PROCEEDINGS BOOK

12th International Conference on New Trends in Architecture and Interior Design 2026

12th ICNTAD CONFERENCE

INTERNATIONAL CONFERENCE ON NEW TRENDS IN ARCHITECTURE AND INTERIOR DESIGN

April 10-12, 2026

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12th ICNTAD 2026

12th International Conference on New Trends in Architecture and Interior Design 2026

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Dear Colleagues,

I am honored to invite and send you this call for papers on behalf of the Congress Organization Board of the 12th International Conference on New Trends in Architecture and Interior Design 2026 (12th ICNTAD'26), to be held in Barcelona, Spain between 10-12 April 2026.

The conference will focus on a broad range of topics related to new trends in architecture and design. The conference organizers call for papers and presentation proposals that are relevant to the conference themes. Given the conference's theme, papers with any of the following or related subjects would be appropriate for presentation:

Criticism of sustainability/unsustainability
The architecture of philosophy/architecture without philosophy
Professional settlement of interior architecture
Human contact to space with furniture
Intangible skin of space: lighting design
Tangible skin of space: material
Ideology in architecture or architecture of ideology
Spaces without space: virtual spaces
The artistic value of space
Architecture without architect
Cultural codes / architecture
Artificial intelligence: The designer's new role
Rethinking design education in the digital age

The 12th International Conference on New Trends in Architecture and Interior Design Conference 2026 (12th ICNTAD'26), aims to bring together experts from several institutions, such as universities, administrative organizations, architects, engineers and designers, within the framework of conference topics of building, architecture, interior design, product, material, etc. High-level academicians, professionals and design students from around the world will explore the intersection of design, architecture and best practices with leaders from the design profession. We also positively encourage the participation of early-career scholars and postgraduate researchers.

We eagerly anticipate your presence at our congress, scheduled for 10–12 April 2026, with the aim of achieving a successful scientific congress and leaving a lasting impression on your memory.

Regards
Prof. Dr. Burçin Cem ARABACIOĞLU
Conference Chair

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INTERNATIONAL CONFERENCE ON NEW TRENDS IN ARCHITECTURE & INTERIOR DESIGN

10 April 2026 Friday

WELCOME SPEECH (9:50 – 10:00)

CONFERENCE CHAIR: Prof. Dr. Burcin Cem ARABACIOGLU

KEYNOTE SPEECH (10:00 – 10:40)

Vicente GUALLART

TEA & COFFEE BREAK 10:40 – 11:00

SESSION A (11:00 – 12:20)

SESSION CHAIR: Assoc. Prof. Dr. Didem TUNCEL

11:00 – 11:20
PAPER TITLE : AI-SUPPORTED PARTICIPATION AND THE CHANGING ROLE OF THE ARCHITECT: INSIGHTS FROM URBAN TRANSFORMATION PRACTICES IN ISTANBUL
AUTHOR(S) : Tuğçe TERZİ - Çiğdem POLATOĞLU SERTER
11:20 – 11:40
PAPER TITLE : REFRAMING THE EXHIBITION SPACE EXPERIENCE: AN AI-BASED NEURO-ADAPTIVE PERSPECTIVE

AUTHOR(S) : Janset CANBEK - S. Banu GARİP
11:40 – 12:00
PAPER TITLE : A COHORT-SEQUENTIAL STUDY ON STUDENT PERCEPTIONS OF DESIGNING WITH GENERATIVE AI IN DESIGN STUDIOS
AUTHOR(S) : Demet ARSLAN DİNÇAY - Leman Figen GÜL - Sinem KIRKAN - Yasemin ÇORAKLI - Burak DELİKANLI
12:00 – 12:20
PAPER TITLE : THE ARCHITECTURE OF PHILOSOPHY/ARCHITECTURE WITHOUT PHILOSOPHY: KENZO TANGE'S MASTER PLAN FOR THE SACRED GARDEN IN LUMBINI BETWEEN BLISS AND NEGLECT
AUTHOR(S) : Lucija PERKO

LUNCH BREAK 12:20 – 13:40

SESSION B (13:40 – 15:20)

SESSION CHAIR: Assoc. Prof. Hande Zeynep KAYAN

13:40 – 14:00
PAPER TITLE : RETHINKING DESIGN EDUCATION IN THE DIGITAL AGE: THE ENDURING ROLE OF HANDS-ON MAKING IN ARCHITECTURAL PEDAGOGY
AUTHOR(S) : Tibor Zoltán DÁNYI
14:00 – 14:20
PAPER TITLE : CONCEPTUALIZING ECOLOGY-BASED ARCHITECTURAL DESIGN EDUCATION AS A TEACHING MODEL
AUTHOR(S) : Gamze LOKUM SÜVARİ - Neslihan DOSTOĞLU
14:20 – 14:40
PAPER TITLE : FAÇADE AND ROOF ANALYSIS FOR RENEWABLE ENEGY INTERVENTIONS IN STUDENT DORMITORIES AT EMU CAMPUS IN GAZİMAĞUSA / NORTH CYPRUS
AUTHOR(S) : Harun SEVİNÇ
14:40 – 15:00
PAPER TITLE : TRANSFORMING THE NON-PLACE: FROM TRANSIENCE TO A SENSE OF PLACE IN AIRPORTS – THE CHANGI EXAMPLE
AUTHOR(S) : Yağmur ÇIRAKOĞLU - Sinem TAPKI - Ebru KAMACI KARAHAN
15:00 – 15:20
PAPER TITLE : THE SUSTAINABILITY POTENTIAL OF VERNACULAR ARCHITECTURE: HOUSEALUATION OF THE TRADITIONAL ARCHITECTURE OF TİRİLYE WITHIN THE FRAMEWORK OF THE VERSUS PRINCIPLES
AUTHOR(S) : Zeynep ÜSTÜN - Zümeyran GÜNGÖR - Sinem TAPKI

TEA & COFFEE BREAK 15:20 – 15:40

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11 April 2026 Saturday

SESSION C (09:40 – 11:20)

SESSION CHAIR: Assoc. Prof. Dr. Feride Pınar ARABACIOĞLU

09:40 – 10:00
PAPER TITLE : ECOLOGY AND SUSTAINABILITY IN INTERIOR YACHT DESIGN: A STATE-OF-THE-ART REVIEW AND DESIGN FRAMEWORK
AUTHOR(S) : Mariateresa CAMPOLONGO

10:00 – 10:20
PAPER TITLE : DISASTER AWARENESS AND PREPAREDNESS IN ARCHITECTURAL PRACTICE: THE CASE OF SAMSUN
AUTHOR(S) : Alper BODUR - Hande ASAR - Kader ÇAMLIBEL

10:20 – 10:40
PAPER TITLE : BETWEEN CAPITAL SPACE AND PUBLIC DEMAND: A CRITICAL OUTLOOK ON THE TERMINAL KADIKÖY PROJECT
AUTHOR(S) : Tunca GÜZELOĞLU - Begüm BAYRAKTAROĞLU

10:40 – 11:00
PAPER TITLE : AWARENESS OF PUBLIC SPACES IN SCHOOL ENVIRONMENTS: THE CASE OF ATAKUM
AUTHOR(S) : Alper BODUR - Yeliz EMECEN - Hande ASAR - Tuğçe ŞANLI KATI - Sedef ŞENDOĞDU - Muammer YAMAN

11:00 – 11:20
PAPER TITLE : MATERIAL MEDIATORS: HOW EVERYDAY FURNITURE AND DOMESTIC OBJECTS SHAPE HUMAN CONTACT WITH SPACE
AUTHOR(S) : Esra Bici NASIR

TEA & COFFEE BREAK 11:20 – 11:40

SESSION D (11:40 – 13:00)

SESSION CHAIR: Asst. Prof. Dr. Begüm BAYRAKTAROĞLU

11:40 – 12:00
PAPER TITLE : SERVICE SPACE ADAPTATION FOR TRADITIONAL TIMBER-FRAME HOUSES: A MODEL FOR SUSTAINABLE CONSERVATION
AUTHOR(S) : Deniz AVCI

12:00 – 12:20
PAPER TITLE : A CONCEPTUAL OVERVIEW OF ADAPTIVE REUSE POTENTIAL OF INDUSTRIAL BUILDINGS IN URBAN DEVELOPMENT AREAS
AUTHOR(S) : Kiraz ÇİFCİBAŞI DURNA - Feride Pınar ARABACIOĞLU

12:20 – 12:40
PAPER TITLE : DETERMINING EQUIVALENT DIFFICULTY DESIGN TASKS FOR EXPERIMENTAL STUDIES IN ARCHITECTURAL DESIGN EDUCATION
AUTHOR(S) : İhsan Erdem ER - Feride Pınar ARABACIOĞLU - Hasan TASTAN

12:40 – 13:00
PAPER TITLE : INTEGRATION OF GENERATIVE ADVERSARIAL NETWORKS INTO PARTICIPATORY ARCHITECTURAL PRACTICE: A SCOPING REVIEW
AUTHOR(S) : Nur YILMAZ - Gamze ATAY

LUNCH BREAK 13:00 – 13:40

SESSION E (13:40 – 15:20)

SESSION CHAIR: Prof. Dr. Damla ALTUNCU

13:40 – 14:00
PAPER TITLE : THE TRANSFORMATION OF EVERYDAY PRACTICES INTO SPATIAL NARRATIVES THROUGH SENSORY PARAMETERS: THE MACRO MUSEUM
AUTHOR(S) : Emel BAŞARIK AYTEKİN - Hatice AŞKIN

14:00 – 14:20
PAPER TITLE : THE EFFECT OF LIGHTING DESIGN ON THE SPATIAL ATMOSPHERE AND USER EXPERIENCE IN RESTAURANTS
AUTHOR(S) : Melis AYDOĞAN - İpek FİTOZ - Zerrin Funda ÜRÜK

14:20 – 14:40
PAPER TITLE : CHILDREN AS URBAN CO-DESIGNERS: KADİFEKALE
AUTHOR(S) : Didem KAN - Yasemin ALBAYRAK KUTLAY

14:40 – 15:00
PAPER TITLE : UPCYCLING-BASED REPRODUCTION PRACTICES OF JANE PERKINS WITHIN THE FRAMEWORK OF SUSTAINABLE ART
AUTHOR(S) : Gizem SEYMEN - İrem BEKAR

15:00 – 15:20
PAPER TITLE : SUSTAINABLE INTERIOR SPATIAL CONFIGURATION IN THE CONTEXT OF LOCAL MATERIALS AND SPATIAL CONTINUITY: THE CASE OF PALANGA K HOUSE
AUTHOR(S) : Füsun SEÇER KARİPTAŞ - Fatma Ceyda GÜNEY YÜKSEL - Umur ÖZBEK - Fatih KARİPTAŞ

TEA & COFFEE BREAK 15:20 – 16:00

SESSION F (16:00 – 18:00)

SESSION CHAIR: Assoc. Prof. Dr. Gamze ERGİN

16:00 – 16:20
PAPER TITLE : DECODING URBAN UNCANNINESS THROUGH A VISUAL GROUNDED THEORY APPROACH: THE CASE OF BALAT-FENER
AUTHOR(S) : Aslı YÜCEL

16:20 – 16:40
PAPER TITLE : LUXURY BRANDING IN INTERIOR SPACES AS A STAGE FOR SYMBOLIC CONSUMPTION: THE SIMULACRUM OF LUXURY AND BRAND IDENTITY IN BRANDED RESIDENTIAL INTERIORS IN ISTANBUL.
AUTHOR(S) : Bahtiyar Posta - Burçin Cem ARABACIOĞLU

16:40 – 17:00
PAPER TITLE : THEMATIC EVOLUTION ANALYSIS OF CO-LIVING RESEARCH: A BIBLIOMETRIC STUDY
AUTHOR(S) : Nisa Nur GÖKSEL - Burçin Cem ARABACIOĞLU

17:00 – 17:20
PAPER TITLE : INTEGRATING SEISMIC SAFETY AND ENERGY EFFICIENCY IN EXISTING BUILDINGS
AUTHOR(S) : Hilal GÜNAY

17:20 – 17:40
PAPER TITLE : CONSTRUCTION OF SENSORY ATMOSPHERE: THE CONCEPT OF SILENCE IN SACRED SPACES
AUTHOR(S) : Teoman Barış GÜL - Gamze ERGİN

17:40 – 18:00
PAPER TITLE : GENERATIVE AI IN ARCHITECTURAL DESIGN: MAPPING ITS POSITION ACROSS DESIGN PHASES AND IMPLICATIONS FOR THE ARCHITECT'S ROLE
AUTHOR(S) : Laura CORMIO - Luigi VELLA - Maura MENGONI

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AI-SUPPORTED PARTICIPATION AND THE CHANGING ROLE OF THE ARCHITECT: Insights from Urban Transformation Practices in Istanbul

Tuğçe TERZİ[1], Çiğdem POLATOĞLU SERTER[2]

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Abstract
This study examines how AI-enabled participation reconfigures the architect's role in contemporary urban transformation processes. Drawing on qualitative fieldwork in Istanbul—including semi-structured interviews, observational data, and early-stage prototype testing—the research investigates how digital dashboards, NLP-based clustering tools, and automated scenario modules shape communication, decision-making, and stakeholder engagement. Rather than accelerating design outputs, the findings indicate that AI systems redistribute interpretive power and make negotiation processes more visible, fostering clearer interactions among residents, planners, and technical experts.
Concurrently, the study reveals emerging vulnerabilities in data governance, algorithmic transparency, and digital literacy disparities. In response, the paper presents an empirically grounded conceptual model that reframes the architect's role as a facilitator, platform creator, and process manager in AI-supported participatory contexts. While international cases are discussed at a conceptual level, the empirical analysis remains focused on Istanbul. By prioritizing role transformation over broader socio-political debates, the paper aligns with the ICNTAD'26 theme *"Artificial Intelligence: The Designer's New Role"* and positions AI-enabled participation as an evolution of both design practice and methodology. The study concludes that AI-supported participation can enhance trust and inclusivity only when embedded within transparent, accountable, and accessible governance frameworks.
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Keywords: artificial intelligence; participatory design; urban transformation; architect's role; digital platforms

1. Introduction

AI-enabled digital platforms are reconfiguring how urban decisions are negotiated, challenging conventional professional roles in architectural and planning practice. Traditionally, these professionals held significant control and power over information and decisions within the vertical structures of the planning process [1,2]. However, most architects and urban planners have worked in large megacities, which has made their work socially exclusionary and created asymmetries in the information available to residents [3,4]. Such situations highlight the need to develop a framework for participation that operates at the junctures of contemporary cities as socio-technical systems. The literature on the socio-technical systems of buildings, developed primarily by Habraken [5] and Sanoff [6], calls for a redistribution of agency in the design process. Following these authors, a line of thought has emerged that attempts to link participation in design processes to a form of justice drawing on participatory design [7–9]. The rapid transformation of cities, however, often results in the same issues: tokenism, inadequate inclusion of affected populations in the processes, and imbalances in the distribution of power within participation processes.

The advancement of AI technology creates new opportunities but also poses various obstacles that affect this environment. AI participation tools, including dashboards, automated scenario generators, natural language processing systems, and predictive analytics, enable users to process and analyze large volumes of user feedback data in real time [10–13]. Recent research shows that generative AI technologies enable rapid visual creation, empower group imagination, and that AI-based classification with topic modeling helps analyze public consultation themes, enabling multi-agent simulations to simulate how people would respond to different design choices [14–17]. The development of the new technology has also created challenges,

including algorithmic discrimination, unequal access to technology, and biased data systems that may obscure critical information from underrepresented populations. AI-assisted participation operates as a sociotechnical system that requires effective governance, framing, and ethics [18–20].

The architect faces an essential shift in their work due to the evolving architectural environment. The architect now performs three main roles: producer of physical form and facilitator of stakeholder communication; digital platform curator and feedback loop manager [21–23]. This change follows patterns evident in current international developments:

- Barcelona's Decidim platform integrates AI-assisted classification of citizen feedback.
- Helsinki's "AI in Planning" program combines spatial analytics with sentiment analysis.
- The Smart Participation Hub in Seoul enables residents to group their preferences for different housing types [24–26].

The current projects show that architects need to work with computers, yet they must also understand how users create content and how to connect machine-generated results to human social environments. Istanbul provides a critical context for examining these dynamics, given ongoing challenges related to unequal access to decision-making, procedural opacity, and varying levels of digital literacy. This study draws on research conducted in Bayrampaşa, Zeytinburnu, and Kartal—supported by TÜBİTAK (Scientific and Technological Research Council of Türkiye) and Yildiz Technical University—to examine how AI-based participatory tools simultaneously enhance participatory processes while revealing new barriers to inclusivity, transparency, and trust. Accordingly, the study asks:
"How do AI-assisted participatory mechanisms reshape the role of the architect within contemporary design and decision-making processes, particularly in contexts of urban transformation?" The following sections present the theoretical framework, methodological approach, and analytical findings that address this question and position the architect within emerging AI-supported participatory governance structures.

2. Theoretical Framework

The following section situates the research at the intersection of participatory design, AI-facilitated civic participation, and the evolving professional duties of architects in digitally mediated contexts, building on the contributions presented in the introduction. These areas provide the analytical basis for interpreting the study's empirical results. Collectively, they elucidate how digital tools and algorithmic frameworks transform agency, communication, and authority in contemporary design and decision-making processes.

2.1. Participatory Design and Shifts in Agency

Participatory design emerged as a critique of decision-making procedures that exclude consumers from shaping their own living spaces. Early challenges to centralized authority in architecture—particularly Habraken's critique of mass housing and Sanoff's focus on community-driven knowledge production—prompted a reevaluation of design accountability. These viewpoints framed participation not only as a procedural inclusion mechanism but also as a means of redistributing agency, responsibility, and authority within the design process.

The 1970s were a pivotal era for socially aware, human-centered design, as Victor Papanek redefined design as an ethical and political endeavor rather than solely a market-driven activity. His resource-sensitive initiatives, like radios made from recycled materials for underprivileged areas, showed how design can meet social needs within material limits and challenge who defines needs, validates knowledge, and benefits from solutions. This critique established design ethics as a discipline centered on social responsibility, equity, and user dignity, combining participatory design with civic empowerment goals [40]. Despite these objectives, the socially engaged design movements of the 1970s lacked the institutional and socio-technical frameworks needed to facilitate extensive democratic engagement. Citizen contributions became increasingly traceable and accountable in design processes only in the late twentieth century, due to the advent of digital communication technologies, participatory media, and co-design approaches [41]. Although later studies connecting participatory design with democratic theory and the right to the city highlighted the redistributive potential of participation within governance frameworks, numerous modern participatory methods remain predominantly tokenistic [7–9, 27]. In this context, Arnstein's ladder of involvement remains a vital reference, demonstrating that most urban transformation procedures are restricted to the tiers of "informing" and "consultation," with minimal advancement toward partnership or delegated authority [9,28]. The

ongoing disparity between participative goals and institutional practices highlights the necessity to reconceptualize participation beyond established protocols (Figure 1).

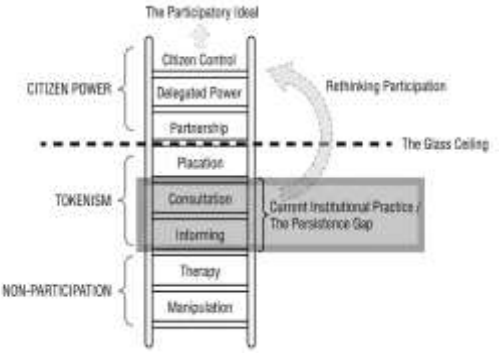

Fig. 1. A Conceptual Framework for Understanding the Persistence Gap in Participatory Practices

Historical trajectories suggest that participatory design has always striven to ethically improve everyday life through democratic participation, but it has struggled to maintain that ideal over time due to the constraints of the era's institutions and technology. Although early social design and participatory movements captured the normative foundations of participation, they lacked the socio-technical infrastructure needed for continuity, transparency, and large-scale coordination. Today's digital and AI-supported participatory mechanisms are therefore an infrastructural response to persistent problems of the past, offering the potential to organize feedback, manage complexity, and reinforce participation over time. This turn does not solve the persistent challenges of participation but repositions them within the contemporary socio-technical context, which, in the next section, will analyze the opportunities and challenges of AI-supported participatory design.

2.2. AI-Supported Participation: Opportunities and Risks

Artificial intelligence has created new systems that improve citizen feedback management by processing and interpreting information at an advanced level. Organizations use AI tools that combine natural language processing (NLP) with sentiment analysis, topic modeling, and multi-agent simulation to analyze large public feedback datasets using automated, systematic methods [10–17]. Research shows that generative AI technology supports workshops by generating user input combinations and developing fresh concepts and rapid visualizations, enabling all users to participate equally in co-design activities [14, 29]. The current opportunities bring risks that require people to develop management strategies. Research indicates that AI systems will intensify current social inequalities because they contain built-in discrimination in their algorithms, operate with limited data, and serve populations that lack digital connectivity [18–20, 30]. The digital divide creates problems stemming from income, age, educational level, device availability, and language skills, resulting in datasets that do not represent vulnerable populations [31]. AI systems function as black boxes, preventing users from understanding how their feedback data is classified and prioritized [32]. The identified risks establish AI-supported participation as a technology that requires transparent operations and ethical oversight, and as hybrid systems that unite digital platforms with physical interaction methods.

2.3. Computational Methods in Participatory Analysis

Today's research focuses on integrating computer systems with team collaboration tools. Recent studies indicate that systems can be automated to cluster large volumes of text-based feedback by combining NLP and Topic Modeling [12,15]. Within co-design workshops, Computer Vision can classify sketches, diagrams, and models created by participants [11]. Spatial AI integrates GIS with Machine Learning and is used to detect patterns of human behavior, including movement, points of access, and various zones within a residential area [10]. Social planners use Multi-Agent Systems to predict social behavior, including simulating agent-based behavior across a variety of planning scenarios [17]. These technical models provide planners and architects with sophisticated analyses and the ability to transform participation into an ongoing,

data-driven process. These models work best with reliable, high-quality datasets. However, the applicability of these models depends on the stability and quality of the underlying datasets, as well as on professionals' ability to interpret outputs critically and contextually [33].

2.4. Global Practices and the Changing Role of the Architect

Cities worldwide are adopting digital systems to transform how people work in their communities. The Decidim uses AI to classify feedback by theme [24], Helsinki uses AI in planning to merge sentiment with spatial analysis [25], and Seoul applies machine learning for housing requirements [26]. Architects must oversee platform design and data interpretation, linking algorithms to systems. The transition requires learning computational logic, creating spaces for diverse stakeholders to interact, and managing information systems [21–23, 34]. They now handle spatial design, digital support, and data management, combining human judgment with AI. Oxman describes digital design as an "entangled practice" enabling human and non-human agents to create outcomes together [19].

2.5. Positioning the Study Within the Literature

Through three main findings, the research contributes to the theoretical discussion in new ways. First, the research goes beyond the normative participation theory by examining how AI tools affect participation in real-world urban development projects. Second, the framework positions the architect's professional metamorphosis as a positive change, accompanied by additional responsibilities in project facilitation, digital system development, and mediation. Third, the research integrates global industry standards with empirical field studies to delineate the business and technological potentials and constraints arising from varying levels of digital skills, missing data representations, and opaque algorithms. The research established Istanbul as a global discussion platform and developed an empirical framework to study AI-based participatory design through its social and technological systems, rather than viewing it as a standard technological advancement.

