central to daily life, supporting economic activities for over 70% of the population across distances of up to 40 km.

Despite these barriers, the study highlights significant opportunities. Government incentives such as VAT exemptions, combined with lower fuel costs, potential reductions in air pollution, and strong stakeholder willingness, provide a strong foundation for expanding e-motorbike use. The study concludes that while awareness is not a problem, infrastructure, regulations, and supply-chain efficiency must be strengthened. A collaborative approach involving government, private sector, and civil society is essential for successful transition to sustainable electric mobility in Rwanda.

To enhance adoption, the following actions are recommended:

- Strengthen Incentives: Maintain tax exemptions, import duty reductions, and regulatory clarity to promote EV adoption.
- Enhance Public–Private Collaboration: Expand clean-energy charging stations in both cities and rural areas.
- Integrate Policies into Frameworks: Develop binding national and local regulations governing infrastructure, accessibility, and standards.
- Improve Battery Capacity: Encourage innovation to extend battery life, reduce charging frequency, and ease pressure on infrastructure.
- Regulate Spare Part Pricing: Establish transparent price controls to prevent exploitation and ensure affordability.
- Promote Research on Sustainability: Support studies on recycling, circular economy practices, and long-term environmental impacts of e-motorbike adoption.
- Overall, e-motorbikes hold strong potential to transform Rwanda’s transport sector, but success depends on strategic interventions that align infrastructure, affordability, policy, and innovation.

Disclosure statement

The author reports there are no competing interests to declare.

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BUILT FORM

Heritage Protection as Progressive Urbanism? Defending the Legacies of the Welfare State

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Viewpoint

Berlin heritage

There are three World Heritage Sites in Berlin – can you guess what they are? You might expect to discover that, first, Museum Island and, second, the Palaces of Potsdam and Berlin are included on the list. But you might be more surprised by the third site – Berlin Modernism Housing Estates, six housing estates constructed between 1910 and 1933, principally from the period of the Weimar Republic. They are claimed to testify to innovative housing policies in a period when the city of Berlin was particularly progressive socially, politically and culturally. Together they 'contributed to improving housing and living conditions for people with low incomes through novel approaches to town planning, architecture and garden design' also providing 'exceptional examples of new urban and architectural typologies', which 'exercised considerable influence on the development of housing around the world' (UNESCO, 2008).

Housing crisis

The heritage of social housing seems particularly important in a moment when the availability of affordable, decent housing is a crisis issue in many countries. Writing from a British perspective, twentieth century social housing before 1979 – and the election of the Thatcher government which heralded a radical break from post-war consensus politics – speaks to a period when there was a widely held political aspiration to provide decent and better housing for all. Whilst the results were mixed, the best examples, now often given heritage status, show a scale of ambition, generosity and social priority that is difficult to imagine in the contemporary world. In England the 'Post-war listing' programme has positioned state heritage protection as an unlikely advocate and defender of the diminishing material and symbolic legacy of the architecture of the welfare state from the 1950s, 1960s and 1970s. The legacies of this period are very different between different countries, but in many cases examples of such buildings are being formally protected as heritage. This opens-up important issues of how this period of planning history is framed,

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understood and valued within contemporary society. For example, do we consider material legacies of this period as important purely in terms of design, or is the social intent of the period of equal importance in our appreciation of such environments today?

The potential consequences of heritage protection for social housing – and its potential to contribute to more progressive urban outcomes – was the focus of my Leibniz Research Alliance Fellowship in June 2025 based at ZZF in Potsdam. The aim was to begin to extend the work we have undertaken in England (While and Pendlebury, 2025) to the German context, in the expectation that the different political context of both the creation of welfare state architecture and its subsequent political positioning will show elements of transnational overlap but also significant difference. Of particular interest in the case of Germany are the different histories – and trajectories – between the east and west of the country. And my first task, focusing on Berlin, was to try and understand something of the history and heritage status of the social housing in the city.

More berlin housing heritage

Whilst Berlin's history of innovation in social housing came to an abrupt stop under National Socialism, it returned with force in both Berlins in the 1950s. In West Berlin, this was exemplified by an international competition for the Hansa Quarter. The International Building Exhibition (INTERBAU) includes social housing blocks by eminent German architects, including the returning Walter Gropius as well as international figures such as Arne Jacobsen, Alvar Aalto and Oscar Niemeyer, although perhaps the most famous consequence of the exhibition was built elsewhere – the Le Corbusier reworking of the Unite d'Habitation. The counterpoint in the east, with an equal level of ambition but very different architectural approach, was the monumental series of blocks aligned along Stalinallee (now Karl Marx Allee), influenced by socialist urbanism and classicism. The combined innovation of new social housing methods and typologies from east and west has led to unsuccessful attempts to be included on Germany's tentative list of future World Heritage Sites.