3. Methodology

This study adopts a mixed-methods qualitative design supported by fieldwork, thematic coding, and AI-assisted prototype testing. The methodological approach prioritizes triangulation—combining interviews, observations, and digital interaction data—to assess how AI-supported participation mechanisms influence stakeholder engagement and reshape the architect's role [35]. Fieldwork was conducted between 2023 and 2025 in Bayrampaşa, Zeytinburnu, and Kartal in Istanbul. Data collection included: 42 semi-structured interviews, observations of public meetings and on-site coordination, user interaction logs from digital participation prototypes, and written and verbal feedback from residents and local actors. All interviews were transcribed verbatim and anonymized in accordance with ethical guidelines for qualitative urban research [36]. Interview transcripts, field notes, and platform feedback were analyzed through a three-stage coding procedure:

- Open Coding: Initial meaning units were identified (e.g., "lack of transparency, digital barriers").
- Axial Coding: Codes were grouped into relational categories such as governance opacity, digital divide patterns, and user perceptions of uncertainty.
- Selective Coding: Three overarching themes emerged (e.g., "participation gaps").

The general structure of the code tree is shown in Figure 2 which illustrates how thematic clusters are formed:

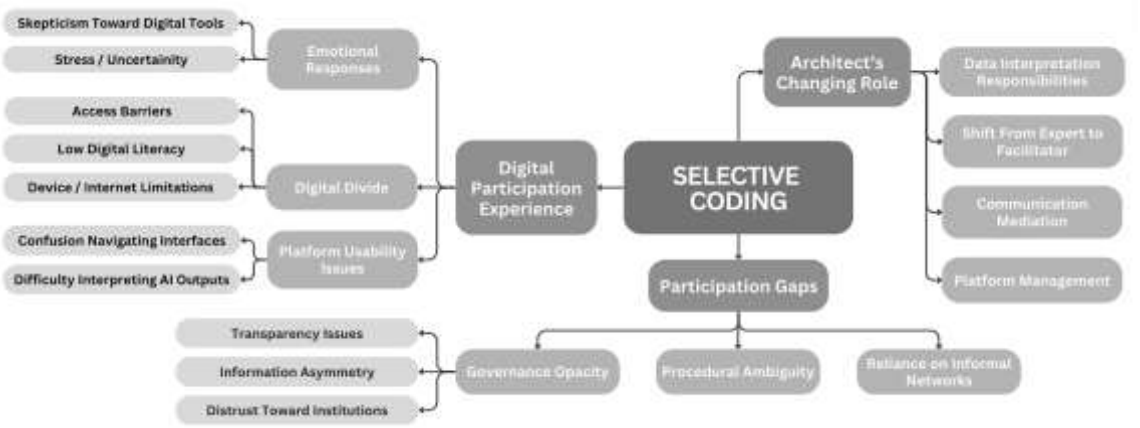

Fig. 2. Code Tree

The study included three prototype interaction tools:

- Interactive dashboards visualizing project phases
- Online participation panels supporting comment submission and option comparison
- AI-assisted modules (summarization, clustering, sentiment analysis)

Eighteen participants tested the prototypes. User feedback informed understanding of digital literacy barriers, trust and distrust dynamics, and the clarity of AI-mediated outputs. Differences across the three field sites were evaluated in terms of digital access, household composition, trust in institutions, displacement history, and prior participation experience. This comparative logic aligns with contemporary methodological approaches in urban-sociotechnical research [38]. The overall analytical flow is summarized in Figure 3, which provides a step-by-step representation of the analysis's inductive logic:

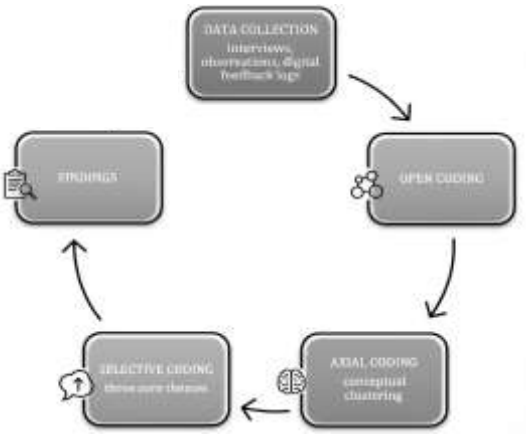

Fig. 3. Qualitative Analysis Flowchart

While the empirical analysis is based solely on fieldwork in Istanbul, it also draws on international cases as conceptual reference points. These references do not serve as empirical comparisons, and no primary data were collected outside Istanbul; rather, they are used to situate the findings within broader global discussions of the nexus between digital participation, algorithmic governance, and socio-technical inequality. This preserves methodological limits and respects that the analytical scope remains methodologically contained. However, it allows the discussion to include internationally relevant patterns.

3.1. Ethical and Governance Considerations

The implementation of participatory design frameworks throughout the study cycle facilitated the systematic reduction of significant ethical and governance problems associated with AI-assisted participation, such as data privacy, algorithmic bias, opacity, and the digital divide.

- *Data security and privacy:* All digital comments, interaction logs, and interview transcripts were anonymized before analysis in accordance with institutional ethical protocols. Personal identifiers were removed, and datasets were moved to the university's secure, access-restricted storage. AI systems were completely segregated from identifiable personal data during all phases of the research process.
- *Algorithmic bias mitigation:* AI-generated clusters and summaries were developed using a human-in-the-loop approach and corroborated with qualitative interview data. This monitoring served as an interpretive corrective mechanism, designed to avert the excessive amplification of dominant narratives and the marginalization of weaker voices.
- *Transparency and access limitations:* The prototyping phase uncovered ongoing issues related to system opacity, user trust, and autonomous adaptation. These issues highlighted the digital gap as a structural limitation, notably impacting older persons and socio-economically disadvantaged populations. Consequently, AI-based technologies were not designated as replacements for participatory approaches, but rather as supplementary elements within hybrid planning processes.

4. Findings

4.1. Participation Gaps in Urban Transformation

Structural participation barriers emerged consistently across all field sites, particularly regarding transparency, decision timing, and emotional displacement pressures. These patterns mirror global critiques of procedural inequality [1–4, 27, 28]. Table 1 presents participant-derived codes and quotations illustrating three dominant patterns: loss of belonging, lack of transparency, and demand for digital access.

Table 1. Thematic Analysis of Participation Gaps in Urban Transformation

Theme	Sub-Codes	Representative Quotations
Loss of Belonging	Alienation, weak attachment	*"They only told us the moving date; no one asked us about the design of the new apartments."* (Homeowner, Bayrampaşa) *"The flats are physically better, but since they were not designed with us, they feel alien."* (Tenant, Bayrampaşa)
Lack of Transparency	Decisions pre-made, limited documentation	*"Meetings are held, but decisions are already made before we enter the room."* (Tenant, Zeytinburnu) *"There is no transparency; even the official project files are not shared with us."* (Shopkeeper, Kartal)
Demand for Digital Access	Need for mobile platforms, dissatisfaction with outdated tools	*"If there were a mobile app, we could easily share our ideas and complaints."* (Student, Küçükçekmece) *"They are still using paper notice boards to communicate in the 21st century—it is totally insufficient."* (Young resident, Küçükçekmece)

4.2. Digital and AI-Supported Participation Experience

Digital prototype testing revealed both opportunities and barriers. Participants appreciated visualization, scenario comparison, and structured access to information—findings consistent with Barcelona Decidim + AI and Helsinki's AI Planning Program [24–26]. These findings are supported by Tables 2a and 2b. The empirical data presented in the tables were collected from three ongoing urban transformation contexts in Istanbul (İsmetpaşa Neighborhood Urban Transformation Project in Bayrampaşa, the Sümer Neighborhood Housing Renewal Area in Zeytinburnu, and the Orhantepe Urban Regeneration Area in Kartal). These sites were selected to reflect different institutional arrangements and spatial conditions, especially housing transformation practices.

Table 2a. Thematic Analysis of Dashboard and Prototype Testing

Theme	Sub-Codes	Representative Quotations

Transparency	Visualizing stages increases clarity	*"For the first time, I could see the project stages clearly on the dashboard." (Homeowner, Bayrampaşa)* *"The visualization made technical reports understandable." (Tenant, Zeytinburnu)*
Accessibility	Mobile access is strong; elderly need alternatives	*"I could open it on my phone without any problem; this makes participation easier." (Student, Küçükçekmece)* *"Elderly residents still need physical alternatives." (Community leader, Kartal)*
Usability of AI Tools	Scenario comparison most useful feature	*"The AI-generated scenarios helped me imagine different housing options quickly." (Tenant, Bayrampaşa)* *"It was very useful to compare alternatives side by side." (Homeowner, Zeytinburnu)*

Table 2b. Quantitative Observations from Prototype Testing

Theme	Sub-Codes
Number of participants	42 (21 homeowners, 12 tenants, 6 students, 3 NGO representatives)
Study locations	Bayrampaşa İsmetpaşa Neighborhood Urban Transformation Project; Zeytinburnu Sümer Neighborhood Renewal Area; Kartal Orhantepe Urban Regeneration Area (Istanbul)
Most frequently used feature	AI-generated scenario comparisons (used by 78% of participants)
Highest rated feature	Dashboard visualizations of project phases (average 4.5/5 rating)
Least used feature	Open comment sections (only 35% actively contributed written feedback)

4.3. Transformation of the Architect's Role

The most distinctive outcome of this study is the documented shift in the architect's role—from a project-based expert to a mediator within sociotechnical systems. This aligns conceptually with Kolarevic [21], Oxman [19], and Schön [34]. The findings indicate three simultaneous role transformations (Table 3):

- **A facilitator**, guiding interactions between stakeholders,
- **A platform creator**, responsible for designing digital participation environments,
- **A process manager**, integrating feedback loops into project cycles.

Table 3. Thematic Analysis of the Transformation of the Designer's Role

Theme	Sub-Codes	Representative Quotations
1. Facilitator	1.1. Mediating between actors 1.2. Guiding discussions	*"Instead of deciding for us, the architect helped organize our inputs into the dashboard." (Homeowner, Bayrampaşa)* *"She guided the meeting so that both tenants and owners could express their opinions equally." (Tenant, Zeytinburnu)*
2. Platform Creator	2.1. Designs digital participation tools 2.2. Curates and structures user input	*"The prototype felt like a new space designed for communication, not just a building plan." (Student, Küçükçekmece)* *"Feedback categories showed that our voices were systematically considered." (NGO member, Kartal)*
3. Process Manager	3.1. Ensures continuity of participation 3.2. Integrates feedback into design cycles	*"We could track how our comments influenced the updated scenarios." (Homeowner, Bayrampaşa)* *"The architect was not only drawing plans but managing the entire cycle of participation." (Community representative, Zeytinburnu)*

This transformation aligns with global debates in architectural theory that call for rethinking design education and professional responsibilities in the digital age. The Istanbul case illustrates how AI-supported participation can serve not only as a practical mechanism for engagement but also as a theoretical lens for redefining the designer's identity in urban transformation projects.

5. Discussion

The role of AI-supported participatory design in shaping architectural practice remains ambiguous. However, it alters design processes, agency, interpretive control, and communicative power cycles among urban change stakeholders without automating these processes. In participatory processes, architects are

distrusted, especially when they mediate technical restrictions, guide stakeholder discussions, and coordinate decision-making phases, as in the Istanbul case study. The findings support top-down participation critiques [6,9] and demonstrate that AI participatory tools limit the documentation, monitoring, and evaluation of diverse forms of participation. Participants, especially architects, view digital dashboards as more than tools. In these technologies, architects construct and participate in social and technological participatory frameworks, where data is not just the result of technical processes but of collaborative ones. Frameworks that integrate human and algorithmic decision-making institutional processes go beyond participatory mechanisms and social and technical frameworks. Thus, the architect becomes a mediator and organizer of interaction frameworks, aligning data flows, stakeholder inputs, and computational processes to meet design goals. This validation of Kolarevic, Oxman, and Carpo's frameworks includes empirical evidence from fieldwork and prototypes. The researchers highlighted issues with AI-supported participatory systems. Most participants complained about the algorithms' ambiguity, their influence on input, and accountability concerns. They also noted disparities in digital access and literacy, which could reinforce social inequalities if used without considering accessibility, transparency, and hybrid modes of participation. These fragments of evidence pertain to digital governance. If AI systems are used, transparency, ethics, inclusion, and systemic issues must take priority over complexity. Evidence shows that architects' roles are shifting toward AI-supported participatory systems. Figure 4 illustrates these role-based functions:

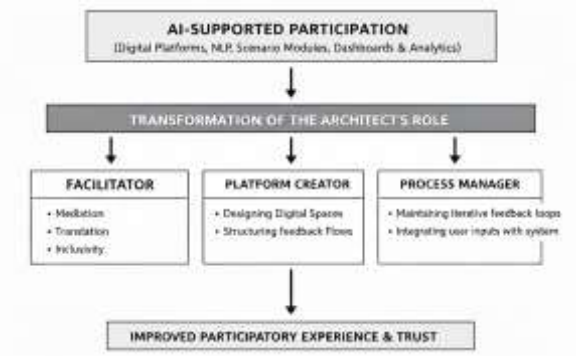

Fig. 4. Descriptive Chart: AI-Supported Participation & Designer Role Shift

The facilitator, who clarifies understanding and communication; the platform maker, who structures and designs digital spaces for interaction and data exchange; and the process manager, who maintains and oversees cycles of participation. Rather than constituting an abstract theoretical proposition, this framework is derived directly from observed practices, stakeholder interactions, and concerns documented during fieldwork and prototype iterations.

Figure 5 extends this empirically based role framework by integrating results into a conceptual–analytical framework. It positions AI-enabled participation within institutional boundaries, not as a linear journey toward citizen power. The framework conceptualizes AI as a horizontal infrastructure spanning varying degrees of participation, while noting that the potential to move beyond tokenism depends on governance, accountability, and professional mediation. By placing the architect at the intersection of time, place, and digital layers, Figure 5 reconceptualizes professional architecture as an infrastructural, relational practice, grounded in socio-technical complexity:

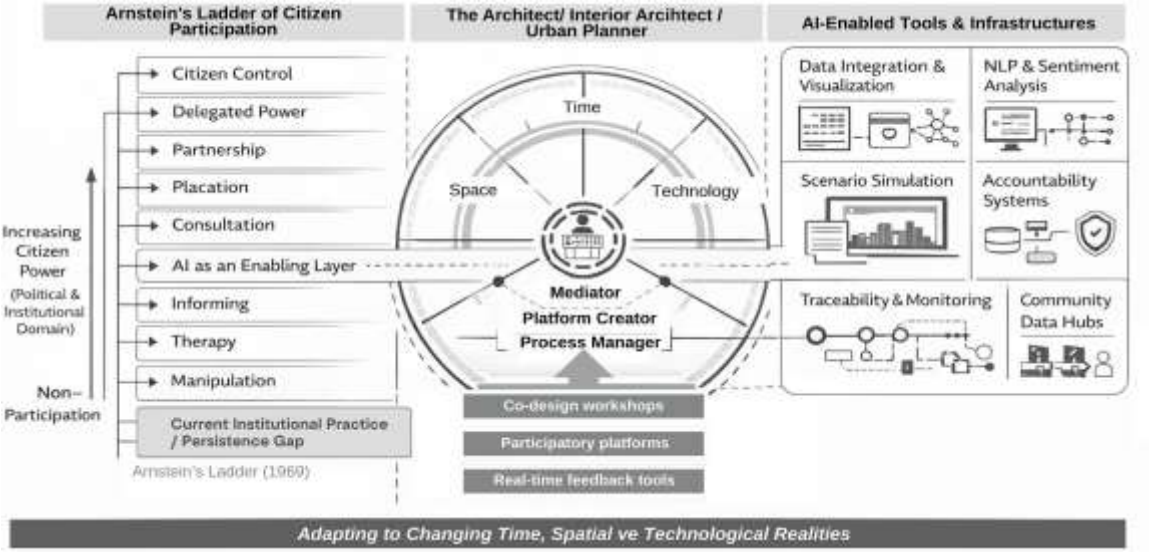

Fig. 5. Conceptual–analytical model of AI-enabled participation and the evolving role of the architect

6. Conclusion

This paper demonstrates that AI-enabled participation transforms architectural practice not by automating design decisions but by reallocating decision-making authority and interpretive responsibility across stakeholders, digital systems, and institutional actors. Empirical evidence from the Istanbul example shows that AI-driven methodologies—such as dashboards, NLP-assisted clustering, and scenario comparison modules—serve as socio-technical frameworks that enable stakeholders to negotiate planning decisions with enhanced transparency and traceability. These interactions support the emerging consensus that architectural proficiency is shifting from form generation to the orchestration of communicative, analytical, and iterative processes.

The study's principal contribution is articulating a triple framework that conceptualizes the architect as a facilitator, platform creator, and process manager. This paradigm is grounded in empirical research rather than abstract theory. However, its implications extend beyond the specific case environment. Figure 4 illustrates how architects navigate hybrid interactions between human judgment and algorithmic systems in AI-supported participatory environments. Expanding on this empirically established role configuration, Figure 5 presents these findings in a conceptual-analytical model that situates AI-enabled participation within broader institutional and governance contexts.

The results indicate that the impact of AI-enabled engagement is not solely determined by technological competence. Participation depends on institutional accountability, ethical data governance, and accessible digital infrastructure. Participants' concerns about algorithmic transparency, the long-term viability of participatory platforms, and the concrete influence of digital contributions on decision-making processes underscore ongoing weaknesses in AI-supported systems. These considerations highlight the need for governance frameworks that integrate institutional commitment, clarify data ownership, and facilitate hybrid involvement that combines quantitative data analysis with interpretive and deliberative methodologies.

This study offers a transportable framework for examining how participation is structured, constrained, and reconfigured within digitally augmented urban governance, rather than a universal or prescriptive paradigm. Subsequent research could enhance this approach by conducting comparative studies across other governance contexts—such as Europe, North America, and the Global South—to investigate differences in trust-building, digital literacy, and participatory behavior. Furthermore, longitudinal studies are required to evaluate whether AI-enhanced participatory systems can sustain engagement and institutional continuity beyond initial pilot phases, thus establishing AI-supported participation as a sustainable and equitable element of modern design governance.

7. Limitations and Future Research

Several methodological considerations must be taken into account when interpreting the data. User feedback from the dashboard prototype, especially regarding streamlined functionalities and the scenario comparison module, serves as the primary empirical input for evaluating the initial operational capabilities of AI-assisted participatory tools. This prototype phase, however limited in time and location, offers an initial empirical foundation for analyzing how these tools interact with participatory design processes. Secondly, although the number of evaluated instances is limited, qualitative data gathered from interviews and prototype encounters reveal a variety of viewpoints and highlight fundamental theme patterns that closely align with the research topics. However, the study's contextual specificity limits broader generalization. Future research should prioritize the inclusion of "digitally invisible" subgroups—such as elderly residents and socio-economically disadvantaged populations—to reduce the likelihood that AI-enabled participation will perpetuate existing social and spatial inequities. Third, while changes in trust, digital engagement, and receptiveness to AI-supported systems were observed, the study's cross-sectional design limits the ability to evaluate their temporal evolution. Thus, longitudinal and comparative research methods are essential not only to validate the existence of digital trust but also to investigate the institutional, social, and technological factors that facilitate its creation and maintenance.

Ultimately, although the conceptual framework draws on international discussions and case-specific literature, the empirical results are grounded in the Istanbul context. This contextual grounding underscores the need for comparative studies that examine how facilitator, platform creator, and process manager roles operate across governance environments with varying degrees of institutional transparency, regulatory capacity, and civic infrastructure. Recent advances in explainable AI and multimodal participatory interfaces offer promising opportunities to mitigate algorithmic opacity. Future research should investigate how AI-supported participation can be integrated into governance frameworks that promote accountability, inclusivity, and institutional learning, thereby reinforcing its role as a sustainable and contextually relevant element of modern design governance.

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REFRAMING THE EXHIBITION SPACE EXPERIENCE: AN AI-BASED NEURO-ADAPTIVE PERSPECTİVE

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Abstract
Traditional exhibition spaces, within the framework of the ideology defined in the literature as the 'White Cube,' construct the space as an isolated backdrop, the artwork as an untouchable object, and the viewer as a passive observer. This static hierarchy restricts the dialogue between the space and the user. By altering this hierarchy, this study aims to redefine the exhibition space as a 'sentient organism' that establishes a dialogue with its user. Although studies on 'Experience Design' and 'Interactive Spaces' have successfully moved the viewer beyond a passive position, these spaces still generally rely on pre-defined scripts. This study, aiming to transcend the current concept of the 'experience space,' proposes a 'Neuro-adaptive' and 'Sentient' spatial typology in which the space responds in real-time to the emotional state defined through user behaviors. Here, experience is not a consumed process, but a generative dialogue produced instantaneously between the user and the space. Within the scope of this study, a conceptual 'neuro-adaptive exhibition unit' based on the theory of Enactive Cognition is proposed within the context of a high-circulation transition space (Istanbul Metro). Unlike traditional practices, this proposed system does not contain a physical artwork. The viewer, shedding the role of observer, becomes the subject of the dematerialized artwork. The conceptual spatial typology proposed in this paper investigates how the intimate exhibition experience is transposed into a public dimension through the 'spatial porosity' afforded by configured semi-transparent surfaces. Accordingly, the study re-evaluates the hierarchy between the viewer, the space, and the exhibition object on structural and perceptual planes. It is anticipated that the work could offer a potential restorative effect within the busy flow of urban life. In subsequent phases, the aim is to prototype this conceptual model within a Virtual Reality (VR) environment. This paper contributes to architectural discourse by proposing a speculative neuro-adaptive exhibition typology that reframes exhibition space as a sentient, generative system rather than a static container.
© 2026 Selection and/or peer-review under responsibility of the scientific committee
Key Words: Exhibition Design; Sentient Space; Neuro-adaptive Architecture; AI-driven Space; Spatial Porosity

1. Introduction

In his work Inside the White Cube, Brian O'Doherty [1] deconstructs the modern gallery space, thereby problematizing its ideological background. With its sterile atmosphere, the gallery space has become a barrier that hinders contact between the artwork and the visitor by confining both within invisible boundaries. The visitor is reduced from a 'viewer' to a mere 'eye,' pushed into the position of a passive 'ghost' unable to touch the artwork or exist on the same level with it. Conversely, the artwork is trapped in a timeless utopia within the isolated space. It becomes an 'untouchable sacred' object observed from a distance.

As O'Doherty [1] points out, artists have developed various counter-practices such as installation, happening, and land art to challenge the 'White Cube' ideology. By destabilizing the hierarchy imposed by the gallery space, these practices have removed the viewer from a passive position and proposed new interaction scenarios that render them a part of the artwork. Subsequently, approaches emerged that positioned the space as a more active actor, transforming it into an element that is 'experienced' itself. Thus, the concept of 'Experience Design' entered the literature, leading to discussions on interactive spaces that establish a dialogue with the visitor.

In today's world, as digital practices become part of the process, interactive experience design is increasingly influenced by the digitized world. New art practices and experiential spaces have emerged that interact with visitors in the digital realm. As Bollini and Borsotti [2] state, these exhibition spaces have elevated the visitor from a passive observer to the status of a near 'co-author.' Consequently, the gallery is transforming into a 'hybrid' narrative ecosystem where the physical and digital intertwine. Through their analysis of the relationships between visitor, space, and object, Bollini and Borsotti [2] emphasize that in these 'phygital' experiences, the exhibition space is no longer just about displaying objects.

In this context, the conceptual approach presented within the scope of this paper aims to facilitate a real-time, organic dialogue between the space and the visitor. Here, the installation emerges precisely from this dialogue. By transposing these theoretical discussions onto a 'neuro-adaptive' plane, this study investigates a new spatial typology applicable to the spaces of the Istanbul Metro.

2. Neuro-adaptive Architecture: A Reading of Space-Body Dialogue through Enactive Cognition

This neuro-adaptive transformation exists not as a mere data visualization, but as a process of atmosphere creation. It utilizes the power of the atmosphere generated by the space. As emphasized by Peter Zumthor [3] in his concept of 'Atmospheres,' this process creates a 'Sensorial' environment that envelops the body and creates an emotional resonance. In this context, the proposal offers a multisensory experience grounded in Juhani Pallasmaa's [4] critique of the 'hegemony of the eye' in modern architecture.

The space generates an atmospheric and multisensory response, the parameters of which are determined by artificial intelligence based on emotional state predictions derived from the visitor's behavioral and psychophysiological data. Thus, while technology becomes an invisible instrument that amplifies the atmospheric intensity of the space, the experience transforms into a holistic encounter perceived through the body. Furthermore, a unique dialogue is established with each visitor, and the space continues to learn through every different individual who experienced this space.

This atmospheric language, developed by the space acting as a sentient organism, is grounded in a neuro-scientific foundation within architectural theory. John P. Eberhard [5], known for his work at the intersection of neuroscience and architecture, emphasizes that the built environment and human biology are phenomena that continuously influence one another. The theories of Foglia and Wilson [6] on 'Embodied Cognition' and Varela, Thompson, and Rosch's [7] The Embodied Mind: Cognitive Science and Human Experience extend this relationship to the mental plane. According to this view, the mind is not independent of the body; rather, it is an active process that makes sense of the world through dynamic actions established with the body and the environment.

Thanks to this strong correlation between the built environment and consciousness, a shared language bridged by atmosphere is established between the exhibition space and the visitor. As the visitor's emotion changes, the space changes; as the space changes, the visitor's emotion transforms; and a synchronized dialogue initiates between human and space.

3. Dissolving the Exhibition Hierarchy through Spatial Porosity

Spatial porosity is addressed not merely as a physical opening or an 'open door,' but as a capacity for mutual exchange between public and private spaces. Porosity is defined as a dynamic 'interface' that performs, rather than a static transition. This concept aligns with the discussion on the blurring of boundaries found in Toyo Ito's [8] discourse on 'Blurring Architecture.'

In the proposed conceptual design, an attempt has been made to create this state of porosity, with the aim of extending the individual's exhibition experience to a public scale. By facilitating a spillover into the public realm and shifting the actor-visitor from an individual to a collective state, such permeability disrupts the 'Exhibition Space - Object - Viewer' hierarchy imposed by the traditional gallery space. Ultimately, it creates a hybrid realm of existence where actors integrate on a horizontal plane. As illustrated in Fig 1, the atmosphere within a visually permeable space is visually visible to individuals outside the space.

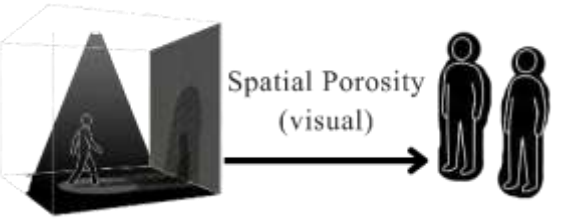

Fig. 1. Graphic visualization of the concept Spatial Porosity (Visual effect)

4. Methodology

This study proposes an exhibition space typology based on the 'Sentient Space' metaphor, located at the Istanbul Ayazağa metro station. This research has been conducted using the Research through Design (RtD) approach; where the design process is conceived not merely as a final product, but as a research tool that tests theoretical discourse. This study does not claim to present a fully operational software system; instead, it proposes a conceptual system architecture that synthesizes architectural design with neuro-scientific data, grounded in existing 'Human-in-the-Loop' and reinforcement learning literature. The proposed neuro-adaptive exhibition space is a speculative conceptual project that questions the boundaries of current interactive exhibition practices.

4.1 Interaction Framework

The proposed exhibition unit operates through a multi-layered and cyclical system architecture. This architecture aims to establish a cybernetic interaction grounded in continuous feedback among the user, sensors, artificial intelligence, and spatial atmosphere components, see Fig 2.

Sensing**:** The data collection process is structured around "non-contact sensing" technologies that do not require the user to wear any devices. The technical feasibility of this configuration relies on the study "The Analysis of Body Emotion Recognition in New Media Art Exhibition Space" conducted by Weinan Liu and Hyung-Gi Kim [9]. This referenced study demonstrates that depth cameras and skeleton tracking technologies can infer emotional states with high accuracy based on visitors' posture and movement dynamics.

Processing & Learning**:** In the proposed project framework, Artificial Intelligence is positioned as a mediator bridging human and space, rather than as an autonomous decision-maker. The transformation of the system into a structure that 'learns' over time, rather than providing a static response, is configured through the 'Human-in-the-Loop Reinforcement Learning' technology described in the literature, see Fig 2. This learning cycle operates through the following stages:

- Rule- Based Start: Initially, the system generates responses based on fundamental relationships derived from the literature.
- Observation and Recording: When the space responds, sensors monitor the visitor's emotional change and record the outcome of the action in the database.
- Evolutionary Adaptation: With each visitor, this cause-and-effect list expands. Over time, the system evolves into an adaptive structure by learning which atmospheric combination yields a more effective response to a specific emotional state.

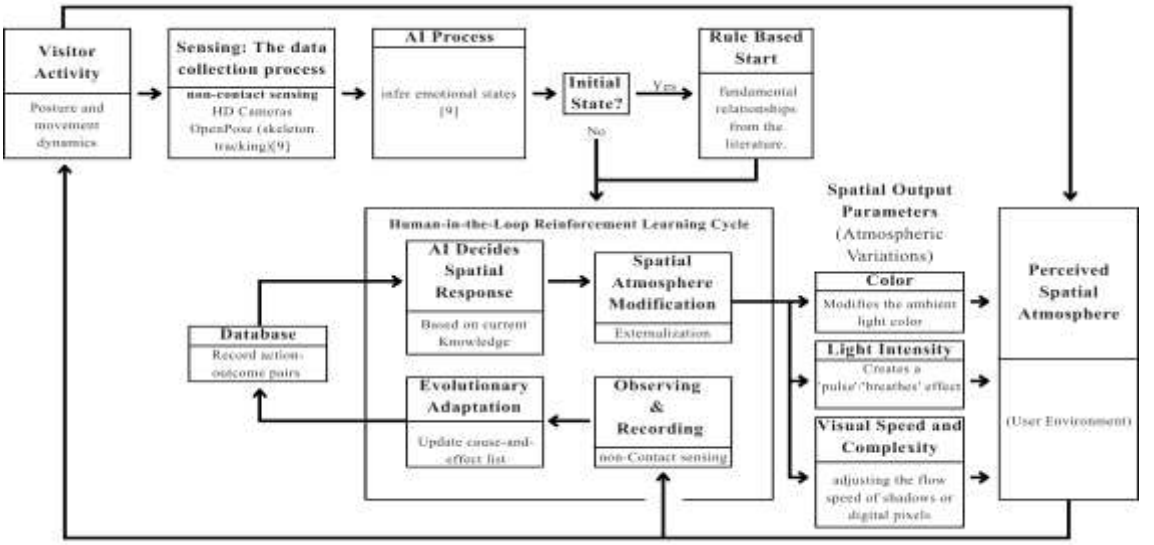

Fig. 2. Technical flowchart of the Human-in-the-Loop Reinforcement Learning cycle, illustrating the transition from rule-based initial states to evolutionary spatial adaptation.

4.2 Spatial Output and Atmospheric Parameters

The system's capacity to generate spatial output and its physical responsiveness are supported by current technological developments in the field of neuro-adaptive architecture [10]. Case studies in the literature demonstrate that human emotional states can be predicted via behavior and converted into physical responses. For example, Philip Beesley's [11] 'Sentient Chamber' project translates neural activity into light and sound modulation using biometric data. Similarly, 'empathy engine' skyscraper prototypes in New York are able to dynamically modify lighting and music in common areas by mapping the crowd's emotions through biosensors and machine learning [10]. These examples demonstrate that the technical infrastructure exists for the real-time translation of biometric data into spatial parameters.

In the proposed design, the final output of artificial intelligence is the transformation of behavioral data into a physical atmosphere, see Fig 3. This process is grounded in the reflection of the user's internal emotional state onto the space through the principle of 'Externalization.' Artificial Intelligence generates spatial variations by manipulating the following three fundamental parameters:

- Color: Modifies the ambient light color according to the nature of the emotional state.
- Light Intensity: Creates a 'pulse' effect where the space 'breathes' in unison with the user by modulating the brightness of the light.
- Visual Speed and Complexity: Materializes emotional intensity by adjusting the flow speed of the interplay of shadows or digital pixels on the surfaces.

Fig. 3. Visualization of different atmospheric parameters

4.3 Externalization

The proposed system is configured as an interface that transforms internal data into a spatial experience. Drawing on Maiese's [12] theory of 'affective scaffolding,' the transfer of internal affects to an external environment (in this study, the exhibition space) shifts the domain of emotional processing from the mind to the physical environment. This externalization creates a distance between the subject and their emotion, enabling the individual to witness their own affective state as an external observer. This process allows the individual not merely to 'feel' their emotions, but to gain a new awareness of them by viewing (witnessing) them as an observer.

This process unfolds through the following stages:

- Spatialization of Emotion: The system analyzes the visitor's instantaneous psychophysiological data (via sensors). These data find a tangible counterpart in the physical atmosphere of the space.
- Externalization: The visitor encounters their own emotional state as an observable 'object' through the atmosphere of the space. This situation enables the visitor to witness their own emotional state as an external observer.

- Cyclical Interaction: The space renders the current state visible. The sensory contact established by the visitor with the spatial counterpart of their own emotion inevitably creates new changes in their psychophysiological data. The system instantaneously perceives these changes and continues to reflect them onto the atmosphere. Thus, the exhibition transforms into a dynamic process where the visitor and the space continuously reproduce one another, see Fig 4.

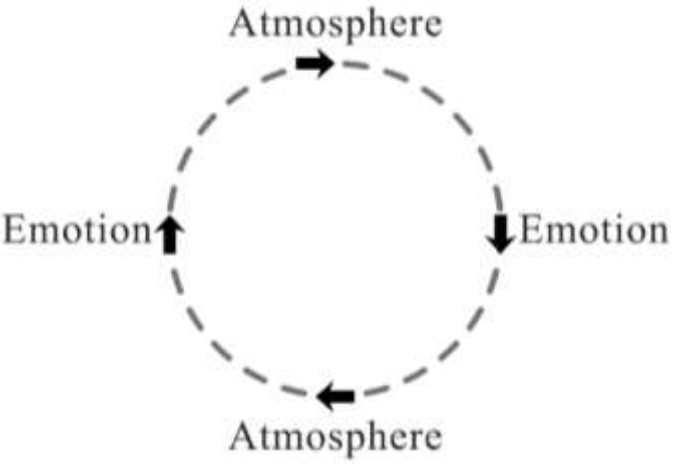

Fig. 4. Graphic visualization of the Cyclical Interaction.

The emotion recognition model utilized in the proposed system is based on the artificial intelligence technology developed by Liu and Kim [9], which focuses on non-contact emotion analysis through limb movements. Rooted in the six fundamental emotions widely discussed in psychological literature (happiness, sadness, anger, fear, surprise, and disgust), Liu and Kim [9] identify posture, movement fluency, and speed as the primary indicators of emotional states. Their study emphasizes that in environments such as exhibition spaces, full-body movements serve as more intuitive and comprehensive emotional carriers than facial expressions. The AI model in question was optimized during its training phase through cross-validation with contact-based sensors, such as EEG, evolving into a prediction mechanism with a high degree of accuracy.

The initial mapping presented in Table 1 was synthesized by integrating the movement analyses of Liu and Kim [9] with Coulson's [13] research on "Attributing Emotion to Static Body Postures." The atmospheric outputs within this mapping such as color, light, and visual complexity were constructed by referencing the neuro-adaptive architectural parameters established by researchers such as Makanadar [10] and Beesley [11].

In the proposed system, the "Initial State" of the AI is built upon these theoretical parameters. However, the system is not confined to a static dataset; it engages in a continuous learning process within a "Human-in-the-Loop" (HITL) reinforcement cycle. By recording the action-outcome pairs derived from each user interaction into its database, the AI dynamically updates and optimizes the existing mapping. This continuous calibration process enables the system to offer an increasingly personalized experience for every user. As the database matures over time, the space transcends being a stable experience area and evolves into a deepened, multi-layered structure with every new encounter.

The atmospheric output mapping presented in Table 1 was synthesized by integrating several foundational studies in the fields of psychology and neuro-adaptive design:

- Ambient Light Color: The emotional correspondences of colors were established based on Plutchik's [14] "Wheel of Emotions" model, which defines a widely accepted correlation between eight primary emotions and specific color spectrums.
- Light Intensity and Dynamics: The brightness levels and rhythmic variations, such as the "breathing effect," were derived from the neuro-adaptive principles found in the works of Makanadar [10] and Beesley's [11] "Sentient Chamber." These parameters are synchronized with visual data flow to regulate and support the user's arousal levels.
- Visual Speed and Complexity: The flow velocity within the separators, shadow density, and overall visual complexity were determined by referencing the "Emo-land" study by Rohani and Akçay Kavakoğlu [15],

which explores human-centric spatial adaptations driven by emotional data

Table 1. Mapping of emotional states to behavioral inputs and atmospheric spatial outputs.

Emotional State	Psychophysiological / Behavioral Input	Atmospheric Output: Ambient Light Color	Atmospheric Output: Light Intensity	Atmospheric Output: Visual Speed and Complexity
Happiness	Relaxed and smooth movement; head tilted back, chest stable, arms raised above shoulder level with straight elbows.	Yellow	High Brightness: Constant high-lumen output to support positive arousal.	Dense and fast-moving visuals; complex silhouettes.
Anxiety	Tense and short, restricted movements.	Blue-green transitions	Irregular Flickering: Fast, non-rhythmic brightness changes to reflect restlessness.	Distorted visuals; fast but stuttering movement; sudden speed transitions.
Anger	Sudden timing; backwards head bend, no abdominal twist, arms raised upward/forward; variable weight transfer.	Red	Dynamic & Sharp Transitions: High-contrast, sudden flashes of intense light bursts.	Lower density and complexity compared to happiness; slower pace.
Sadness	Forwards head bend (unique to this state); forwards chest bend, no body twist, arms resting by the sides.	Blue	Low Brightness: Dim, "faded" light levels to reflect an introspective state.	Lower density and complexity compared to happiness; slower pace.
Immersion	Linked to "looking at a fixed point" for an extended duration.	Yellow-green transitions	Slow Pulse: Very slow "breathing effect" light, synchronized with user respiration.	Slow-moving visuals; complex silhouettes.
Fear	Backwards head bend; no abdominal twist; forearms raised; variable weight transfer.	Green	High Contrast Variations: Rapidly decreasing/narrowing light volume to reflect constriction.	Distorted, irregular visuals; fast but stuttering movement.
Surprise	Backwards head and chest bend; any degree of abdominal twist; arms raised with straight forearms.	Light Blue	High Contrast Variations: Sudden increase in light volume and spatial reach.	Dense and fast-moving visuals; complex silhouettes.

Note: The emotion disgust is excluded from the mapping table due to its significantly low recognition rate in previous studies.

5. Model Proposal

5.1 Design Proposal: Emotion Exhibition in the Metro via the 'Sentient Space' Metaphor

Developed as a design proposal study, this conceptual project is situated in the Istanbul ITU Ayazağa metro station, see Fig 5. Metro stations, which align with Marc Augé's [16] concept of the 'non-place,' are transitional spaces characterized by the anonymization of individuals and where communication is mediated through signage. Far removed from the sterile atmosphere of the traditional 'White Cube' ideology and possessing a chaotic and noisy texture, this choice of location examines how the proposed exhibition configuration can exist despite the challenges of the existing context. Furthermore, the 'porous' structural nature of the project, situated within the station's dense human circulation, enhances the design's public impact and accessibility.

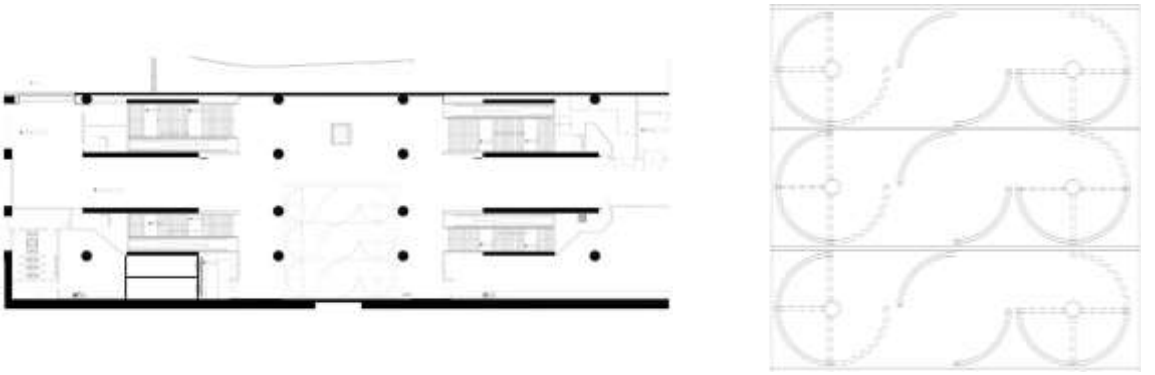

Fig. 5. (a) ITU Ayazağa Metro Station floor plan (b) Plan of the proposed unit

5.2 Spatial Configuration and Structure

The structural framework of the design is grounded in a modular and kinetic system configuration. Semi-circular separators integrated onto turntables configure the act of entry not as the use of a traditional door, but as a form transformation of the space, see Fig 6. Activated by the visitor's engagement with the system, this kinetic shell rotates around its own axis to close, isolating the interior space from the outside world, see Fig 7. This autonomous mechanism enforces occupancy restrictions through a physical 'reflex,' thereby securing the singular nature and privacy of the experience. The fact that the system remains closed to the outside while an experience is in progress ensures that the user is physically detached and isolated from the chaos of the metro station.

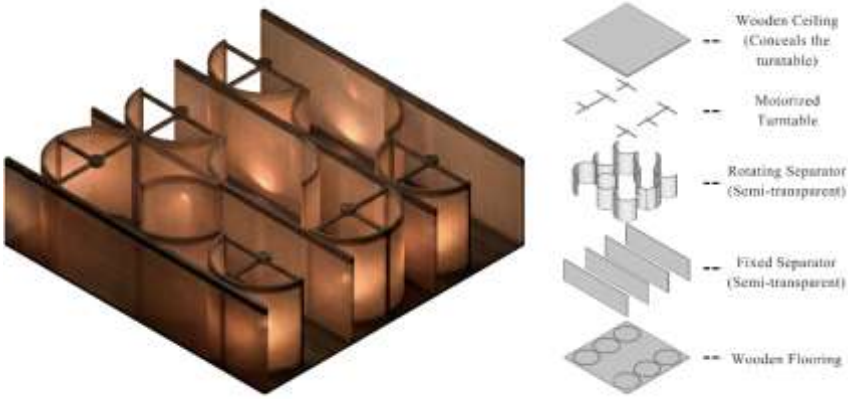

Fig. 6. (a) Axonometric visualization of the proposed unit. (b) Exploded axonometric visualization of the proposed unit.

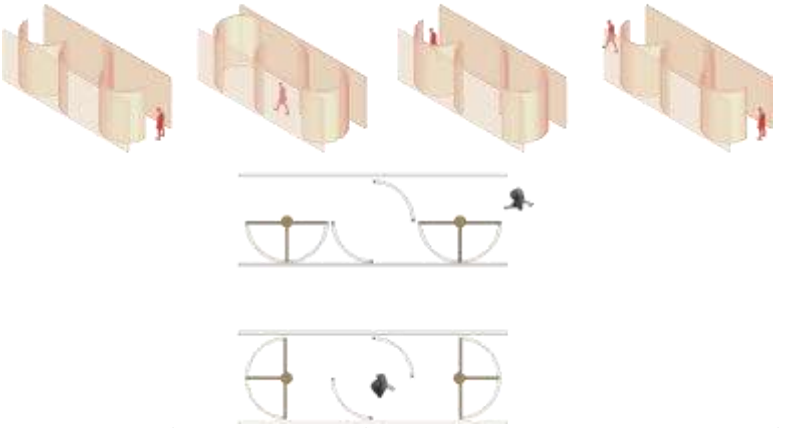

Fig. 7. (a) Diagrammatic representation of the circulation path of the proposed unit. (b) Graphic representation of the movement of the turntables in plan view.

The proposed unit is configured not as a static obstacle blocking the existing linear circulation of the metro corridor, but as an alternative and curvilinear route articulated to the circulation. This spatial alternative route offered to the user does not completely impede the pragmatic metro discipline that aims for the shortest path. By opting for this curvilinear route instead of passing rapidly through the straight corridor, the visitor adds an intentional 'delay' to their journey. Even if the visitor prefers merely to 'walk-through,' this curvilinear route stretches the duration of the experience, transforming the relationship established with the space into a 3-5 minute 'moment of deceleration'.

5.3 Porosity and Public Interface

In this study, the theory of 'spatial porosity' is materialized through semi-permeable textile materials that form the envelope of the structure. By disrupting the perception of a defined and rigid door at the entry and exit points, the space itself is transformed into a fluid transition zone. This strategy does not confine the structure solely to the user within the interior; it also incorporates the urban passerby into its sphere of influence through visual porosity. Here, the principle of 'Externalization' mentioned in the methodology section transforms into a public performance. Through semi-translucent surfaces, the user inside becomes a 'semi-visible' subject who is exhibited while their privacy is maintained; meanwhile, the hierarchy between space, exhibited object, and viewer intertwines in every scenario, acquiring a dynamic structure.

Furthermore, the design disrupts the industrial coldness and monotonous rhythm of the metro station through the dynamic interplay of light and shadow it emits. Even passengers who are in a rush and choose not to enter the unit become a passive part of the experience by virtue of this 'atmospheric leakage', see Fig 8.

Fig. 8. Graphic visualization of the concept of atmospheric leakage.

The architectural and atmospheric configuration of the proposed model is grounded in specific theoretical and neuro-scientific foundations. Table 2 summarizes the relationships between the design decisions, the

targeted user experience (intent), and the supporting literature. Each architectural element, from material selection to spatial form, is configured to support the 'sentient space' metaphor and to facilitate the targeted neuro-adaptive dialogue between the user and the environment.

Table 2. Design decisions, intents, and theoretical basis of the proposed model.