After the construction of the Berlin Wall, the large-scale construction of social housing continued in new forms in both territories until the Wall's fall. In part this took the form of large-scale peripheral estates. In the west these were pushed out to the south (Gropiusstadt) the west (Falkenhagener Feld) and most monumentally to the north (Märkisches Viertel). In the east the later peripheral estates were grouped around the areas of Marzahn, Hellersdorf and Hohenschönhausen. Although not yet generally defined as heritage, a few buildings in these estates have been given monument status. Alongside the construction of peripheral estates there were also redevelopment efforts of social housing in the inner city. The best known of these is the International Building Exhibition (IBA) which ran in West Berlin during the 1980s, using the concepts of 'careful urban renewal' and 'critical reconstruction.' International celebrity architects on this occasion included Rob Krier, Charles Moore and Aldo Rossi, representing a distinct postmodern turn. Not surprisingly, some of these works now have heritage status.

Although German reunification and in the case of Berlin the 'stitching back together' of a divided city is to be celebrated, reunification also led to the cessation of significant social housing building programmes in Berlin, albeit a decade later than with the conservative, neo-liberal political turn in the UK. The reasons for this are not simple, but initially housing demand was low, accompanied by high costs for reconnecting a city systematically severed for 45 years which led to the sell off of assets, including housing. Whilst in Berlin the provision of affordable housing today is perhaps less of a crisis issue than in many British cities, and London specifically, that there is a problem is clear. Despite its innovative and generous history of housing provision and a history of renting and protection for renters, Berlin has not been immune from global neo-liberal forces driving the commodification of housing. Do the protected legacies of earlier eras have any role to play in resisting these changes?

Heritage protection as progressive urbanism?

Historic building conservation is normally perceived as something conservative, rather than as a site of resistance in the city. However, preserved fragments of social housing stand as material testimony to periods when providing decent housing for all was a widely held political and social priority. Furthermore, protecting buildings for heritage purposes potentially challenges market hegemony, disrupting normal processes of capital accumulation. This may be part of the reason, along with a lingering antagonism to the material legacies of the welfare state ('concrete monstrosities'), why the government in England has distinctly cooled on extending protection to more post-war social housing in recent years. Robin Hood Gardens by Alison and Peter Smithson is the most well-known casualty, making way for a high-density area regeneration programme. Furthermore, some of the estates in London that do have protection through listing have been fully gentrified through radical tenure changes. But in our article (While and Pendlebury, 2025), we argue there may be tactical possibilities for resistance, a basis for community engagement, and a more local and bespoke approach to regeneration.

And in Berlin?

It is difficult to resist the juggernaut of neo-liberal housing policies that in many countries have made our houses commodities rather than homes. However, my preliminary impression of Berlin in comparison to England is of a generous and independent approach to heritage listing, of an inspirational history of innovation and provision of social housing, of a tradition of renting and protecting renters' rights and, importantly, of a history of civic mobilisation and resistance that cumulatively make me feel optimistic of the progressive potential of Berlin's rich history of social housing in providing some resistance to these global forces.

Disclosure statement

The author reports there are no competing interests to declare.

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BUILT FORM

Rethinking Heritage: A Critical and Personal Perspective

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Viewpoint

Beyond the stones: integrating unofficial heritage at Göbeklitepe

The discovery of Göbeklitepe marks a pivotal turning point in human history, so profound that it was announced as history's 'zero point' (Yolaçan & Aktın, 2024). Its significance is further cemented by UNESCO (2018), which has recognised the site as possessing Outstanding Universal Value across three distinct categories. Göbeklitepe is situated in southeastern Türkiye, approximately 15 kilometers northeast of the city center of Şanlıurfa, on a limestone plateau overlooking the Harran Plain. Its elevated position provides wide visibility across the surrounding landscape, enabling gatherings of early hunter-gatherer groups while also offering direct access to the stone resources used in the site's monumental architecture. This geographical setting is integral to understanding Göbeklitepe's spatial organisation and ritual functions, making its physical context an essential part of the site's broader narrative. While the global recognition is rightly celebrated, this viewpoint argues that a crucial dimension is being overlooked in the prevailing heritage narrative: the heritage of the local population. This essay highlights the risk of losing the unique rituals and deep-rooted connections the local community maintains with the Göbeklitepe landscape. It posits that by formally integrating this intangible, living heritage into the site's overarching story, we can not only preserve it but also profoundly enrich Göbeklitepe's collective value for all of humanity.