Design Decision	Design Intent	Theoretical Basis
Material: Semi-permeable Textile and Wood	To maintain privacy while sustaining visual contact with the public realm at the level of shadows.	Toyo Ito [8]: 'Blurring Architecture' (Dissolution of boundaries); architectural porosity.
Form: Circular / Modular	To create a corner less, fluid circulation that creates a sense of security and generates an 'enveloping' effect.	Coburn, Vartanian & Chatterjee [17]: 'Buildings, beauty, and the brain.' Neuroscientific research indicates that humans prefer curvilinear forms over sharp angles. Curvilinear forms evoke a sense of safety.
Circulation: Rotating Entry Panels	To create a 'transition zone' opened by action, rather than using a physical door.	Toyo Ito [8]: 'Blurring Architecture' (Dissolution of boundaries); blurring zoning by creating threshold spaces.
Feedback: Atmospheric Reflection	To present data not as didactic information, but as an ambient feeling.	J. Pallasmaa [4]: 'Peripheral Vision' (Unfocused vision) & P. Zumthor [3]: 'Atmospheres'.
Location: Metro Station	To transform an identity-less 'non-place' into a personal and sentient 'space of experience.'	Marc Augé [16]: Redirecting the concept of 'Non-places' toward a place possessing identity and a position in collective memory.

6. Potentials and Limitations of the System

While neuro-adaptive architectural practices possess the potential to establish a cybernetic and empathic interaction between the space and the user, they simultaneously introduce discussions regarding 'privacy' and 'data security.' As pointed out by Makanadar [10], the continuous monitoring of human emotions and cognitive states by the built environment carries the risk of inducing 'surveillance' anxiety in the user, thereby disrupting the naturalness of the experience and creating a 'Panopticon' effect. Particularly in a public space such as a metro station, the question of how to instantaneously obtain the user's explicit consent and ensure data security constitutes the primary ethical barrier to the feasibility of this typology.

This ethical barrier can be overcome by structuring the data collection process based on anonymized emotional states (skeleton and posture analysis) rather than on identification (facial recognition, etc.). Consequently, the system remains a temporary interface concerned not with 'who' is present, but with 'how' they feel.

6.1 Risk of Technological Interpretation and Cognitive Dissonance

Another critical risk in the architectural integration of affective computing technologies is the probability of the system making a 'misinterpretation' due to the complex and individual nature of emotions and their psychophysiological responses. Although depth cameras and skeleton tracking analyze bodily gestures, in cases of cultural differences or neurodiversity, the system may encode the user's stress as 'excitement' or their calmness as 'indifference.' This situation can create cognitive dissonance and alienation in the user. Therefore, instead of imposing an atmosphere based on prescriptive judgments, the proposed system should adopt 'probabilistic' and fluid atmospheric transitions that slowly calibrate themselves according to the user's response. This also allows the user to project their own subjective meanings onto the space.

6.2 Risk of Spatial Manipulation

The transformation of space into a 'sentient' entity carries the risk of manipulating the user to induce a specific emotional state. In this study, Artificial Intelligence is positioned not as a directive 'therapist,' but as a reflective 'mirror' that enables the user to become aware of their own state. The process of externalization described by Maiese [12] comes into play here; the space transforms the user's internal rhythm into a spatial rhythm. This 'living dialogue' aims to remove the experience from the realm of manipulation and transform it into a process of awareness where the user just witnesses their own emotional state.

6.3 Transformation of the Non-Place

Finally, the metro station that aligns with Marc Augé's [16] definition of a 'non-place', holds the potential to transform the sociological character of the space. An anonymous space of transition evolves, however temporarily, into a 'relational' sphere of experience endowed with identity. This intervention within the metro station, a public realm, proposes an inclusive identity by opening the artistic and spatial experience to the flow of everyday life and to all segments of society, and offers the potential to acquire a collective memory.

7. Conclusion

This study proposes a speculative conceptual spatial typology that discusses the hierarchy of the gallery space ideology through the emerging field of 'neuro-adaptive architecture.' Through this conceptual project, a framework has been presented that discusses the boundaries between architectural space, digital technology, and human consciousness. The results put forth by the research can be summarized under three main headings:

7.1 Spatial Paradigm:

The study discusses how the digitizing hybrid and interactive configurations of exhibition spaces can be advanced further through neuro-adaptive systems. It interprets the concept of 'space of experience' through a spatial configuration that establishes a cybernetic dialogue with its user; consequently, the visitor's instantaneous emotional state and the space's atmospheric response to it have become the spatial experience itself.

7.2 Re-functionalization of the 'Non-Place':

The selection of the Istanbul Metro as a case study examined the project's potential to serve as a sociological intervention. The study discussed the potential for transitional spaces where communication is severed, defined by Marc Augé [16] as 'non-places', to transform into 'relational spaces' where personal awareness is experienced through the proposed system. The spatial configuration, established through semi-permeable surfaces, transforms the intimate experience into a public performance, thereby creating the potential for an unexpected 'moment of pause' and a 'restorative' space within the chaotic flow of urban life. Furthermore, this intervention in the metro station, which is a public space, proposes an inclusive identity by opening the artistic and spatial experience to the flow of everyday life and to all segments of society.

7.3 Future Projection:

The limitations of the study are the fact that the proposed system has not yet been tested in an empirical environment and the risk that emotion recognition algorithms may reduce complex human psychology. In this context, the presented model currently stands as a speculative design proposal. In future studies, it is aimed to simulate this configuration in a Virtual Reality (VR) environment and to test it via proxy surveys. Thus, the validity of the theoretically configured 'restorative effect' can be tested.

Studies in the field of neuro-architecture reveal that the built environment exerts direct effects on human neurological processes, mental states, and behavioral patterns. In this context, 'atmosphere' stands out not

merely as a spatial background of architecture, but as a fundamental design component shaping perception, affect, and behavior. The adaptation of the atmosphere to respond to the user's instantaneous psychophysiological data holds the potential not only for the dissolution of the traditional gallery space hierarchy, but also for defining a new spatial threshold for individual introspection and a potential restorative experience within anonymized urban transitional spaces dominated by speed and chaos.

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A COHORT-SEQUENTIAL STUDY ON STUDENT PERCEPTIONS OF DESIGNING WITH GENERATIVE AI IN DESIGN STUDIOS

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Abstract

The increasing integration of generative artificial intelligence (Generative Artificial Intelligence – GenAI) into design education has generated growing academic interest, particularly regarding its pedagogical potential within design studio environments. While much of the existing literature focuses on short-term implementations or isolated case studies, cohort-sequential research examining how students' perceptions and design practices evolve through sustained engagement with GenAI remains limited. This study aims to address this gap by presenting a l cohort-sequential analysis conducted over seven consecutive semesters within undergraduate architecture and interior architecture design studios.This study is grounded in the Educational Design Ladder Model and adopts a gradual, pedagogy-driven approach that places design education at its core. The studio process was structured around a staged design framework, enabling systematic observation of how GenAI was integrated across different phases of the design process. Within this framework, experimental implementations of generative AI were conducted in studio courses each academic semester. Each phase was developed based on the findings of the previous term, and the process was progressively diversified through the introduction of new GenAI models and evolving workflows.The research involved 97 second- and third-year undergraduate students who engaged with various GenAI tools, including ChatGPT, Midjourney, DALL·E, and, at advanced stages, ComfyUI. A mixed-methods research approach was employed, combining Likert-scale questionnaires, self-assessments, and open-ended survey responses from 63 students, along with semi-structured interviews conducted with 15 students. These methods were used to examine students' technical experiences, perceptions of accessibility, and cognitive engagement with GenAI. The findings indicate that students perceive GenAI not as a substitute for human creativity but as a supportive design companion. GenAI tools were found to be particularly valuable during the early stages of the design process, especially in terms of visualization, rapid ideation, and creative problem-solving. However, the use of more complex, node-based systems revealed concerns related to control, authorship, and creative depth. Over time, increased familiarity with the tools contributed to stronger perceptions of user control and greater alignment between students' mental design intentions and the generated outputs.Overall, this study demonstrates that when embedded within a structured and critically guided pedagogical framework, GenAI functions as a cognitive catalyst in design education. The findings emphasize the importance of integration and instructor mediation in transforming generative AI from a visualization aid into a meaningful component of design learning.

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Key Words: *Design Education; Generative Artificial Intelligence; Design Studio Pedagogy; Student Perceptions; Cohort-Sequential Design*

1. Introduction

In recent years, the increasing use of generative artificial intelligence (GenAI) as a supportive educational tool has attracted researchers' attention. This interest stems from its ability to assist students in developing essential skills, including creative problem-solving [1], promoting student engagement [2], supporting data analysis [3], enhancing personalized learning experiences [4], and improving grading and feedback process [5]. Consequently, there is a surging interest in design education, employing GenAI as a design companion

in design studio, where the testing and application of GenAI are becoming a standard practice in the field [6, 7].

Particularly in the design studio, as Gero (1996) predicted in the early stages of computational design, AI in general has evolved from a tool that automates routine tasks into an 'inspirational style tool' and 'creative catalyst'[8]. It is now increasingly utilized during the early phases of the design process to inspire creative outputs and explore diverse representations and models (see [9] for different areas of AI employments).

Despite this growing interest, much of the existing literature remains focused on short-term implementations or isolated case studies (see [10], for a review). There is a notable lack of cohort-sequential research that examines how student perceptions and design practices evolve across multiple, distinct cohorts in a studio setting. This study aims to fill this gap by providing a comprehensive analysis over seven consecutive semesters. By involving different student cohorts, including second and third year architecture and interior architecture students, the research offers a broader, more generalized understanding of whether GenAI functions not merely as a tool, but as a transformative and cognitive catalyst in design education.

2. Design Teaching in GenAI Era

Design education has continually absorbed new digital tools: from CAD and parametric modelling to simulation and BIM. GenAI extends this trajectory by making high-quality text and images accessible through natural-language interaction. In studio teaching, this matters because students can externalize ideas quickly, generate many alternatives, and iterate on representations with less technical overhead than earlier visualisation workflows [6]. For this reason, the key pedagogical issue is not whether students will use GenAI, but how they use it: where it enters the workflow (research, sketching, option generation, critique), how decisions are documented, and how instructors assess learning when parts of the production are delegated to large models that are hard to inspect and trained on broad datasets [11,12].

2.1. A brief overview of AI development and applications in design

Since Alan Turing's early formulation of machine intelligence, AI research has moved through several paradigms shaped by available computation and data. Early design-oriented AI often relied on symbolic representations and rule-based reasoning, aiming to support decision-making and design synthesis [8]. Contemporary AI, in contrast, is dominated by machine learning and deep learning, where models learn patterns and representations from large datasets rather than being explicitly programmed [7].

A major change for creative industries has been the rise of deep generative models that can produce new artefacts rather than only classify or predict. Foundational approaches include Variational Auto-Encoders (VAEs) [13] and Generative Adversarial Networks (GANs) [14]. More recently, diffusion models have become central to image generation pipelines, from early formulations [15] to widely used denoising diffusion probabilistic models [16] and latent diffusion methods that make high-resolution generation computationally feasible [17].

Transformer architectures further accelerated GenAI by enabling large language models and multimodal systems that connect text and images at scale [18]. Many of these systems are described as "foundation models": models trained on broad data that can be adapted to many downstream tasks, including design ideation, description, and visual exploration [19]. In education, this matters because foundation models make powerful capabilities widely available, but they also bring practical concerns into the studio—limited transparency about how outputs are produced, uneven data quality and bias, high computational cost, and new questions about attribution and academic integrity [11,12]. These conditions make "using the tool" insufficient as a learning goal; students also need to learn how to question, verify, and situate model outputs within a defensible design process.

2.2. GenAI in design studios: adoption patterns and emerging pedagogical trends

In many design studios, GenAI tools are now used as part of weekly study, particularly in early phases: generating mood and atmosphere studies, testing spatial narratives, and producing quick visual variations that can be discussed in critiques [6,20-25]. Empirical studio reports show that students often start with text-to-image generation for rapid ideation and then move toward more controlled workflows (e.g., image-to-image, masking, or multi-stage pipelines) as their skills develop [20].

Several studies describe how GenAI changes the nature of representation work in the studio. For example, first-year experiments with GenAI image generators report that students use these tools to (i) explore spatial

organisation, (ii) elaborate details, and (iii) construct atmospheres; sometimes treating the generator as a co-designer rather than a passive tool [24]. In collaborative settings, GenAI can also act as a shared visual mediator: collage-based workflows have been shown to support teamwork by externalising individual ideas into a negotiable common ground [25].

These observations align with a broader view of studio GenAI use as human–AI co-creation. Interaction-focused frameworks emphasise turn-taking, agency, and how "surprise" or "suggestion" from the system can trigger reframing during ideation [26]. Related HCI research further shows that the way students interact with models such as, prompting, revising, critiquing, and re-prompting, often becomes a learned design skill in its own right [27].

Across studios, a few pedagogical patterns are emerging. First, instructors increasingly require process documentation (prompt logs, intermediate outputs, and reflection notes) so that learning remains evaluable beyond the final image. Second, "prompt literacy" is treated as representational competence: students learn to translate intent into constraints, references, and evaluative criteria. Third, teaching increasingly blends GenAI with established computational workflows (e.g., parametric modelling, simulation, or fabrication) to avoid reducing studio work to image production alone [6,7,20,24].

At the same time, significant limitations are becoming clearer. When students repeatedly see polished AI outputs, they may converge too quickly on a narrow set of options, which can reduce divergence and contribute to design fixation unless the process is carefully scaffolded [28]. In addition, dataset bias can push work toward familiar styles and visual sameness, making it harder for students to develop a distinct design language. Finally, questions of authorship, attribution, and intellectual property complicate studio assessment and later publication practices, especially when images and text are partly generated [11,12]. Together, these issues support a shift from simple "tool adoption" toward critical GenAI literacy that addresses limits, provenance, and responsible use.

Overall, teaching in the GenAI era benefits from framing these systems as part of "hybrid intelligence": students orchestrate AI capabilities while keeping designerly judgment at the centre [29]. Practical implications include (i) teaching interaction strategies for exploration and critique, (ii) aligning assessment with evidence of process and reflection, and (iii) embedding ethical discussion into studio routines. These points motivate the cohort-sequential approach of the present study, which examines how student perceptions and practices evolve as GenAI becomes a stable part of studio culture [6].

3. Cohort- Sequential study

This study positions the evaluation of students' perspectives as a critical yet underexplored starting point for integrating GenAI models into design education. It aims to address this gap by examining students' knowledge, attitudes, motivation, and ethical awareness regarding GenAI use within design studio framework. By doing so, the study seeks to contribute to a more holistic understanding of AI integration that extends beyond output-oriented assessments.

The research was conducted by a consistent team of investigators who serve as faculty members and studio instructors within the Departments of Architecture and Interior Architecture at the same institution. While these two disciplines naturally differ in terms of spatial scale, technical requirements, and thematic focus, the pedagogical framework of the design studios was intentionally synchronized to ensure methodological consistency. To maintain a unified contextual framework, both student groups participated in identical seminars, workshops, and introductory GenAI training sessions. The integration of AI tools followed a parallel curriculum where the same evaluative criteria and assessment rubrics were applied across both departments. This approach allowed the researchers to observe the impact of GenAI across different design scales while maintaining a controlled and comparable pedagogical environment. Furthermore, prior to the study, a preliminary assessment indicated that the majority of students had limited to no professional familiarity with GenAI in a design context, necessitating the foundational 'knowledge building' phase described in the methodology.

Within the scope of the research, undergraduate architecture and interior architecture students in second and third year (2022 Spring -2025 Fall)(97 students in studios but not all gave consent) engaged with selected GenAI models over seven consecutive semesters. The primary objective was to observe and analyze the evolving experiences of students as GenAI tools were progressively integrated into the design studio curriculum.

3.1. Procedure

Each semester, a new group of students participated in the studio, ensuring that the findings reflect a broad range of perspectives rather than the progress of a single group. In each studio, process was structured into five stages: 1-Foundational level (knowledge comprehension), 2-Product Level (application), 3-Analyse, 4 Synthesis, 5 Evaluation (adapted the Educational Design Ladder Model based on [30]) during which GenAI tools were systematically introduced and utilized.-The Educational Design Ladder Model was adopted as the foundational framework for this study, as it provides a structured, multi-staged approach that facilitates both knowledge acquisition and the subsequent application of that knowledge in design tasks within novel technological environments. In alignment with this model, each studio period commenced with an initial phase focused on knowledge building, conducted through intensive seminars and workshops. During this stage, students were introduced to the theoretical and technical underpinnings of Generative AI (GenAI).

Following this, the process transitioned to a second phase, where students were expected to operationalize this acquired knowledge to develop their design projects. Given the rapid evolution of GenAI technologies, a core objective of the studio's pedagogical design was to ensure that students maintained currency with state-of-the-art tools. Consequently, the integration followed a progressive technical trajectory: beginning with text-to-image synthesis (utilizing ChatGPT, Midjourney, and DALL-E) to establish foundational prompt literacy, and advancing to more complex image-to-image workflows and node-based systems (such as ComfyUI) as students attained higher levels of technical proficiency. While subsequent stages involved a hybrid workflow with diverse modeling and simulation tools, the 'product level' was prioritized in this reporting to provide a deep, granular analysis of how GenAI influences early-stage design decisions.

3.2.Data Collection

Data were collected from seven distinct cohorts of undergraduate students (who gave consent and to be volunteers for participation, in total N= 63). To capture a comprehensive view of the students' experiences, a mixed-methods approach was utilized. While the total number of students enrolled in the design studios across all periods was 97, the final analyzed dataset was limited to 63 participants. This discrepancy is primarily attributed to strict adherence to research ethics and voluntary participation protocols. Although all 97 students participated in the pedagogical process as part of their curriculum, only 63 provided explicit informed consent to have their survey data and design outputs included in the research study. Furthermore, cases with incomplete survey responses or missing process documentation were excluded to maintain the integrity of the statistical analysis.

At the end of each semester, the contribution of GenAI to the design process was subsequently evaluated through student self-assessments and structured questionnaires administered. With a selected group of students who have shown interest to be part of the research, open ended and a semi-structured interview was conducted. To assess student experiences, the survey investigated several key areas: the perceived quality and realism of AI-generated images (Figure 1), the potential of these tools to either limit or enhance creativity, and the students' personal judgment on the functional integration of AI as a collaborative assistant in architectural design.

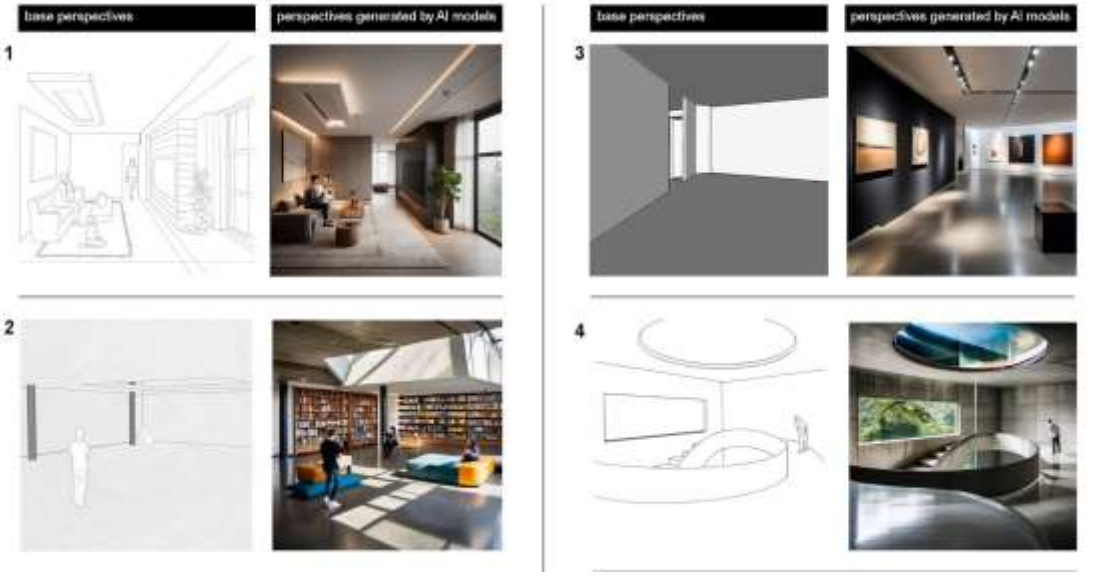

Fig. 1: Transformation of base perspectives into AI-generated visuals by students.

3.3. Results

The quantitative analysis of this study was conducted using a 5-point Likert scale, focusing on three core dimensions: perceived impact on creativity and innovative solutions, the success of the tool in reflecting the designer's mental imagery, and the efficacy of generated visuals as a source of inspiration (Figure 2). To ensure the internal consistency of the instrument, a reliability analysis was performed, yielding a Cronbach's Alpha coefficient of 0.92, indicating excellent internal reliability for the items evaluated.

While the findings generally indicate a positive perception across all dimensions, a more nuanced distribution was observed regarding the capacity of GenAI to accurately reflect mental imagery. Unlike the relatively unified positive responses for 'inspiration,' the item 'The AI-generated images successfully captured the atmosphere I had in mind ' exhibited a notable dispersion. The response frequencies for 'disagree' and 'strongly agree' categories were remarkably close, and neutral is the highest, suggesting that despite the overall optimism, there remains a significant gap or a 'bottleneck' in achieving precise intentionality within current GenAI workflows. This lack of a strong consensus highlights the subjective nature of prompt-based translation compared to the more universally accepted role of AI as an inspirational catalyst.

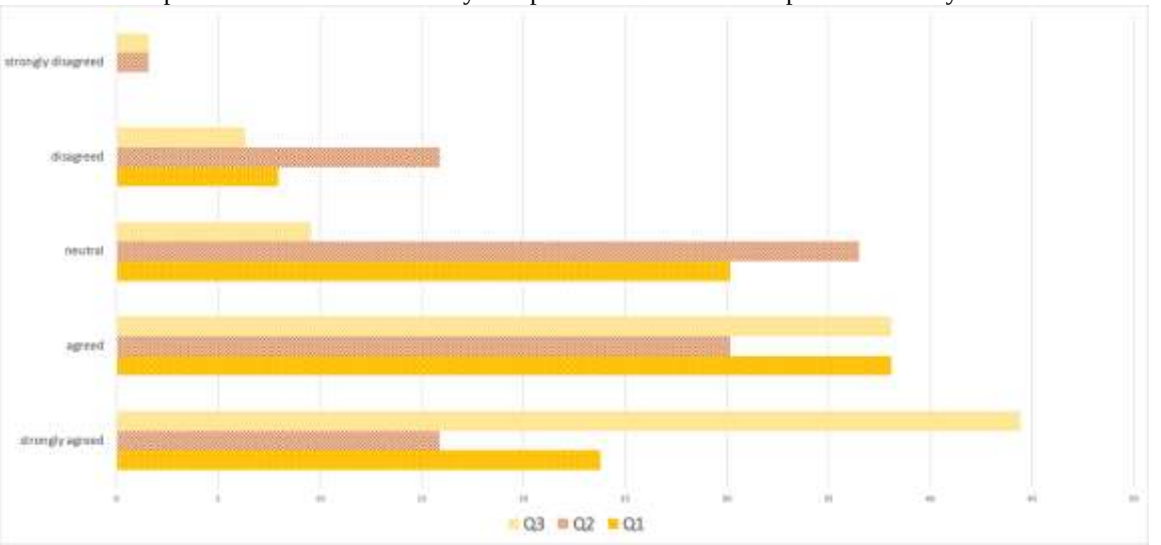

Fig. 2:Percentages of group-based visualization of participant's (N=63) from the Likert-scale-based questions of the semi-structured questionnaire results.

Q1:Generative AI tools improve my problem-solving abilities by offering creative and innovative solutions

Q2:The AI-generated images successfully captured the atmosphere I had in mind.

Q3: The generated images serve as a catalyst for developing innovative design ideas.

In the final semester, fifteen students used the ComfyUI interface to get their design projects done, and a semi-structured interview was conducted with them. Following the interview, four students who showed interest in using generative AI were selected. These students continued to use generative AI tools in their design projects, and a second semi-structured interview was conducted. The questions posed to the students during these interviews were grouped and analyzed under the headings "Section I. Technical Experience", "Section II. GenAI Accessibility", and "Section III. Cognitive Experience", combining verbal feedback with 0-10 scale ratings. The questions in Section I. Technical Experience focused on participants' ease of use, understanding of the node-based interface, overall technical experience, and intention for future use. Section II. GenAI Accessibility included questions related to perceived control over outputs, ease of learning, comparison with web-based generative AI tools, and accessibility of the workflow. Section III. Cognitive Experience addressed participants' perceived creativity support, exploration of AI limits, alignment between mental design and generated outputs, and overall cognitive engagement during the design process. Figure 3 shows the results of the first (Phase 1 in week 8) and second (Phase 2 in week 12) semi-structured interview.

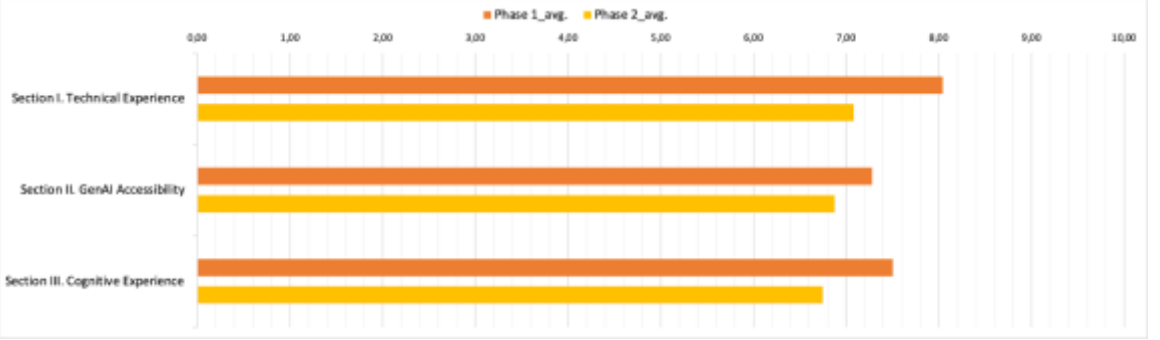

Fig. 3:Group-based visualization of participants' first (n=15) and second (n=5) semi-structured interview results.

When average scores are compared between phase 1 and phase 2, the results indicate that overall scores remained relatively similar across phases. Phase 2 results suggest small variations in average scores, indicating that continued use did not significantly change overall evaluations. For a more detailed analysis, a comparison between phase 1 and phase 2 was conducted at question level (Figure 4). In this analysis, improvements are observed in perceived control, alignment between mental design and generated outputs, and overall familiarity with the GenAI. These findings suggest that, although average scores show limited change, continued use of GenAI supports more confident and informed use over time, leading to better outcomes for participants.

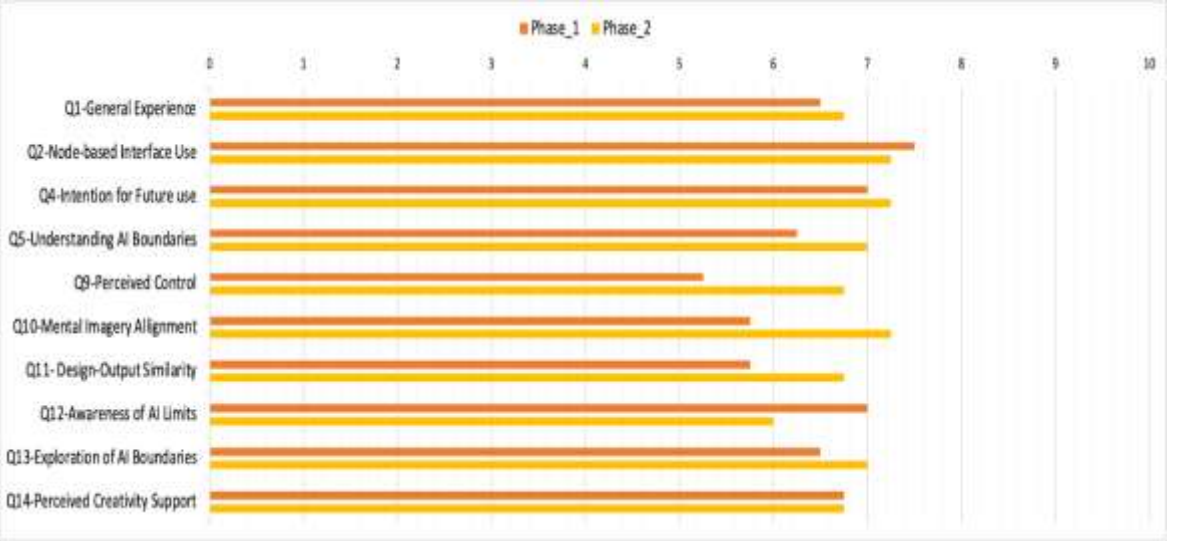

Fig. 4: Participants' scores variation in phases

Participants highlighted how GenAI facilitates the detection of design details that might otherwise be overlooked or time-consuming to visualize manually. One student noted:

> *"It helped me identify details that could have remained at a very fine level and would have taken a long time to see. Additionally, it made a significant contribution to concretizing the designs that were taking shape in my mind."*

The findings also emphasize that the designer's ability to articulate their mental intentions through prompts directly impacts the success of the outputs. As one participant reflected:

> *"In the second phase, since I described more materials and added more detailed information, I think the results were much more successful. Instead of saying 'create an environment from scratch,' I described all the elements, and it worked much better."*

The qualitative data revealed that AI tools were primarily valued for: 1)Material, color, and lighting decisions, 2)Time efficiency in generating and comparing alternative scenarios and 3) Psychological motivation, fostering a sense of accomplishment and confidence during the initial ideation phase. However, students also noted technical limitations such as spatial misinterpretations and visual inconsistencies, which necessitate a critical and selective approach by the designer. Overall, the findings indicate that while generative artificial intelligence is a powerful early-stage tool for atmospheric exploration, its effectiveness depends on the designer's critical and selective use. Figure 5 presents examples of outputs generated by participants using GenAI.

Fig. 5: Examples of the outputs generated by using GenAI

The qualitative data provided a nuanced understanding of the students' transition between different GenAI interfaces. While the overall sentiment was positive, the integration of more complex systems like ComfyUI revealed significant pedagogical and technical hurdles. Participants noted that the high hardware requirements (GPU capacity) and the steep learning curve of node-based interfaces impacted their user experience. One student explicitly favored simpler tools due to efficiency concerns:

> *"I wouldn't use it in my future work because it takes too long to process and the outputs were not exactly what I wanted. At the moment, I would prefer to use Midjourney."*

Another participant rated their experience with complex tools as a 5 or 6 out of 10, citing that the results were not immediately usable despite technical success in matching the prompt:

> *"The results... were not something I could directly take and use... because the processing time was long, I don't think it was something I could practically use."*

A critical concern raised by students was the tendency of AI to produce "aesthetic uniformity" and generic visual languages, which some felt suppressed original design expression. The loss of atmospheric depth and contextual authenticity was a recurring theme in the feedback. A key observation was the correlation between prior familiarity with node-based tools (like Grasshopper) and the ease of adapting to ComfyUI. This suggests that students with a background in computational design adjusted to advanced GenAI interfaces more positively than those without such experience.

4. Discussion and conclusion

The findings of this study confirm that the integration of Generative AI (GenAI) into the design studio has moved beyond a mere technical trend, evolving into a fundamental component of the architectural design process. The survey and interviews' results reveal a predominantly positive attitude among students, who increasingly perceive generative AI not as a replacement for human creativity, but as a sophisticated supportive tool for rapid ideation and visual exploration. The predominantly positive feedback from students across seven semesters suggests that GenAI functions as a "cognitive catalyst," directly addressing the gap identified by [7 and 26] regarding AI's role as an inspirational tool.

Unlike short-term implementations often found in current literature [9], the sustained positive reception over multiple cohorts of our study indicates that the benefits of GenAI are consistent and replicable. Students specifically highlighted how tools like Midjourney and ComfyUI facilitated "creative problem-solving" and "rapid ideation," echoing the skill-building advantages noted by Chan and Hu (2023) and increasing student engagement [1 and 2]. The shift from basic prompting to more complex node-based workflows (such as ComfyUI) as students gained experience further demonstrates that AI literacy is becoming an integral part

of the design studio's pedagogical structure. While AI tools offer unprecedented speed in generating design alternatives, the feedback from students underscores a nuanced balance between enhanced productivity and the potential limitations these models may impose on original creative thinking

However, the findings also reveal a more ambivalent and, in some respects, contradictory perspective on the role of Generative AI in the design studio. Although AI tools were initially welcomed by students as a novel and curiosity-driven development that facilitated workflow efficiency, the survey results indicate a noticeable hesitation regarding their impact on creativity and the designer's agency over the project. In contrast to the predominantly positive qualitative feedback highlighted earlier, students' quantitative responses frequently employed neutral statements when evaluating the overall contribution of AI to the design process. This suggests that while AI use at the introductory level is perceived as motivating and engaging—particularly in overcoming early design inertia—it does not necessarily translate into a profound or transformative influence across the entire design trajectory. From this perspective, the role of GenAI appears to remain largely instrumental rather than conceptual, supporting speed and visualization without substantially reshaping students' creative decision-making or authorship. Such findings align with broader observations on the integration of digital systems into everyday practice, where initial enthusiasm and efficiency gains do not automatically result in deeper cognitive or methodological shifts in design thinking.

By providing diverse representations and alternative design models in the early stages, these tools allow students to bypass the 'blank page' syndrome, thereby enhancing their engagement and personalized learning paths. However, the results also imply that the role of the instructor remains crucial in guiding this 'design companion' to ensure it supports, rather than replaces, the student's critical judgment and original creative voice. Despite the overall positive reception, the cohort-sequential data also points toward potential risks regarding technical and cognitive dependency. While GenAI tools accelerate the production of complex visuals, there is a risk of students becoming over-reliant on these systems, potentially leading to a 'black-box' cognitive process where the user loses control over the underlying design logic. If not carefully integrated into the pedagogy, such dependency may diminish the student's ability to engage in independent critical thinking and manual problem solving core components of the 'designerly way of thinking' [29]. Furthermore, the ease of generating high-fidelity outputs through tools like Midjourney might create a false sense of architectural competence, where the speed of representation masks a lack of structural or functional depth in the design proposal.

Ultimately, this seven-semester cohort-sequential analysis suggests that providing a sequential learning path from theoretical grounding to practical problem solving is the most effective way to transform GenAI from a visual aid into a meaningful and transformative component of design education. Looking forward, as these technologies evolve, we anticipate a transition toward a co-evolutionary design partnership. This shift will likely redefine the 'designerly way of thinking' into a hybrid intelligence, necessitating a pedagogical framework that prepares students not just to use GenAI, but to critically orchestrate autonomous systems in the creation of future built environments.

Acknowledgements

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THE ARCHITECTURE OF PHILOSOPHY/ARCHITECTURE WITHOUT PHILOSOPHY: KENZO TANGE'S MASTER PLAN FOR THE SACRED GARDEN IN LUMBINI BETWEEN BLISS AND NEGLECT

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Abstract
Lumbini is globally recognized as the birthplace of Siddhartha Gautama, the Buddha, as evidenced by the Lumbini pillar inscription dating to 249 BCE and the archaeological remains. In response to growing international interest in preserving and interpreting this sacred landscape, the United Nations and the Government of Nepal initiated the systematic development of Lumbini in the late 1960s. Japanese architect Kenzo Tange, a leading figure in modern architecture and urban design of the post-war period, whose work was strongly informed by ideals of world peace, was commissioned to conceive a comprehensive masterplan for Lumbini. Tange and his team sought to establish a design framework that would both protect the ancient core and articulate a meaningful spatial narrative for contemporary pilgrims and visitors. Owing to its outstanding cultural and religious importance, reflecting early Buddhist pilgrimage practices and long-standing spiritual traditions, the site was designated a UNESCO World Heritage Site in 1997.
Despite its visionary scope, the implementation of the masterplan has unfolded over decades and remains incomplete, shaped by shifting institutional priorities, funding limitations, political changes, evolving conceptions of heritage management, as well as the problematic issues regarding, among others, the lack of inclusion of the local community. In the presented paper, the author examines the conceptual foundations, design strategies, and conservation outcomes of Tange's masterplan, situating the Lumbini case within broader debates on master planning for sacred landscapes, cultural sustainability, and the role of local communities in the broader contexts of design and planning within the complex field of heritage preservation and interpretation.

Key Words: *Kenzo Tange; Lumbini Master Plan; Planning in Heritage Context; Inclusive Heritage; Heritage Interpretation*

1.Introduction – Lumbini, Buddha's birthplace: sacred, forgotten, rediscovered

Lumbini, located in the southern Terai plains of present-day Nepal, holds profound historical, religious, and cultural significance as the birthplace of Siddhartha Gautama, who later attained enlightenment and became the Buddha. According to Buddhist textual traditions, Queen Maya Devi gave birth to Siddhartha in the Lumbini grove in the 6th century BCE while traveling to her parental home [14]. This event established Lumbini as a space of deep spiritual significance, as one of Buddhism's four principal pilgrimage sites. The other three - Bodhgaya, where the Buddha attained enlightenment, Sarnath, where he delivered his first sermon, and Kushinagar, where he died and was cremated - are all located in India. At these Indian sites, monumental temples accumulated over centuries serve as authoritative architectural markers of pivotal moments in the Buddha's life, structuring and formalizing pilgrim devotion. Beyond the sacred precincts, however, the experience is frequently shaped by intense commercial activity, as clusters of hawkers, souvenir stalls, food vendors, and restaurants give way to hotel-lined roads catering to pilgrims across economic strata. Lumbini presents a contrasting condition. Set within a quiet, agricultural landscape and far less developed than the other three sites, it is a place where the spiritual is not overshadowed by the mundane. Souvenir sellers are few, restaurants are scarce, and hotel options are limited; instead, many pilgrims are accommodated within monasteries, reinforcing Lumbini's contemplative character.

The sanctity of the place was formally inscribed into the physical landscape in 249 BCE, when Emperor Ashoka erected a commemorative pillar identifying Lumbini as the birthplace of the Buddha. The Ashokan intervention[a] represents one of the earliest instances of spatial marking and symbolic architecture at the site - an

[a] Ashoka, also known as Ashoka the Great, is considered one of the greatest rulers, who governed from 268 to 232 BCE and expanded the Mauryan Empire to its widest territory and peak of power. However, the most significant change in his rule did not come from the fierce violence of his early years, but from his conversion to Buddhism and his promotion of tolerance and nonviolence across the vast empire. He became a patron of Buddhism, supporting the rise of the doctrine across India. He reportedly dispatched emissaries to several countries, including Syria and Greece, and he sent his own children as missionaries to Sri Lanka. Ashoka communicated his new philosophy through inscriptions carved on stone pillars and rocks placed at pilgrimage centers and along major trade routes. These edicts are among the earliest

idea that would later resonate strongly with modern planning concepts. Archaeological remains from subsequent periods, including foundations of stupas, monasteries, and votive structures, indicate that Lumbini flourished as an important pilgrimage and monastic center from the early centuries BCE [16], [29], rather than a dense urban settlement. Stupas, monasteries, and water features were dispersed within a largely natural grove, reflecting an early spatial order that emphasized procession, contemplation, and proximity to nature. Despite its early prominence, from the late first millennium CE onward Lumbini experienced a gradual decline. The waning of Buddhist patronage, political instability, the gradual expansion of Muslim communities in the region and environmental transformation led to the abandonment of monastic structures and the encroachment of dense vegetation. Over time, the site lost not only its architectural presence but also its spatial legibility. This prolonged period of neglect resulted in a condition in which spiritual significance persisted in textual memory, while the physical and spatial order of the site gradually dissolved. By the medieval period, Lumbini had largely vanished from active pilgrimage routes and scholarly records.

The rediscovery of Lumbini in 1896, marked by the identification of the Ashoka Pillar, re-established its historical authenticity but also exposed the fragility of its archaeological remains [15]. It occurred in the late 19th century during a period of intensified archaeological exploration in South Asia, when Alois Anton Führer, a German archaeologist, working in collaboration with Nepali officials, identified in 1896 the Ashoka Pillar near the village of Rummindei (developing from its Prakrit inscriptional form to *Lumbini* in Sanskrit/Pali literary form). The pillar inscription conclusively identified the site as the Buddha's birthplace, marking a turning point in Buddhist archaeology and heritage studies. Twentieth-century excavations[b] uncovered modest and fragmented foundations rather than monumental architecture, highlighting the challenge of commemorating a place valued primarily for its symbolic origin rather than its surviving structures. These investigations also revealed additional remains, including the Maya Devi Temple complex, further confirming Lumbini's historical authenticity. More recent excavations in 2013 strengthened this evidence by demonstrating the stone's precise central alignment with ancient architectural features; the archaeologists found that the marker stone is located in the precise east-west alignment typical of Ashoka's shrines, the location matching ancient descriptions. A series of brick structures from different periods, a central shrine from the 3rd century BC and a marker stone placed directly in the center of these structures constitute a central structure that is consistent with ancient Buddhist traditions of marking sacred places of birth or enlightenment [2], [8].

The gradual historical retrieval of Lumbini transformed it from an obscured archaeological landscape into a focal point of global religious and cultural interest. This renewed attention, supported by the Nepalese royal family, laid the foundation for international involvement in its conservation and development and ultimately led to the commissioning of Kenzo Tange's masterplan in the second half of the 20th century. Understanding this historical trajectory, from sacred origin to abandonment and rediscovery, is essential for contextualizing both the spiritual significance of Lumbini and the planning challenges addressed by modern interventions.

Fig. 1. (a) Lumbini in the 1970ies, before the development of the Sacred Garden (Url8); (b) The aerial view of Lumbini today (Url7).

known examples of writing in India. Rather than using Sanskrit, the official court language, they were written in regional languages so that ordinary people could easily understand their message. The Lumbini pillar is inscribed in the Prakrit language using the ancient Brahmi script.

[b] Führer's research that started in 1893 was followed by the excavations led by P C Mukherjee in 1899, then by General Keshar Shamsher between 1933 and 1939, Debala Mitra in 1962, and The Department of Archaeology in 1970 [15], [19].

2. Development plan: U Thant, the UN, Kenzo Tange

Buddha's birthplace was a relatively important point on the trading route until the 10th century, as indicated also by historical records by the famous (mostly Chinese) visitors [14], [29]. However, it fell into gradual oblivion and was prior to the 19th century largely ignored, in large part also due to its challenging accessibility, severe climatic conditions, inadequate accommodation, and limited government engagement and the country's restricted access to foreigners well into the 19th century. It wasn't until 1956 that the Nepal royal family acknowledged the importance of the site, but the place has not been promoted or well known until much later [11].

U Thant, Secretary-General of the United Nations from 1961 to 1971, played a pivotal role in transforming Lumbini from an archaeologically identified site into an internationally recognized place of pilgrimage. After his 1967 visit to Lumbini, which left him deeply moved and shocked by the state of the abandoned and unremarkable site, he encouraged the Nepalese government to consider developing Lumbini as a global centre for pilgrimage, heritage and culture, not merely an excavation site (see Fig 1.a). Using his position at the UN, he framed Lumbini as a project of international cultural heritage, rather than a solely national or religious concern [4].

The International Committee for the Development of Lumbini (ICDL) was established in 1970 in New York under the auspices of the United Nations; the committee initially included thirteen countries and later expanded its membership[c]. The committee brought together representatives from Buddhist and non-Buddhist countries, reflecting his vision of Lumbini as a universal space [23]. Their assignment consisted in choosing an architect, developing a funding source and overseeing the initial plan before handing it to a development trust under the government of Nepal. This was not an easy task, as the project was, according to the UN report, to express the spirit of Buddhism, including its international and universal aspects, but in the same time be firmly rooted in the soil of Terai and be interlocked with the local countryside and population and with its regional development [11].

2.1 Elaboration of the Plan

To realize this vision, the committee sought an architect who could balance modern planning with spiritual restraint and at the same time avoid monumental dominance over the sacred archaeological core. They engaged Kenzo Tange, a renowned Japanese architect known for blending modernist architecture with traditional Asian spatial principles. Japan's strong Buddhist heritage and its post-war commitment to peace and nonviolence that shaped its international cultural diplomacy made Tange - a symbol of post-war Japanese cultural renewal and national identity, whose works embodied the principles of peace and rebirth - a politically and symbolically appropriate choice. And while Tange never designed a Buddhist site before (he was not even considered a practising Buddhist), he became world-famous as the author of the Peace memorial at Hiroshima. Moreover, what most probably brought him to the attention of the UN was his 1963 urban masterplan for the earthquake-stricken city of Skopje (today North Macedonia), which had been sponsored by the United Nations Development Programme (UNDP). His personal architectural credo later came to be known as ''metabolism'': main principle is the distinction between permanent structural cores and changeable, replaceable elements that allow changing of the design by the users over time [22]. This most certainly exerted an influence on his plan for Lumbini, as further explained below.

In addition, it should also be taken into account the influence that Carl Pruscha most likely had on Kenzo Tange's plan - or parts of it - elaboration. Pruscha, an Austrian architect-planner who was sent to Nepal by the United Nations in the mid-1960s, undertook extensive physical planning work in the Kathmandu Valley, including documenting cities, their monuments and the country's cultural heritage, and designing notable buildings that set path to preservation and appreciation of contextual modernism in the city's development. He later became connected with Kenzo Tange through his involvement in the early stages of the Lumbini project by suggesting UNESCO to invite Tange, whom he knew from their shared connections via Harvard and architectural networks, to lead the master plan design and collaborating with him on planning tasks in Tokyo and during site visits in Kathmandu [10]. The modern barrel-vaulted complex constructed in local red brick that Pruscha used in his Nepal Women's Association project (today the Taragaon Museum) evidently left an impression and has been incorporated by Tange into design of the structures also in Lumbini [10].

ICDL initiated the preparation of the so-called Lumbini Master Plan, which was conceptualized by Tange and his firm URTEC beginning in 1972, but only finalized and approved in 1978. Implementation commenced in 1978 and was initially scheduled for completion by 1985; however, progress proved slower than anticipated. In response, the Lumbini Development Trust (LDT) was established in 1985 to oversee the management and implementation of the 1×3 mile Lumbini Project Area in accordance with Tange's Master Plan (see below). Despite repeated attempts to implement the plan, it has been subject to ongoing interruptions, modifications, and

[c] The initial member states were Afghanistan, Cambodia, India, Indonesia, Japan, the Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Singapore, Sri Lanka and Thailand. Later, Bangladesh, Bhutan and the Republic of Korea also joined [Url10].

opposition, and remains to this day largely unrealized and, for a series of reasons further explained below, in a deteriorated state of conservation.