The contemporary global understanding of cultural heritage is predominantly derived from a Western perspective. This viewpoint solidified into an established paradigm in the post-World War II, reinforced by an emphasis on the 'common value of humanity' (Smith, 2006). In contrast, Critical Heritage Studies (CHS) has emerged as an interdisciplinary field that interrogates the very processes by which certain aspects of the past are selected and designated as 'heritage' in the present. CHS moves beyond a perception of heritage as a static, inherited relic, reconceptualising it as a dynamic socio-political process that is actively constructed, contested, and imbued with power. This paradigm questions existing power dynamics by asking whose heritage is prioritized and seeks to democratise heritage creation. Furthermore, it highlights the

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multiplicity of contested perspectives, aiming to include marginalised voices that have been historically overlooked (Harrison, 2010).

On top of that, Harrison introduces the concept of 'unofficial heritage'. In simple terms, unofficial heritage refers to aspects of cultural heritage that are deeply valued by a community or group but are not formally recognized, protected, or listed by official governmental or international bodies like UNESCO, a national ministry of culture, or a state historic preservation office. This unofficial legacy may encompass a structure, location, or landscape linked to specific memories, rituals, or narratives of community that fall beyond legal regulations; alternatively, it may consist of intangible beliefs or practices developed around official heritage sites.

The Wishing Tree anecdote in Göbeklitepe can be considered as an example of unofficial heritage rising around an official heritage, as in the second alternative. In the following sections, we will examine the frictional relationship between unofficial and official heritage, which can help enhance the value of the site's story. Before, I will walk you through my personal journey of insight, where we will examine our approach to examples of official heritage that we believe to be valuable from a Western perspective and the relationship that local people have with those examples when they encounter them.

A personal re-evaluation of heritage and value

My personal engagement with the concept of heritage began during my architectural education, where I developed a strong interest in architectural projects within archaeological sites. One such project was designed by Cengiz Bektas in the ancient city of Aphrodisias. While studying this project, I encountered a pivotal story about the photographer Ara Güler. The narrative describes how Güler, having lost his way, stumble upon a village that assembled a completely combined life with the ancient city of Aphrodisias and stayed there overnight. The following morning, he noticed and began photographing the villagers' use of ancient marble elements and artefacts in their daily lives—for instance, the seating unit in the village square brought from the ancient theatre or the column pieces placed under the posts supporting the roof of the village coffeehouse. His subsequent publication of these photographs is said to have been a catalyst for the official declaration of the area as a protected archaeological site, which eventually led to the relocation of the villagers.

Upon first hearing this story, my instinctive reaction was a somewhat condescending judgment: I assumed the villagers failed to recognise the 'value' of the cultural heritage surrounding them, a perspective subtly ingrained through my own Western-influenced education. However, upon engaging with Critical Heritage Studies, I began to question my own assumptions. A critical question emerged: Why didn't these people value these objects in the way I did? This line of inquiry led to a deeper self-reflection. I asked myself why the marble stones were valuable to me. Was it due to their aesthetic quality or their historical significance? Had I not received a formal architectural education, would I still have perceived them as valuable? If these objects were merely framed and displayed in a museum, divorced from their context, would they truly hold meaning for me?

I came to realise that what transforms an object into 'heritage' is not the object itself, but the narrative and the system of beliefs constructed around it. This realisation prompts a fundamental question: what is our own heritage? We must identify what we valued or cared about within our own culture, prior to the internalisation of this imposed Western perspective. Perhaps our true heritage lies in our traditional practices or even in our personal memories—a seashell from a memorable trip, a photograph, or a grandchild's simple drawing. These can constitute a personal heritage, valued and cared for because of the associated stories and emotions. In the example of Aphrodisias, the people who lived among those ancient marbles have built lots of personal ties, stories and memories as personal heritage. The only tangible traces of those days are the photos of Ara Güler.