The Master Plan (hereafter MP) encompasses an area of approximately 5×5 miles (approx. 8 km), at the center of which lies a one–square-mile (almost 2.6 $m^{2)}$ Sacred Garden. Tange's large-scale master plans often relied on abstract, diagrammatic scales rather than locally specific measurement systems; using miles allowed him to conceptualize Lumbini as a territorial landscape rather than a town-scale development, reinforcing the plan's symbolic and infrastructural clarity. Therefore, the use of miles emphasizes spatial order and proportional relationships (5×5 miles, 1×3 miles) rather than exact dimensions. These simple ratios supported the plan's cosmological and symbolic reading, making it legible as a geometric and ritual diagram. The area of the Sacred Garden and its immediate surroundings was inscribed on the UNESCO World Heritage List in 1997[d]. Within the broader MP, a defined 1×3 mile area - designated as the Lumbini Project Area - comprises three principal zones: the New Lumbini Village, the Cultural and Monastic Zone, and the Sacred Garden (see Fig.2). This project area was expropriated and placed under government ownership during the 1970s [23].

2.2 Design Concept

The spatial organization of the 1×3 mile Lumbini Project Area was developed in detail according to symbolic principles, particularly *geometric order* and the *conceptual path toward enlightenment*. The primary entrance is located in the north, within the New Lumbini Village (left side, marked in green on Fig.2), where visitors begin their journey from a realm associated with worldly activity. From there, movement progresses southward through the *Cultural* and *Monastic Zone* (centrally placed, marked in orange on Fig.2), intended for learning and spiritual preparation, before culminating in *the Sacred Garden* (right side, marked in light blue on Fig.2), the site of enlightenment and the core heritage property. These three zones are physically and symbolically linked by a *central canal* that structures the axial composition of the plan. The remaining land within the 5×5 mile boundary functions as a *buffer zone*, intended to protect the integrity and contemplative character of the central project area.

Fig. 2. Kenzo Tange's Master plan of Lumbini, divided in three zones: New Lumbini Village, Monastic Zone and Sacred Garden (Url4).

The plan emphasized use of locally available materials: earth, water, vegetation, and exposed brick: materials historically associated with the archaeological remains of Lumbini, so as to maintain material continuity with the site's ancient foundations. The restrained palette is thus privileging authenticity, legibility, the principle of minimal intervention and low maintenance requirements. Tange's MP thus aligns closely with modern heritage conservation principles, even though it predates many of their formal codifications: it supports the principle of material authenticity, responds to contemporary concerns for sustainability and long-term maintenance and reflects the principle of minimal intervention, a cornerstone of modern heritage doctrine articulated in documents such as the Venice Charter (art.9) [6] and later UNESCO and ICOMOS guidelines [7], [27].

Rather than recreating traditional Buddhist temple complexes, Tange developed a functional and broadly universal design that sought to balance pilgrimage, tourism, conservation, and symbolic meaning [23]. He saw Lumbini not only as a heritage site, but as a "Universal Center for Peace", a place where world religions, different Buddhist traditions, pilgrims, and visitors from all over the world could meet. This condition directly informed Kenzo Tange's approach: instead of reconstructing lost monuments, his MP sought to reframe the landscape as an experiential and cosmic system. As previously mentioned, Tange appears to have distanced himself from both Buddhism as well as traditional Japanese architecture in his work, and was in spite of that later widely praised and

[d] Recognized for its significant cultural, religious and archaeological value, particularly the remains proving it as the Buddha's birthplace [25].

even defined by those very associations - particularly following his receipt of the Pritzker Prize in 1987 and in the period after his death.

2.2.1 Spatially Constructed Sacred Journey

Tange's design philosophy for Lumbini could be partly understood as a response to the historical discontinuities linked with the place. Drawing from his broader theoretical interest in structure, axis, and movement, Tange and his team proposed a MP that reinstated spatial clarity without imposing architectural dominance on the sacred core. The north-south axial organization, the gradual transition from the secular to the sacred, and the deliberate restraint exercised in the Sacred Garden reflect an attempt to translate Lumbini's fragmented history into a coherent modern spatial narrative. This loose, landscape-oriented configuration aligns closely with Kenzo Tange's interpretation of Lumbini as a sacred terrain requiring controlled movement and symbolic sequencing rather than conventional urban density. The layout and placement of all elements, from the visitor/village area to the monastery area and the sacred, peaceful garden, symbolize a spiritual journey from the secular to the sacred, ending at the exact birthplace of the Buddha.

By aligning modern planning principles with the site's ancient pilgrimage logic, Tange transformed Lumbini's history of emergence, disappearance, and rediscovery into a guiding design framework. The MP does not merely accommodate the past; it interprets absence, fragmentation, memory and holistic spiritual reflection of the cosmos, as essential components of place-making. In this sense, the historical evolution of Lumbini is not a backdrop to the MP but could be interpreted as its conceptual foundation, shaping an architectural response that bridges archaeology, spirituality, and modernist planning.

2.2.2. The journey of body and mind as part of the experience of the sacred space

Central to Kenzo Tange's MP for Lumbini is the deliberate use of symbolic geometric shapes (in Tange's own words [23], *the form of a circle enclosing a square is a mystical universal symbol of purity and simplicity*), as also the use of *axis* and *void* as architectural and urban instruments through which spiritual meaning is spatially constructed. Rather than relying on monumental buildings, Tange employs these abstract ordering principles to articulate a sacred journey, transforming Lumbini into an experiential landscape where movement and emptiness become primary carriers of significance. Moreover, the layout of Tange's Sacred Garden cannot be fully apprehended at ground level; its overall structure becomes legible only from an aerial perspective, while on the ground it unfolds as an immersive, almost mystical journey of gradual discovery.

The north–south axial alignment forms the organizational backbone of the MP. Extending from the New Lumbini Village in the north through the Monastic Zone and culminating in the Sacred Garden, the axis establishes a clear directional sequence that guides visitors from the secular realm toward the spiritual core. This linear ordering recalls both ancient pilgrimage routes and modernist planning traditions, reflecting Tange's synthesis of historical precedent and contemporary spatial logic. Symbolically, the axis acts as a conceptual spine that restores legibility to a historically fragmented site. By imposing a strong geometric order on a dispersed archaeological landscape, Tange reasserts coherence without reconstructing lost structures. The axial clarity also enables the coexistence of diverse architectural expressions within the Monastic Zone, allowing national monasteries to align with a shared spatial framework while maintaining individual identities.

Equally critical to Tange's vision is the treatment of the Sacred Garden as a designed void. Unlike conventional developments that emphasize built form, Tange preserves the area surrounding the Maya Devi Temple (constructed exactly on the spot of Buddha's birth) as an open, minimally articulated landscape (as seen on Fig.3). This intentional absence of architectural dominance underscores the primacy of the birthplace itself, reinforcing the notion that sacredness in Lumbini resides in origin rather than monumentality. The void functions both spatially and conceptually. Spatially, it creates visual relief and contemplative distance, isolating the archaeological core from surrounding development. On conceptual, philosophical level, it resonates with Buddhist concepts of impermanence and emptiness, translating abstract spiritual principles into tangible spatial experience. In this sense, it could be argued that Tange's restraint becomes an architectural strategy that aligns modern design with Buddhist thought.

However, although Tange's MP envisioned the Sacred Garden as an open, landscape-dominated space, with architecture kept deliberately subdued, after 1990, conservation strategies shifted toward enclosing the archaeological core within a temple-like protective structure that can be seen on site today, reintroducing architectural dominance at the very center of the site. This is contradicting both Tange's vision and emerging UNESCO landscape-based approaches and has contributed to intensified criticism and increasing calls for reassessment [1], [26].

Fig. 3. Aerial view of the Sacred Garden area, seen from the southern end. Water canal can be seen in the middle, with the Monastic Zones on the left and right of the central axis (Url12).

The deliberate, mindful, spiritual as well as physical journey is an essential part of the experience. Progressing along the central axis was planned as a movement southward through a gradual reduction of scale, noise, and architectural density. Water bodies, pathways, and controlled vistas choreograph this transition, fostering a meditative rhythm that contrasts with the functional clarity of the northern zones. Water canal acts as a symbol of harmony, purity, at the same time acting as a spiritual and physical path, escorting the transition towards the transcendental. This emphasis on procession could be interpreted as a time-based spatial experience, where architecture unfolds through processing movement rather than instant visual comprehension (Fig 4.b).

Fig. 4. (a) Lumbini Museum entrance and (b) the central canal with its long axial layout leading towards the Sacred Garden (photos by author).

The pilgrimage route thus becomes a narrative device, allowing visitors to internalize the spiritual significance of Lumbini through bodily engagement. The act of walking, framed by axial order and culminating in spatial emptiness, transforms pilgrimage into a modern ritual. However, it is important to mention how the eventual

introduction and use of motor boats (as well as tuk-tuks and other means of transport for the visitors) on the central canal can be regarded as problematic from heritage, environmental, and planning perspectives for several reasons; motorized boating undermines the project's symbolic and contemplative intent by introducing noise, fuel odours, water movement, and spectacle that are incompatible with the canal's role as a quiet, meditative element and the site's sense of serenity and introspection that define the site's heritage significance [5], [28]. Observations at the site reveal that most visitors do not partake in the intended spiritual experience of peace, often failing to grasp the essence and purpose of the designed space, and may perceive the MP as largely disconnected from Lumbini's contemporary context.

From the above analysis of the MP it can be understood how Tange intended to reinterpret modernist planning tools to serve a spiritual and archaeological context. The plan avoids stylistic imposition, instead relying on abstract spatial principles capable of accommodating historical absence, temporal diversity and cultural plurality. In doing so, Tange advances a model of sacred landscape planning that prioritizes spatial experience over form, structure over object, and spiritual meaning over physical remains. His approach can be interpreted as a belief that modern architecture can engage deeply with memory, ritual, and place, without sacrificing clarity or universality.

3. Lumbini today: between Disruptions, Disparities, Neglect and Local Disengagement

The implementation of the plan, approved in 1978 and expected to be completed by 1985, has been slow, often disrupted and contested, despite the engagement of Lumbini Development Trust and financial support by the United Nations Development Programme (UNDP). Other than developing the Sacred Garden area surrounding Buddha's birth stone, the land was to be prepared for the future monastic compounds, as well as pilgrims' village that was supposed to include museum, research centre, police station, tourist facilities, accomodations and supporting infrastructure: plumbing, electricity, road access, etc. The design also included the so-called buffer zone and landscaping to separate the park area from the residential settlements. This points to the project's original intention to be a part of a larger plan of the region's development. As already mentioned, the plan remains largely unfulfilled to this day and planned structures are – due to numerous factors, such as bureaucratic inefficiencies, graft, internal changes, including insurrection in Nepali government, as well as the 2001 royal family massacre, or more recently the student unrests - either in a deteriorating state of conservation (see Fig.3 and Fig.4), damaged, used in inappropriate way, unfinished or unbuilt (according to some reports [21], the site was less than 20% completed by 2001).

Fig. 5. (a) View of the neglected structures planned by Tange and (b) the unfinished public utility structures (photos by author).

The Monastic Zones that were originally intended for domestic and foreign Buddhist schools to build respective monasteries (with private money, not interfered with by Nepali authorities) is only partly developed and the grounds, with due exceptions - like the superbly managed German Tara Great Lotus Stupa and the Chinese or Thai monasteries - are unkempt, poorly maintained or even abandoned. There is an obvious lack of basic infrastructure that regards both the Sacred Garden area as the larger Lumbini Terai region. There is almost complete lack of interaction between individual monastic compounds, their visitors and the pilgrims and the same is true for the local population. The development of individual monastic institutions has been criticized partly for its fragmented and uncoordinated nature – although this was, to a certain point, part of the original idea - as many monasteries have been designed and constructed as self-contained projects reflecting the architectural styles, religious traditions, and national identities of their sponsors. This has resulted in a lack of spatial, aesthetic, and

functional coherence across the site, and fragmentation of the conceptual whole of the project. In several cases, institutional priorities have taken precedence over collective planning objectives, leading to uneven development, underutilized infrastructure, and encroachments that undermine the intended sacred landscape. Furthermore, disparities in financial capacity and political influence among sponsoring bodies have produced an imbalanced pattern of development, with some monastic zones highly developed while others remain incomplete or neglected. Collectively, these issues have certainly contributed to the dilution of the MP's integrative vision and have raised concerns about heritage conservation, sustainability, and the long-term management of Lumbini as a unified sacred and cultural site.

In addition, controversies arose with regard to the displacement and resettlement of local communities living within the designated project area. Lumbini is a part of a large archeological landscape, surrounded by a rural hinterland, where a large proportion of its (predominantly muslim) population heavily relies on agriculture. The plan required the clearance of villages and agricultural land to create a controlled landscape, leading to the displacement of long-established residents whose livelihoods were closely tied to the land. Resettlement processes were subject to inadequate consultation, insufficient compensation, and the lack of viable alternatives for income and housing. Many affected families experienced economic marginalization and social disruption as a result of relocation, fostering resentment toward the project and the institutions responsible for its execution. These tensions were further exacerbated by delays in implementation, inconsistencies in policy enforcement, and perceptions that the interests of international stakeholders and religious institutions were prioritized over those of local communities. Furthermore, the majority of local population in and around Lumbini is predominantly non-Buddhist: about 65% of the population in the surrounding villages of Lumbini is Muslim [20]. This has significantly shaped patterns of identification with the site. For many residents, Lumbini has historically functioned less as a living religious landscape and more as an agricultural and residential environment, with spiritual meanings attached to other local traditions and practices. As a result, the designation of Lumbini as an international Buddhist pilgrimage center has often been experienced as externally driven, reflecting the priorities of national authorities, international organizations, and foreign Buddhist institutions rather than those of the local community. Differences in religious affiliation, particularly between the largely Muslim local communities (see above), and the Buddhist character of the sacred site, have weakened feelings of local ownership and emotional connection to Lumbini, thereby posing challenges for effective heritage conservation and sustainable long-term management [1], [2]. Such heritage does not align with the religious practices and cultural traditions of the dominant local socio-cultural groups, which as a consequence results in limited identification with the site and a reduced inclination to perceive it as part of their own collective heritage [2], [15], [17].

In the context of the MP, this disconnect has also intensified tensions surrounding land acquisition, resettlement, and development, as local residents have frequently perceived the transformation of Lumbini less as a shared cultural project and more as a process that imposed restrictions and sacrifices without corresponding social or economic benefits. Consequently, the resettlement issue remains one of the most contested aspects of the MP, raising broader concerns about social justice, participatory planning, issues concerning heritage and identity, and the ethical management of heritage sites. Participatory planning is fundamentally intended to ensure that affected communities are meaningfully involved in decision-making processes, enabling development initiatives to reflect local needs, cultural values, and livelihood priorities while fostering shared ownership and social legitimacy. In the context of Lumbini, such an approach could have been implemented through early-stage consultations, transparent dialogue mechanisms, community representation in planning bodies, and the co-design of resettlement, compensation, and livelihood restoration strategies. However, the limited inclusion of local voices in the formulation and execution of the MP has largely sidelined these principles, contributing to perceptions of exclusion, weakened trust in institutions, and enduring contestation over land acquisition and heritage management. In this respect, the Lumbini case stands in tension with the principles articulated in the Faro Convention, which emphasizes the rights of communities to participate in the identification, interpretation, and management of cultural heritage [3], and underscores heritage as a shared social resource rather than solely an object of expert or institutional control.

4. Conclusion

In the late 1960s, the United Nations and the Government of Nepal initiated the planned development for Lumbini, sacred location of Buddha's birthplace. Japanese architect Kenzo Tange was commissioned in 1972 to design a comprehensive masterplan to protect the archaeological core while structuring the experience of pilgrims and visitors. Tange and his team proposed a functional yet broadly universal design intended to reconcile pilgrimage, tourism, conservation, and symbolic expression. He envisioned Lumbini not merely as a heritage site, but as a Universal Center for Peace, where diverse Buddhist traditions, world religions, pilgrims, and international visitors could converge. This vision fundamentally shaped his approach: instead of reconstructing vanished monuments, the Master Plan reinterpreted the landscape as an integrated experiential and symbolic framework.

Although approved in 1978 and scheduled for completion by 1985, the implementation of the plan has seen many difficulties and disruptions. While the Sacred Garden was developed, much of the planned infrastructure -

including monastic zones, a pilgrims' village, support facilities, and buffer landscaping - remains incomplete, highly neglected or unrealized. Intended as part of a broader regional development strategy, the project has been undermined by bureaucratic inefficiencies, political instability, and governance challenges, leaving many structures unfinished, misused, damaged, or in a deteriorating state of conservation. For instance, the Monastic Zones area, intended for domestic and foreign Buddhist schools to build monasteries independently, remains till today only partly developed and while some are well-maintained, most grounds are neglected, lacking basic infrastructure and interaction between compounds, pilgrims, and the local population. The development has been fragmented and uncoordinated, reflecting sponsors' architectural styles and priorities, resulting in uneven, underutilized infrastructure, spatial incoherence, and imbalanced development. These factors have diluted the plan's vision and raised concerns over heritage conservation, sustainability, and the site's long-term management.

Another controversy surrounded the displacement of local communities in the Lumbini project area, where villages were cleared to create a controlled landscape, but resettlement involved inadequate consultation, absence of inclusion or participation, poor compensation, and limited livelihood alternatives, causing economic marginalization and social disruption. Delays and uneven policy enforcement fueled resentment, especially as international and religious priorities appeared to outweigh local interests. Moreover, with the majority of the surrounding population being non-Buddhist, many locals have limited identification with Lumbini, seeing it more as farmland and residential space than as a sacred Buddhist site.

It could be stated that Lumbini has in the past been largely interpreted in material, symbolic, and visual terms, prioritizing archaeological remains and idealizing sacred landscapes, while intangible cultural practices, agricultural traditions, and the lived heritage of local communities and their needs were largely excluded from the planning and management process. The expropriation of land and the rigid functional zoning effectively displaced local residents from the heritage core, positioning them outside the formal heritage narrative rather than recognizing them as stakeholders or heritage bearers. The prioritization of international pilgrimage, tourism infrastructure, and symbolic spatial order has often conflicted with the socioeconomic realities of surrounding rural communities, highlighting the need to reinterpret Lumbini not only as a sacred and archaeological site, but as a living cultural landscape in which acknowledgment and effective inclusion of the local communities represent an integral core of heritage safeguarding as a pathway toward sustainable development and cultural continuity. Given the exceptional historical, spiritual, and architectural significance of Lumbini, as well as the unique legacy of Kenzo Tange's Master Plan, this project warrants renewed attention from the international community. Reconceived as a center for architectural and heritage studies, Lumbini could serve as a platform for interdisciplinary research, education, and dialogue on sacred landscapes, modern heritage planning, and participatory governance. Such an approach would not only contribute to the preservation and critical reassessment of the site itself, but also position Lumbini as a living laboratory for global heritage practice, reinforcing its relevance for future generations.

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RETHINKING DESIGN EDUCATION IN THE DIGITAL AGE: THE ENDURING ROLE OF HANDS-ON MAKING IN ARCHITECTURAL PEDAGOGY

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Abstract

Digital technologies have profoundly transformed architectural education over the past two decades. Parametric design tools, Building Information Modelling, artificial intelligence and virtual environments increasingly dominate design studios, reshaping both pedagogical methods and students' skill sets. While these tools offer unprecedented opportunities for efficiency and experimentation, they also risk distancing future architects from materiality, construction logic and embodied spatial understanding.

This paper argues that, in the digital age, hands-on making and manual construction practices are not becoming obsolete but are, in fact, more critical than ever within architectural education. Through the example of Lakni Kell (We All Need a Home), a design-build educational initiative founded at the University of Pécs, the study demonstrates how manual engagement with materials, tools and simple structures fosters tacit knowledge, structural intuition and social responsibility that cannot be fully replicated in digital environments.

Drawing on pedagogical theory and practical experience, the paper examines how design-build projects can complement digital design tools by reconnecting students with the physical realities of construction and the social contexts of architecture. The findings suggest that integrating hands-on making into digitally driven curricula supports a more holistic architectural education, preparing students to operate critically, ethically and competently within contemporary design practice.

Keywords: design education; hands-on making; architectural pedagogy; design-build; materiality

1. Introduction

Over the past decades, architectural education has undergone a significant transformation driven by rapid digitalisation. Design studios increasingly rely on computational tools such as parametric modelling, Building Information Modelling (BIM), simulation software and, more recently, artificial intelligence–based design assistance. These technologies have reshaped how students conceive, represent and communicate architectural ideas, often accelerating workflows and expanding formal possibilities.

At the same time, this shift has generated growing concerns within architectural pedagogy. [1] As design processes become increasingly screen-based, students risk losing direct contact with materials, construction logic and the physical constraints that shape built environments. The diminishing role of manual making and full-scale construction in design education may lead to a fragmented understanding of architecture, where spatial concepts are detached from embodied experience and social responsibility.

This paper argues that, paradoxically, the digital age intensifies rather than diminishes the importance of hands-on making within architectural education. Manual construction, material experimentation and design-build practices provide forms of tacit and embodied knowledge that cannot be fully substituted by digital tools. These experiences are particularly relevant when architectural education seeks to address social and ethical challenges, such as housing insecurity and homelessness.

Through the example of Lakni Kell (We All Need a Home), a design-build educational initiative founded at the University of Pécs, this study examines how short, intensive, hands-on workshops can complement digitally driven curricula. The paper demonstrates that engaging students in real-scale construction within socially embedded contexts fosters critical thinking, material literacy and a deeper understanding of architecture's societal role.

2. Theoretical Background

Architectural design has traditionally been understood as a synthesis of conceptual thinking, technical knowledge and embodied experience. Educational theorists such as Polanyi emphasised the significance of tacit knowledge [2]—forms of understanding that are acquired through action and experience rather than explicit instruction. In architectural education, this tacit dimension is closely linked to material handling, tool use and bodily engagement with space.

Schön's concept of "reflection-in-action" further highlights the importance of learning through making. [3] According to this view, design knowledge emerges through an iterative dialogue between the designer and the situation, where resistance from materials and construction processes actively shapes decision-making. Digital design environments, while powerful, often reduce or delay this feedback, substituting physical resistance with abstract simulation.

Design-build pedagogy has emerged as a response to these limitations, reconnecting students with full-scale construction and real-world constraints. By engaging directly with materials and users, students develop a more integrated understanding of structure, detail and responsibility. Previous studies have shown that such approaches enhance spatial intuition, teamwork and ethical awareness, particularly when projects address socially relevant themes. [4]

Within this theoretical framework, hands-on making should not be seen as an alternative to digital design but as a complementary mode of learning. The challenge for contemporary architectural education lies in integrating these approaches into a coherent pedagogical model that reflects both technological advancements and the enduring material realities of architecture.

3. Lakni Kell (We All Need a Home): Design-Build as Pedagogical Practice

3.1 Educational Structure and Pedagogical Approach

Lakni Kell (We All Need a Home) is a design-build educational initiative founded at the University of Pécs that integrates architectural education with socially engaged practice. The programme operates through short, intensive workshops in which students participate in the full design and construction process, from conceptual development to on-site realisation. Typically organised over two days, these workshops challenge participants to make rapid design decisions while responding to real material, spatial and social constraints.

The pedagogical framework of Lakni Kell is grounded in experiential learning and collaborative making. Students work in small, interdisciplinary teams, often alongside international participants, which encourages peer learning and collective problem-solving. Digital tools are used primarily during the initial design phase for communication and coordination; however, the core educational value emerges during the construction phase, where students directly engage with materials, tools and structural logic.

By positioning construction as an integral part of the design process rather than a separate technical exercise, the programme fosters a holistic understanding of architecture. Students are confronted with the consequences of their design decisions in real time, gaining insights into feasibility, durability and safety that are difficult to acquire through digital simulation alone.

3.2 Initiative curriculum context

3.2.1 Departmental Design Competencies

At the Department of Building Structures and Energy Design, it is particularly important that architecture students gain a range of competencies to prepare them for the field, including problem solving, design, knowledge of new materials and technologies and practical experience in the field of construction. The curriculum supports this and helps students to acquire basic skills, which include acquisition of digital design competencies (such as 2D design and 3D modelling).

The We All Need a Home program contributes to this curriculum by highlighting the role of architects in solving important social problems.

The approach acknowledges empathy cannot be attained through lectures and textbooks. As students gain disciplinary and professional knowledge (including competencies in digital design technologies) they learn how to apply it in community workshop contexts that connect to the experiences and insights of people living in underserved communities.
Feedback from previous We All Need a Home projects underscored that the interpersonal exchanges with

unhoused citizens are illuminating life-changing learning experiences. Ultimately students leave the program with an expanded set of competencies in design including:

- sense of how their disciplinary learning connects to their responsibility as citizens
- a keen understanding of the value of the lived experience and knowledge that resides in otherwise disadvantaged communities
- meeting deadlines requires thorough preparation and a schedule so that the construction is completed on time

Additionally, University of Pécs has ten faculties representing many fields of science. To train successful, well-informed students, it is essential to create opportunities for collaboration between different disciplines. Students and teachers of architecture and social psychology have participated in aspects of research phase and students from other faculties have volunteered to some of the case study examples expanded upon in this paper.

3.2.2 The Intersection of Embodied Learning and Digital Competencies

Most of the case study examples engage design, construction and digital competencies that students acquire over the course of their education. Specifically students develop ideas through digital technology (CAD programs and visualization).

What the challenges of this initiative demonstrate, and the case studies will illuminate further, test the limits of digital tools to complex architectural problems of the present-day and future. Students can model spaces digitally but they also must:

- include insights learned in consultation with future residents
- learn physical attributes of traditional construction technologies and tools
- demonstrate professional sustainable development techniques, including project management and financial budgeting
- apply "design thinking" and co-creation methods involving other students, instructors and community members to discover sustainable resolutions.

Through this method, students learn to seek practical answers that can be easily implemented rather than theoretical ones that digital design methods often best support.

Fig. 1. Participants of the workshop are listening to the homeless activists. Image by author

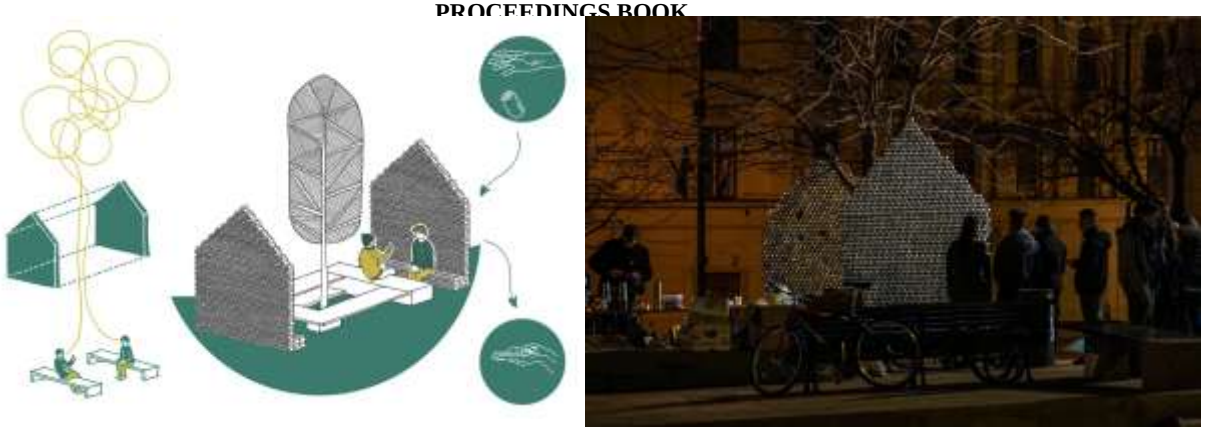


Fig. 2.(a) A slide from the winner's group presentation: The symbolic unfinished house made of beverage cans generates conversation between homeless people and the citizens. (b) Students used 4000 emptied beverage cans to build the structure. At the end of the day every materials were donated to the homeless community. Image by Viktor Novák

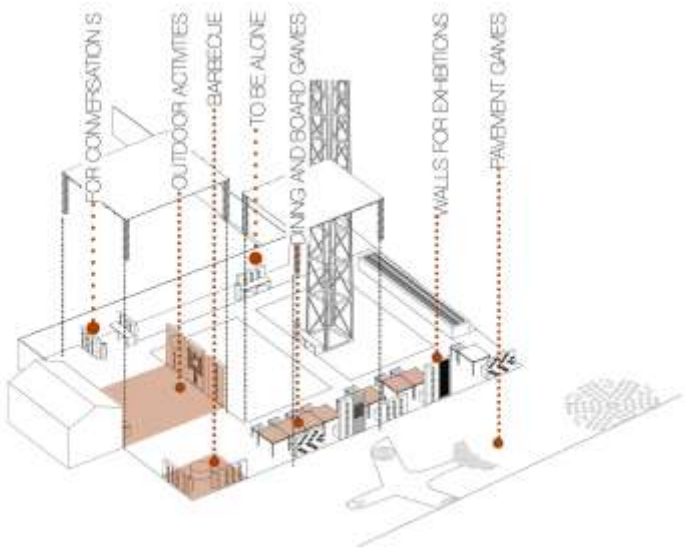
3.3 Case Study 1: Urban Installation in Pécs Main Square (2019)

The first case study examines a temporary urban installation constructed in Pécs Main Square in 2019. The project was developed during a two-day workshop *(Fig. 1)* with international students and aimed to raise public awareness of homelessness through architectural and artistic means. Situated in a highly visible public space, the installation functioned both as a spatial intervention and as a social statement.

Students were required to respond to multiple constraints simultaneously, including limited time, public safety regulations and the symbolic responsibility associated with working in a central urban location*(Fig. 2 a)* . The design process involved rapid prototyping and iterative decision-making, while the construction phase demanded precise coordination and clear structural logic.

From an educational perspective, the project enabled students to experience the impact of architecture beyond academic settings. Engaging directly with the public transformed abstract social issues into tangible spatial questions, highlighting architecture's communicative and ethical dimensions. The physical act of building in a public space reinforced the importance of material choice, stability and craftsmanship, demonstrating how even temporary structures require careful constructional thinking *(Fig. 2 b)*.

3.4 Case Study 2: Outdoor Installation at the Homeless Nursing Home (2020)



The second case study focuses on an outdoor installation designed and built in the courtyard of the Homeless Nursing Home operated by the TÁMASZ Foundation in 2020. Developed during a two-day workshop, the project addressed the need for a usable and dignified outdoor space for residents *(Fig. 3)*. Despite the challenges posed by the COVID-19 pandemic, the installation was successfully realised, underscoring the resilience and adaptability of the design-build approach.

Unlike the public visibility of the first case study, this project was embedded within an institutional and semi-private environment. Students engaged directly with the specific needs of users, requiring sensitivity to everyday use, accessibility and comfort. The design process prioritised simplicity, robustness and ease of construction, reinforcing the importance of pragmatic decision-making.

The educational value of this project lies in its emphasis on socially responsible design under constrained conditions. Students learned to balance conceptual intentions with practical limitations, while the construction process revealed the significance of detailing and material performance *(Fig. 4)*. The project's inclusion in the *Design for the Common Good* exhibition at the Metropolitan University in Budapest in 2023 [9] further demonstrates its relevance as an example of socially engaged architectural education .

3.5 Case Study 3: Temporary Shelter at Szigeti Tanya, Pécs (2023)

The third case study examines the construction of a temporary shelter for a homeless couple at Szigeti Tanya in Pécs in the autumn of 2023. Unlike the previous installations, this project operated at a highly intimate scale *(Fig. 5)*, with direct and immediate consequences for its users. The shelter was conceived and built as an interim housing solution, emphasising functionality, thermal comfort and structural stability.

Students were involved in all stages of the process, including material selection, structural detailing and on-site assembly. Working at a 1:1 scale confronted participants with the realities of inhabitation, requiring careful consideration of dimensions, enclosure and weather protection. The construction process highlighted the limits of digital representation, as many design decisions were refined through physical adjustment and problem-solving on site.

Pedagogically, this project represented a critical learning moment in terms of ethical responsibility and empathy. The direct relationship between design decisions and human well-being reinforced architecture's social impact. The project received significant public attention and was awarded the *Made in Pécs* Prize, reflecting its broader cultural and educational significance *(Fig. 6a,b)*.

Fig. 4. Every building materials were upcycled or recycled. Students used simple technologies and structural solutions. Image by author

3.6 Pedagogical Implications

Across the three case studies, a consistent pedagogical pattern emerges. Hands-on making enables students to develop material literacy, structural intuition and a sense of responsibility that extends beyond

formal design outcomes. The design-build format transforms architecture from a representational exercise into an embodied practice, where knowledge is produced through action and reflection.

Fig. 5. The prospective resident, one of the students involved in the design, and the author of the article discuss the plans. Image by author

These projects demonstrate that manual construction is not a nostalgic return to pre-digital education but a necessary complement to contemporary digital design tools. By integrating hands-on making into architectural curricula, educators can cultivate a more balanced and critically informed design education that prepares students to engage meaningfully with both technological and societal challenges.

4. Discussion: Integrating Hands-On Making into Digital Architectural Education

The case studies presented above illustrate how hands-on making can enrich architectural education in ways that are difficult to achieve through digital design environments alone. While digital tools have expanded the capacity of designers to explore complex forms, simulate performance and visualise ideas at

Fig. 6 (a) the shelter, designed by the students was built from recycled building materials. (b) Interior of a transitional shelter

speed, they risk cultivating expertise that is *detached from material realities, physical constraints and social contexts*.

As Schön's notion of reflection-in-action suggests, design knowledge is often produced in the dynamic interplay between action and feedback — a process that is most potent when mediated through real materials and tools rather than solely via screens.

The *Lakni Kell* projects demonstrate that **embodied and tacit knowledge**, acquired through direct construction, cannot be fully substituted by virtual simulation. In the workshops and build-outs described, students negotiated real structural challenges, responded to unpredictable site conditions, and adapted their design decisions in response to material behaviour — all within compressed timeframes that foregrounded *decision-making under constraint*. These experiences align with research indicating that hands-on making supports the development of spatial intuition, structural literacy and material sensibilities that are otherwise difficult to cultivate in purely digital studios.

Moreover, the projects relied on **community engagement and social interaction**, reinforcing the idea that architecture is not just a technical discipline but also a civic practice. In the courtyard installation for the Homeless Nursing Home, students collaborated with social workers and residents to reimagine a neglected space in ways that addressed human needs and fostered agency — a process that reflects the *community-centred practices* emphasised by the *Design for the Common Good* network. This iterative, dialogic approach to design foregrounds *ethical responsiveness* alongside technical competence.

Importantly, the projects also reveal how manual making can contextualise digital design thinking within *broader social and ecological concerns*. The courtyard installation, for example, utilised recycled and low-budget materials to achieve a versatile, barrier-free space; students learned to prioritize sustainability and user needs alongside architectural form. The shelter built at Szigeti Tanya for a homeless couple further highlighted how design must be accountable to *tangible human conditions* — dimensions that extend beyond algorithmic optimisation or formal visualisation.

The *Lakni Kell* model therefore suggests that the contribution of hands-on making is not merely additive, but *transformative*: it reshapes students' understanding of what it means to design, to build, and to serve communities. Integrating these practice-based experiences into curricula alongside digital design tools yields a more balanced pedagogical approach, one that acknowledges both the *virtual* and the *material* as essential sites of learning.

5. Evaluation of Student Experience

5.1 Methodology

To assess the educational impact of the hands-on building exercise, a short questionnaire was distributed among students who participated in the studio project. A total of 19 students responded to the survey. The questionnaire consisted of nine statements evaluated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), as well as one open-ended question inviting students to reflect on their experience.

The survey addressed three main aspects: students' learning experience, the relationship between digital and physical design processes, and the perceived educational value of hands-on building activities.

5.2 Results

The survey results indicate a generally positive perception of hands-on implementation among participating students.

A large majority of respondents (84%) agreed or strongly agreed that hands-on implementation helped them better understand spatial relationships in their designs. Similarly, 73.7% of students reported that physical implementation improved their understanding of architectural forms and scales.

In terms of the design process, 68.4% of respondents indicated that working with physical materials helped them develop new design ideas, while the same proportion agreed that the process of building helped refine their architectural concepts.

The results also highlight the complementary relationship between digital tools and physical implementation. A significant majority of students (84.2%) agreed that digital tools alone would not have

provided the same insights as physical building work. Additionally, 68.4% reported that combining digital and physical approaches improved their design process.

Physical models were also perceived as valuable evaluation tools, with 73.7% of respondents indicating that they helped them assess their designs more effectively than digital models alone.

Regarding the overall learning experience, 78.9% of students agreed that the hands-on building exercise enhanced their studio learning experience, and a similar proportion expressed interest in seeing more hands-on assignments integrated into architectural education.

Responses to the open-ended question emphasized the importance of tactile interaction with materials and the opportunity to gain practical knowledge about construction and material properties. Several students also highlighted the social dimension of the project, noting the value of contributing to a real-world initiative aimed at helping people in need.

6. Conclusion:Towards a Holistic Design Education for the Digital Age

This study explored the pedagogical value of hands-on building activities within architectural education in an increasingly digital design environment. While contemporary architectural practice relies heavily on digital tools, the results of this project demonstrate that physical making continues to play a significant role in developing students' spatial understanding and design thinking.

The studio exercise described in this paper provided students with the opportunity to engage directly with materials and construction processes, allowing them to experience architectural concepts beyond digital representation. The resulting student projects illustrate how hands-on implementation can support the refinement of design ideas while strengthening the connection between conceptual design and physical construction.

The survey conducted among participating students further supports these observations. The majority of respondents reported that physical implementation helped them better understand spatial relationships, architectural form, and material properties. Students also emphasized that the combination of digital design tools and hands-on building activities enriched their design process and improved their ability to evaluate their projects.

In addition to the pedagogical benefits, the project also demonstrated the value of socially engaged architectural education. By contributing to a real-world initiative aimed at supporting people in need, students were able to connect architectural learning with social responsibility and community engagement.

Overall, the findings suggest that hands-on making remains an essential component of architectural pedagogy. Rather than being replaced by digital technologies, physical model making and building activities can complement digital tools, providing a more comprehensive learning experience that integrates conceptual design, material understanding, and social awareness.

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CONCEPTUALIZING ECOLOGY-BASED ARCHITECTURAL DESIGN EDUCATION AS A TEACHING MODEL

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Abstract
Sustainability challenges that have become more visible due to the effects of the climate crisis have made it crucial to offer long-term and effective solutions. In this context, educational approaches aimed at raising awareness of the ecological impacts of the built environment are gaining importance. This study examines an ecology-based architectural design education program designed to both develop solutions to ecological problems and address the scarcity of architectural education programs for adolescents. Thus, the study aims to conceptualize the ecology-based architectural design education program as an educational model by examining its relationship with scientific and educational models. The study is structured as a conceptual model discussion. The program, designed for the 14-17 age group, aims to improve the perception of the built environment, increase ecological awareness, and enhance architectural literacy through ecology-based architectural design education. It is discussed within the framework of philosophical accounts of scientific models, based on the perspective that educational models can be considered as a subtype of scientific models. The program is conceptualized as an educational model by considering its theoretical, practical, and well-documented qualities as a prototypical intervention. This study proposes an educational model for this age group that focuses on ecology-based education, which can expand learning environments and support the design of similar programs.
Key Words: ***Architectural education; Ecological design education; Built environment perception; Teaching models; Learning by design***

1. Introduction

Our world faces many global problems, such as the depletion of nonrenewable natural resources, the loss of biodiversity, and epidemics, all due to the effects of the climate crisis and unsustainable consumption patterns. It is widely recognized that a significant portion of the use of non-renewable natural resources, which are essential for the sustainability of life on Earth, is consumed during the construction phase of the built environment. This makes awareness efforts regarding the built environment crucial.

According to the United Nations, every person under the age of 18 is considered a child [1]. It is believed that the most efficient way to shape a society in the shortest time and to establish sustainability-based habits is to guide and contribute to the development of children, who are the future members of society. Children whose healthy development is valued, who receive balanced care, who are given a voice, whose learning is encouraged, whose talents are developed, and who can be active participants rather than passive observers in the societies in which they live will be able to have an effective say in both making sense of the present and directing the future. The right of children to freely express their views on matters that concern them, as defined by the 1989 United Nations Convention on the Rights of the Child, points to the importance of children having a voice in all areas of life as participants [1]. Therefore, providing children with education about the built environment is becoming increasingly important to develop their environmental awareness and problem-solving abilities. This education is important not only for children to become architects, but also because it enables them to become part of society, take on participatory roles, develop awareness and problem-solving skills related to the built environment, and enhance their ability to express themselves. In her study, Arın (2015) states that a comprehensive built environment education given to children will have positive effects on the formation of urban consciousness, the internalization of participatory processes, and the active participation of children and young people in the formation of the built environment [2].

Furthermore, considering that establishing a connection with nature in childhood leads to a closer engagement with environmental problems in the future [3], activities that enable children to connect with nature also gain importance. However, starting with problems that children cannot cope with or connect with while trying to make them take responsibility for nature creates ecophobia that distances the child from nature and taking responsibility for nature [4]. Therefore, it is believed that an ecology-based built environment education given to the appropriate age group can both enable children to connect with nature without creating ecophobia and increase their awareness of the built environment, making them informed and active participants in their surroundings. Furthermore, children will develop awareness of global and ecological problems through this method, gain the ability to find solutions to problems they can identify, and thus acquire the capacity to play a role in building the future. Moreover, there are limited studies in child and architectural education targeting this age group, and there is a need for education in this area.

In this context, an educational program has been prepared for high school students aged 14-17 to improve their perception of the built environment and develop ecological awareness regarding the built environment. The Ecology-Based Architectural Design Education program is a 16-hour program consisting of 8 sessions. Due to its multidimensional structure, applicability, repeatability, and transferability, the program is significant as a proposed ecology-based education model in the fields of child and architectural education. It is thought that the education, which will apply the design-oriented thinking method [5], enabling individuals to bring creative and useful solutions to the problems they encounter with a solution-oriented perspective, can also contribute to the development of 21st-century skills [6], which are considered to be the most important skills of the future, defined as collaboration, communication, critical thinking, problem-solving, creativity, culture, and character education. The prepared education program is evaluated as an educational model as a subtype of scientific models due to its qualities such as being a prototype tested in the implementation phase, combining many learning activities around a single goal, having a repeatable and transferable structure, being verifiable, and creating a classroom learning atmosphere.

Within the scope of the study, the aim is to describe the prepared curriculum in detail, to conceptually explain scientific models, and to define the characteristics of educational models. Afterwards, it is planned to evaluate the education program in terms of these determined characteristics and to conceptualize ecology-based architectural design education as an educational model.

2. Scientific Models

Frigg & Hartmann state that models are epistemic tools that represent and explore the world, defined as mediators between theory and the world, created through idealizations and simplifications, and playing an active role in scientific discoveries [7]. Models are created to enable research into the phenomenon itself through simulations, 3D models, theory, maps, etc. [8]. Phenomenological, computational, developmental, explanatory, theoretical, scaled and mechanical models are some of the concepts used in classifying models [8]. These concepts can be diversified according to the types of studies.

The first step in model development is identifying the phenomenon to be studied and constructing the model [9]. Considering that models are simplified and idealized versions of reality, they enhance understanding of the research area, allow for application in situations where direct experimentation is not possible, and can be used to predict possible effects. Weisberg states that some models that accurately represent the structure under investigation can make quantitatively precise predictions and others can only provide qualitative fit [9].

Parker points out that if the model is declared reliable after yielding accurate data, it carries the risk that the model's results for other studies may also be accepted as accurate without thorough investigation. Therefore, she argues that rather than being accepted as generally accurate, models should be evaluated based on their suitability for the purpose for which they were designed [10]. This understanding of models allows for the conceptualization of educational programs as researchable and evaluable pedagogical interventions. Wilson & Cole define educational models as theory-based, field-tested prototypes and state that the developed model becomes a validated prototype [11]. Schweinhart, on the other hand, defines educational models not as a single educational practice but as an intervention method based on a complex system with definable components and scientific evaluation [12].

Based on all these approaches, it can be said that teaching models are educational scientific models. This is because they are intervention methods consisting of many components that simplify a specific academic

field, making it understandable and applicable, and are adequate for the purpose for which they are designed. Furthermore, they can be theoretically developed and applied in the field. Within the scope of this study, Ecology-Based Architectural Design Education will be conceptualized as an educational model due to its ability to simplify and make architectural education understandable for students aged 14-17, its adequacy for the purpose of raising built environment awareness, its theoretical development and practical application in the classroom, and its intervention-based structure consisting of numerous components. In this context, the content of the educational program will first be described, and the aspects that make the program an educational model will be discussed.

3. Ecology-Based Architectural Design Education

The Ecology-Based Architectural Design Education program is an educational program which can be conceptualized as a teaching model structured to simplify architectural education for a specific age group. Within this conceptual framework, the program was developed as a pedagogical intervention structured according to the educational model approach discussed above. It is a 16-hour educational program consisting of 8 sessions, designed for students aged 14-17. The program aims to develop children's awareness of the built environment, provide fundamental knowledge of architectural education to enable students to participate actively in the built environment in their adult lives, make ecological concepts concrete through practice, and pave the way for taking steps towards a sustainable world. Because the study is ecology-based, the program was designed to be implemented with 14-17 year old students who have developed the ability to think and discuss abstract concepts, in order to reduce the possibility of creating ecophobia by avoiding overwhelming narratives. Before preparing the program, key development theories, together with Howard Gardner's theory of multiple intelligences and Urie Bronfenbrenner's ecological development model were reviewed. The ecological development model places the child at the center of development and states that the child interacts with the family, school, neighborhood, and cultural systems surrounding them, and that the child develops through these relationships [13]. The Ecology-Based Architectural Design Education program is also considered to be one of the approaches that can enable the child to reach a competent position in society by placing the child at the center. According to Gardner, who says that intelligence cannot be reduced to a singular structure and is multidimensional, intelligence is the ability to solve problems and produce products within a cultural context, and encountering stimuli that activate more than one intelligence area increases the learning retention [14]. Therefore, the ecology-based architectural design education has been designed to appeal to the maximum number of intelligence types possible. In this context, the ecological development model and the theory of multiple intelligences have been the theoretical foundations of the study in terms of child development. Before the development of the program, literature reviews were conducted, and architectural education programs prepared for children were examined. Before starting the study, an opportunity was provided to observe a successful educational program in practice by participating as an observer in a module consisting of 14 lessons within Arkki Türkiye. In addition, through the children's architecture and design courses offered at the IAU Children's University, trials of the programmed courses were conducted and practical experience in the field was gained.