Figure 1. Two examples of Ara Guler's photos (Demirci, 2022)

In short, what we officially classify as cultural heritage may often be a reflection of a transformation in our perception, shaped by education and institutional processes. The heritage that truly resonates with us on a fundamental level could be something entirely different. Organisations like UNESCO have begun to recognise this through categories like ‘intangible’ or ‘living heritage’. CHS aligns with this, advocating for a more inclusive interpretation of heritage that incorporates marginalised voices and frames heritage not as a relic of the past, but as a process orientated toward the future. From this perspective, the story of Aphrodisias and Ara Güler becomes a valuable part of Aphrodisias’ heritage; for me, his photographs now hold more significance than many of the statues they depict.

The case of the wishing tree at Göbeklitepe: a lesson in inclusive narratives

When we conceptualise heritage not as tangible objects but as the stories and beliefs they represent, it becomes apparent that heritage can hold diverse meanings for different people. In this context, we can examine the ‘wish tree’ at the Göbeklitepe archaeological site—a tree that was present even before the site’s discovery and which embodies this very principle.

In his work, Klaus Schmidt (2012), who led the excavations, devoted significant attention to this ‘Wishing Tree’ on the site. Such trees, common in Anatolian and other cultures, are often considered sacred. People tie pieces of cloth to their branches as part of a ritual of making wishes and vows. This particular tree, located on a hilltop and adorned with colourful fabrics, was especially sacred to local women wishing for children. Moreover, there are two graves thought to belong to two saints, near the Wishing Tree, that is why this area believed as a holly area by certain groups. This kind of belief brings respect and care, thus this certain group in the region has valued to this tree. So, with the term of Harrison they built an ‘unofficial heritage’ with this three at the Göbeklitepe.

Intriguingly, a stone plate (Figure 2) found around this tree is believed to depict a woman giving birth. This female figure is exceptional within the context of Göbeklitepe, where most carvings represent animals or male figures. While its exact meaning is debated, the possibility that this ancient motif is connected to a living tradition that persisted until the excavations began is profoundly exciting. It suggests a long bridge linking history to the present. This could just be a coincidence, but one cannot help but wonder, what if there’s a story behind why locals have turned this place into a sacred place for a similar purpose?

However, it is reported that this Wishing Tree has now lost its vibrant, colourful appearance. Despite signs identifying it, it no longer functions as a living ritual site. This raises a critical question: has the global promotion and musealisation of this world-famous heritage site, while providing economic benefits, inadvertently contributed to the marginalisation and loss of its living, unofficial heritage? As this example demonstrates, the living cultural elements of a place like Şanlıurfa can be vital for understanding even the deepest archaeological past. Anthropological studies and the preservation of living heritage are therefore crucial. The stories and connections revealed through such work can enrich the narrative of Göbeklitepe and foster more sustainable and interactive conservation practices with the local community.

The experience of the Sts’ailes Nation in British Columbia offers valuable lessons for Göbeklitepe. There, the integration of archaeological, ecological, and community knowledge has led to the recognition and revitalisation of ‘living sites’—forest gardens and ancestral landscapes that continue to be used, tended, and celebrated by the community (Beurteaux, 2024). This approach has fostered intergenerational transmission of knowledge, strengthened community identity, and promoted reconciliation by sharing living heritage with others.

Similarly, the management of Patan Durbar Square in Nepal demonstrates the importance of safeguarding both tangible and intangible heritage through community engagement, participatory governance, and the documentation of oral histories and rituals (Shakya Bajracharya et al., 2025).

These examples highlight the potential for balancing conservation, use, and community well-being in heritage practice. Museums and cultural centres play a crucial role in documenting and presenting living heritage. The systematic collection of oral histories, personal narratives, and community memories enriches museum collections, fosters engagement, and preserves diverse perspectives, particularly from marginalised groups.

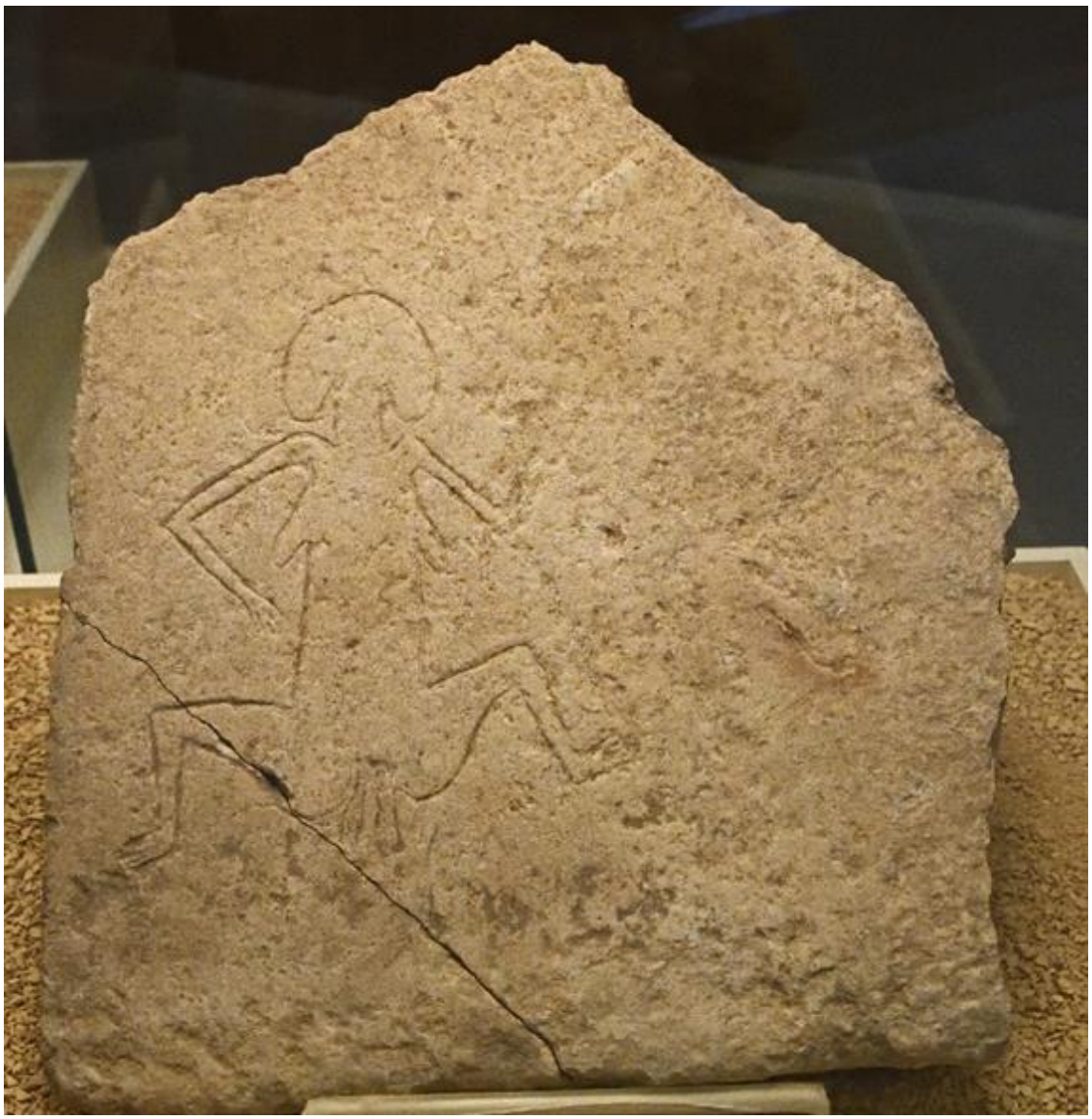

Figure 2. A stone carved with the figure of a woman giving birth in the Göbeklitepe section of the Şanlıurfa Museum (Osseman, 2019)

Conclusion: towards a more careful and inclusive heritage management

Göbeklitepe's designation as a 'zero point' of history need not signal an end to its story. This viewpoint has argued that the site's profound significance is not only found in its ancient stones but also in the living heritage of the local community, as exemplified by the Wishing Tree. The erosion of such unofficial heritage in the face of global recognition reveals a critical flaw in top-down management models. By drawing on the frameworks of Critical Heritage Studies and

lessons from global examples, we see that a more inclusive approach is not merely an ethical imperative but a scholarly necessity. It enriches historical understanding, fosters sustainable conservation, and ensures that heritage remains a dynamic, living process. The challenge ahead is to move beyond tokenistic inclusion and undertake the careful, reflexive work of weaving these marginalised stories back into the official narrative. In doing so, we do not diminish Göbeklitepe's global value; we complete it, transforming it from a monument to humanity's past into a testament to its living, diverse present.

Disclosure statement

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