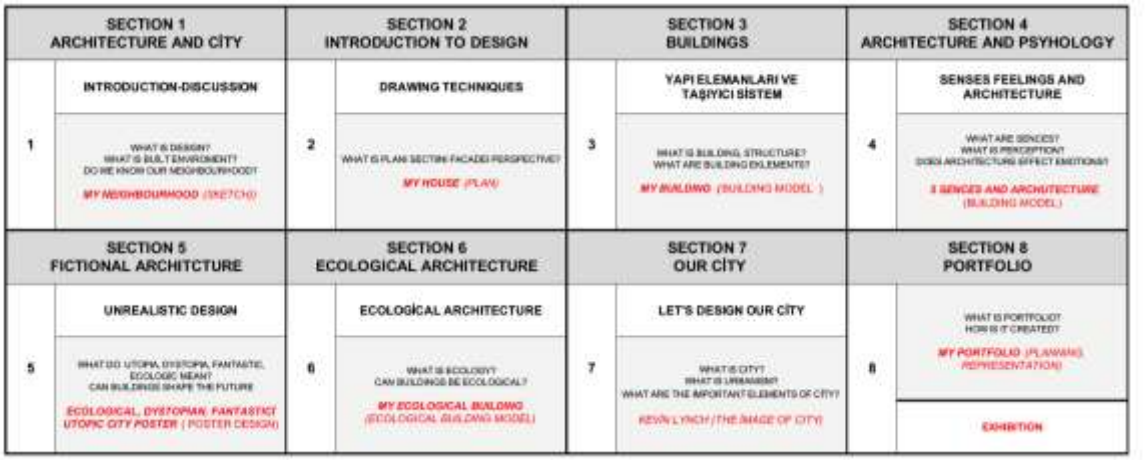

Fig. 1 Ecology-Based Architectural Design Program

As a result of the studies conducted, an ecological architectural education program consisting of 8 sessions has been designed, carefully covering key dimensions of architectural education. The program comprises the following sections: Architecture and City, Introduction to Design, Buildings, Architecture and Psychology, Fictional Architecture, Ecological Architecture, Our City and Portfolio. The goal was to make the education easy to understand and implement, and each session was designed to be completed within two class periods, aligning with the high school curriculum. Furthermore, approval for age and content suitability was obtained from a curriculum and assessment expert and a psychological counseling expert. Within the scope of the education, concepts and content related to architectural education have been simplified and idealized according to age group suitability, thereby creating an educational program with a project-based learning model. In designing the program, an attempt was made to create a simplified reflection of education in the field of architecture, a model that can be applied by other instructors with similar guidelines and content, easily understood and implemented by students, and thus contributing to the development of their perception of the built environment. The designed program was tested in a high school in the Beşiktaş district of Istanbul.

Ecology-Based Architectural Design Education is a program built upon the qualities of educational models, such as suitability for the target audience, pedagogical effectiveness, scope, applicability, capacity for documentation, defined and detailed content, and transferability by different educators. The program is designed to reflect the fundamental topics of architectural education, simplified and idealized for the 14-17 age group. The curriculum is structured as follows: Lesson 1: Professional Awareness; Lesson 2: Architectural Design; Lesson 3: Building Knowledge and Technology; Lesson 4: Environmental Psychology and Aesthetics; Lesson 5: Sustainability; Lesson 6: Restoration and Sustainability; Lesson 7: Landscape and Urban Design. Lesson 8 is structured to represent synthesis and presentation dimensions in architectural education. Accordingly, by bringing together the components of the curriculum and making them visible and traceable, this lesson contributes to the documentability of the model.

3.1. Architecture and City Workshop

The first lesson of the education, the Architecture and City Workshop, is a workshop where participating students and the instructor get to know each other, explanations are given about the lessons to be taught throughout the program, the concept of the city is discussed, ideas about the built environment they live in and the city are explored, and a short presentation is given about design-related professions. After the discussion and presentation, students are asked to draw a simple map of the route from their homes to the nearest grocery store or market.

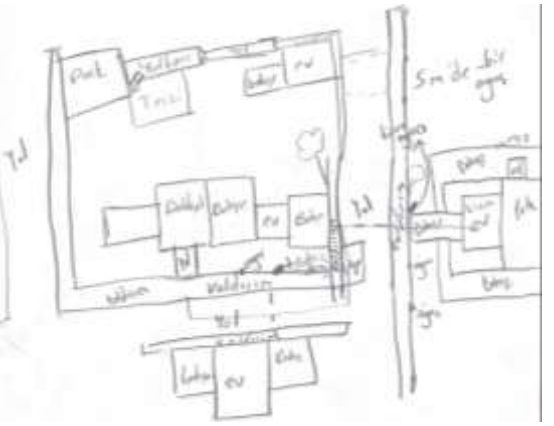

Fig. 2 Sketch Study

Through this activity, students learn about design professions, the concepts of city, user and built environment, communicate their ideas within a group, increase their awareness of their environment through the sketch they draw and begin to express themselves in a simple and confident way. This introductory workshop reflects the model's aim of simplifying architecture for the target age group.

3.2. Introduction to Design Workshop

The second lesson of the education, the Introduction to Design workshop, is a workshop where students learn basic drawing techniques along with concepts such as plan, section, elevation, perspective, and site plan, using examples, through a short presentation at the beginning of the lesson. Within the scope of the

workshop, students are given a 1:50 scale unfurnished plan sheet consisting of a one-bedroom apartment layout as well as a 1:50 scale furniture sheet that can be used in this project. Students are asked to create a plan and furnish the plan according to what they learned in the presentation and to write a short narrative about their home. During the work, students are supported with guidance when necessary. When the work is completed, they are asked to talk about their house and its story to their group members.

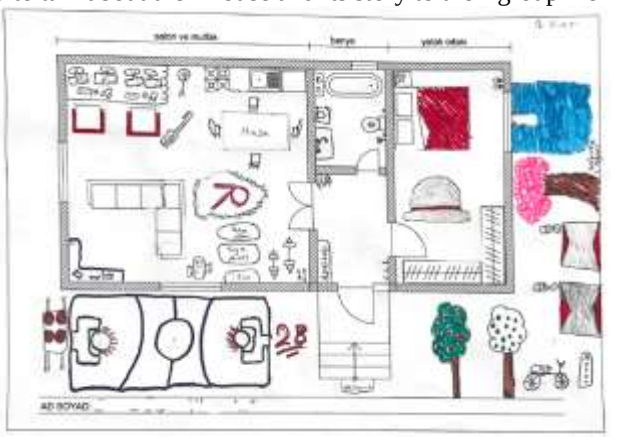

Fig. 3 My House

Through this workshop, students learn the concepts of plan, section, elevation, perspective, site plan, and scale, thus beginning to acquire basic architectural literacy. Furthermore, through the "My Home" project, which is a practical application of the workshop, they have the opportunity to reinforce what they have learned and begin to evaluate things from both user and designer perspectives. In this workshop, the simplification of the architectural design process becomes visible.

3.3. Buildings Workshop

The Buildings Workshop, the third lesson of the education, is a workshop where building types, traditional and modern construction techniques, and building elements are explained in a simplified way through a presentation. Following this, students are asked to build a self-supporting building model using the materials provided, incorporating the building elements described in the presentation. After the presentation, before starting the model, students are given pencils and drawing paper, and they first design their buildings on paper and then create their models. After completing their models, they are also asked to reflect on their design decisions and to describe their buildings.

Fig. 4 My Building

Through this exercise, students gain an understanding of building types, building elements, construction techniques, and load-bearing systems, while reinforcing what they have learned through practical application. They begin to reflect on their design decisions through drawing and develop basic model-making skills. Furthermore, by verbally explaining their ideas, they develop their self-expression skills within a group setting. This workshop provides an understanding of how complex architectural systems can be simplified within teaching models.

3.4. Architecture and Psychology Workshop

The fourth lesson of the education, the Architecture and Psychology Workshop, begins with a short presentation discussing the concepts of sense, perception, and aesthetics, as well as the effects of senses on architecture. The presentation aims to illustrate the connection between design and psychology by showing examples of structures that appeal predominantly to a particular sense. Following the presentation, students are asked to transform the structures they designed in the previous workshop, i.e. Buildings Workshop, into structures that appeal to a chosen sense. The work begins with drawing and designing the structure on paper, and after the main decisions are made, they move on to modeling.

Fig. 5 5-Sensory Architecture

In this process, students develop awareness of the effects of the built environment on people and how structures are perceived, and while transforming a structure to appeal to the senses, they develop awareness of their own senses and the psychological effects of the built environment. Furthermore, by transferring an existing model into a drawing and using it as a transformation project, they both improve their skills in expressing their ideas through graphics and models, and develop awareness of the transformability of existing structures. This workshop connects the educational model to reality through senses and emotions.

3.5. Fictional Architecture Workshop

The fifth lesson of the education, the Fictional Architecture workshop, begins with a brief presentation explaining the concepts of utopia, dystopia, fantasy, and ecology, and presenting examples of built environments that illustrate these concepts. Following the presentation, students are divided into groups and asked to choose one of the concepts and design a built environment poster based on that concept. After the work is completed, the posters are displayed, and the scenarios and solutions they have developed are discussed.

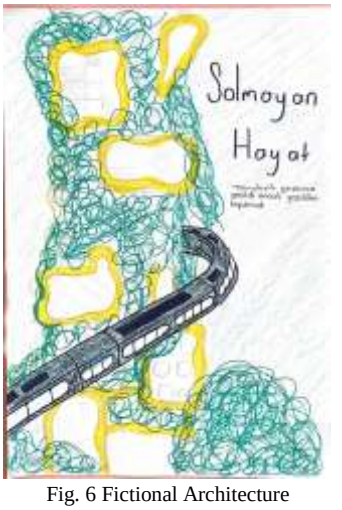

Fig. 6 Fictional Architecture

In this activity, students develop an understanding of utopia, dystopia, fantasy, and ecology, and develop possible built environment scenarios. In this work, where they free their minds by generating ideas with approaches abstracted from reality, they gain awareness of the transformative power of architecture and the possibility of ecology as a solution for a sustainable world. This workshop reflects the predictive aspect of scientific models.

3.6. Ecological Architecture Workshop

The sixth workshop of the education, the Ecological Architecture Workshop, begins with a short presentation defining the concepts of ecology, ecological footprint, sustainability, and ecological architecture, and showing examples of traditional and contemporary structures and their construction techniques. Following the presentation, students are given materials such as gourds, moss, wood, stone, and rope, and asked to transform the gourds into ecological structures. The workshop begins with drawing the gourd on paper, and the design starts on paper and continues on the model. After the model is completed, the drawing is updated based on decisions made during the model making. After the work is completed, students describe their structures and their characteristics.

Fig. 7 Ecological Building

As a result of this work, students examine the concepts of ecology, ecological footprint, and sustainability, gain an understanding of traditional and contemporary examples of ecological architecture, and design a building model incorporating ecological principles. Because they use a solid base, instead of focusing on structural stability, they focus on the qualities that will make it ecological, reinforcing their knowledge of ecological architecture. Furthermore, the use of natural materials helps to establish a connection with nature. Building upon the drawings and models they've created since the beginning of the workshop, students in this workshop also develop their ability to express themselves through drawing and model making, and to communicate in a classroom setting. This workshop makes the developmental aspects of the educational model visible by fostering ecological awareness.

3.7. Our City Workshop

The seventh workshop of the education, "Our City Workshop," begins with a presentation discussing the concepts of city, urban studies, and urban and regional planning, referencing Kevin Lynch's book "The Image of the City" and explaining the elements that constitute a city. Students are then divided into five groups, each tasked with designing a city element. A drawing surface is created by hanging black cardboard panels and each group is asked to take turns drawing their assigned city element. The city design is completed through group work.

During this activity, students learn about the concepts of city, urbanism, and urban and regional planning; they gain an understanding of city elements and what should be present in a city; and they can express the elements that make up a city through drawing. They develop the ability to evaluate the city they live in by understanding that cities are a designable and transformable whole. In addition to improving their ability to express their ideas through drawing, they also develop their collaborative skills. By addressing the built environment as a whole, this workshop reflects the model's adequacy for its intended purpose.

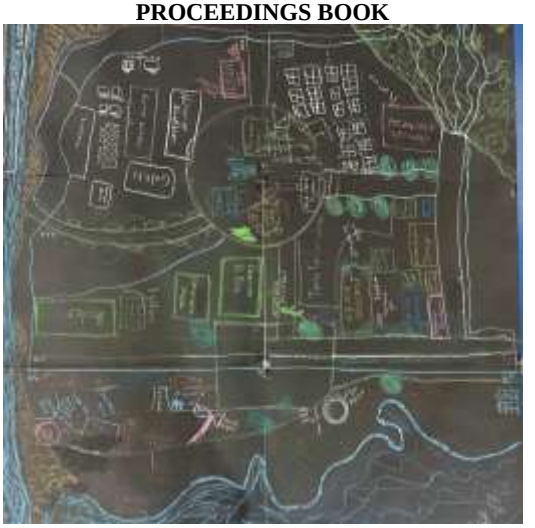

Fig. 8 Our City

3.8.Portfolio Workshop

The Portfolio Workshop, the eighth and final workshop of the education, begins with a presentation explaining the concepts of CV and portfolio and their importance for design-related fields. Following a discussion of what was done and learned during the training, students are given images of their earlier projects and asked to create a portfolio on cardboard in their choice of color, showcasing their work from the workshop. Once completed, the portfolios are displayed in a shared area, allowing students to present all of their work from the workshop.

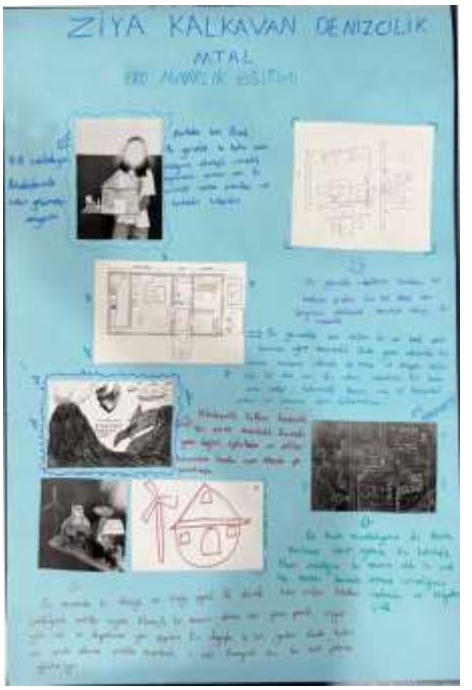

Fig. 9 My Portfolio

Through this work, students gain knowledge about CVs and portfolios, understand the importance of portfolios in the design field, and develop the ability to present their work to their peers. By seeing all their work together, they gain self-awareness by tracking their own development trajectory, as well as the ability to value and take ownership of their work, experiencing a sense of accomplishment. This workshop contributes to recording, compiling and documenting the teaching process of the model.

4. Discussion: Conceptualizing the Educational Program as an Educational Model

This section will discuss how Ecology-Based Architectural Design Education can be evaluated within the framework of theoretical criteria for educational models and how it can be conceptualized as an educational model. Within the scope of this study, the educational model approaches of Wilson & Cole, Schweinhart, Joyce & Weil, and Erkenberg will be briefly defined, and Ecology-Based Architectural Design Education will be evaluated through these approaches.

Wilson & Cole define educational models as prototypes developed based on theory and tested in the field during the application phase, where numerous educational factors are combined into a single functioning system [11]. However, they emphasize that the components of this prototype should be simplified in a way that does not create cognitive load within themselves. The Ecology-Based Architectural Design Education program, as Wilson & Cole state, is an educational program created by bringing together numerous educational elements. The education, created based on theory, is tested in the application phase, and its functionality can be checked with various measurement tools. Furthermore, although the program has a structure consisting of many components, each application is implemented through simplified programs aimed at being age-appropriate for the students so as not to cause confusion.

Schweinhart defines the educational model not as a single education, but as a model consisting of multiple sessions with definable components, and states that for the educational model to be a validated educational model, it has to align with the standards of comprehensiveness, documentation, internal consistency, faithful applicability, model effectiveness, education effectiveness, and dissemination [12]. Ecology-Based Architectural Design Education, as described above, is an educational program consisting of multiple sessions with definable components. For the educational program to be a validated educational program, it has to meet the following standards: comprehensiveness, which includes different dimensions of architecture and is a systematic education considered in terms of process and output; documentation, which aims at post-application documentation with lesson plans, guidelines, materials to be used, and measurement tools, and presenting all work as a final product; and internal consistency, which is ensured by the program being centered around a single purpose and its components being compatible and consistent with each other. Other standards include the dimension of faithful applicability, where the education guidelines are clear and the materials and flowchart have definitions of expected outcomes; the dimension of model effectiveness, where the model is measurable through surveys, scales, and evaluation forms; the dimension of education effectiveness, where the guidelines, material lists, and flowchart are teachable through trainer training; and the dimension of dissemination, where the program is applicable in other schools, cities, and contexts.

Joyce & Weil, focusing on the relationship between models and teachers in the classroom environment, define model families to which they believe the models belonged, namely the "information processing family, social interaction family, personal resources family, and behavioral systems family," and state that the model creates a learning environment in the classroom [15]. In this context, it is possible to improve the competence of the instructors and ensure the applicability of the model through the instructor training programs to be offered to instructors during the dissemination phase of the Ecology-Based Architectural Design Education model. Although architectural practice cannot be reduced to a single family due to its interdisciplinary nature, the prepared program can be related to the "information processing family" with its analytical and problem-solving qualities, to the "social interaction family" with its group work, discussion, and collaboration aspects, and to the "personal resources family" with its creativity, self-awareness, and self-expression qualities. In addition, the program creates an engaging learning environment in the classroom where students work enthusiastically.

Erkenberg, on the other hand, defines collaborative learning models by dividing them into 4 subgroups: problem-based learning, case-based teaching, design learning, and cognitive apprenticeship, and states that collaborative learning models are an alternative to traditional models [16]. Ecology-based Architectural Design Education is related to problem-based learning by offering learning opportunities in the process of seeking solutions to a specific problem, case-based learning by taking place through examples in presentations, learning through design due to the design-based structure of workshops, and cognitive apprenticeship collaborative education models by starting with a presentation and transitioning from an active learning process to an observational process. When all these theoretical frameworks are evaluated as a whole, it is possible to conceptualize Ecology-Based Architectural Design Education as an educational

model that includes collaborative learning models by creating a learning atmosphere that is not a random series of activities, but rather a combination of activities that are brought together within a specific purpose, complementary, applicable, verifiable.

Although it has been stated that the study can be conceptualized as an educational model due to all these common characteristics with educational models, the study does not claim to be a basic architectural education because it is prepared for the relevant age group and cannot cover all architectural education. The educational program, as in all scientific models, demonstrates its adequacy for the purpose for which it was prepared within the scope and features in which it was designed [10].

5. Conclusion

This study focuses on the Ecology-Based Architectural Design Education Program, developed to enhance built environment perception, ecological awareness, and architectural literacy among the 14-17 age group, and examines its position within educational models. The study aims to conceptualize the program as an educational model within the framework of scientific and educational model discussions. The Ecology-Based Architectural Design Education program is described in detail, scientific and educational models are defined, and the qualities that enable the program to be conceptualized as an educational model are emphasized. The study argues that the program is suitable as an educational model because it harmoniously combines different educational practices, has an easily understandable structure, and is a program that is first developed theoretically and then tested in the field. Furthermore, the findings suggest that this multi-component structure can be evaluated within the scope of an educational model because it possesses the qualities of documentation, consistency, applicability, effectiveness, and dissemination, and creates a learning atmosphere. It is explained that the study may not yield the same outcomes for all age groups and all forms of architectural education, and that, as with all models, it is adequate for the purpose for which it was designed. It is believed that conceptualizing the program as an educational model can serve as a basis for adaptation and dissemination efforts by documenting it for other studies that can be conducted in the field. Furthermore, as an ecology-based architectural education program designed to address a gap in the field, it can form a foundation for both children and architecture education studies and research on educational models. The scope of the study can be expanded by examining the results across different target age groups, enriching the educational program, and comparing the outcomes by applying it to different socioeconomic and sociocultural groups.

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FAÇADE AND ROOF ANALYSIS FOR RENEWABLE ENEGY INTERVENTIONS IN STUDENT DORMITORIES AT EMU CAMPUS IN GAZİMAĞUSA / NORTH CYPRUS

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Abstract
Student dormitories represent one of the most energy-intensive building types on university campuses due to continuous occupancy, high cooling or heating demand, and reliance on electricity as the primary energy source. At Eastern Mediterranean University [EMU] in Gazimağusa, North Cyprus, existing dormitory buildings exhibit poor façade and roof performances, significant operational energy waste, and limited integration of renewable energy systems. This study investigates suitable renewable energy interventions as climate protection strategy for the student dormitory (DAÜ 6) through energy retrofit strategies focused on façade and roof performances by means of renewable energy integration. Using a qualitative, design-based methodology supported by existing literature, the research evaluates the building facades and roof areas suitable for renewable energy interventions such as building-integrated photovoltaics, solar thermal collectors, and heat pump systems. The study establishes climate-protective parameters and proposes façade- and roof-based retrofit strategies tailored to Mediterranean climatic conditions. Findings suggest that optimizing the façade and roof performances significantly enhance the feasibility and effectiveness of on-site renewable energy systems, positioning student dormitories as high-impact candidates for campus-scale climate protection strategies.

Key Words: *Student Dormitories; Climate Protection; Façade and Roof Analysis; Energy Retrofit Strategies; Renewable Energy Intervention*

1. Introduction

The building sector is a major contributor to global greenhouse gas emissions, accounting for nearly 36% of all energy-related greenhouse gas (GHG) emissions. This is primarily due to operational emissions required for heating, cooling, lighting, and domestic hot water in these structures [5-6]. It is, however, often exposed to the same climate change it contributes to. As cooling and heating needs rise, energy use grows, and this directly affects both the comfort and daily well-being of occupants. Therefore, addressing these issues through energy retrofits is a high-priority strategy that has the potential to offer significant reduction in carbon and greenhouse gas (GHG) emissions [3].

Universities have a unique and exemplary position in society. Positioned at the forefront of science and education, they bear the responsibility of leading by example in energy efficiency and sustainability. Within these campuses, student dormitories have been identified among the highest energy-consuming building types due to year-round occupancy, high user density, and intensive cooling/heating demand. These buildings, therefore, provide unique opportunities to implement climate-responsive retrofit strategies, combining passive demand reduction with renewable energy integration [4].

At Eastern Mediterranean University [EMU] in Gazimağusa, North Cyprus, dormitories rely almost entirely on electricity to meet operational energy needs [1]. The selected case study is a university-owned student dormitory, DAU 6, located in the north of the campus. The building's unique façade features and flat roof present opportunities to investigate the placement of photovoltaics, solar thermal collectors, or heat pumps. Its high occupancy rate and sizable floor area further amplify its energy demand, making it a representative example of the challenges and opportunities associated with retrofitting existing student housing.

Famagusta experiences hot dry summers and mild wet winters, weather conditions that highlight the difficulties and opportunities associated with sustainable building design: abundant solar radiation offers a reliable renewable energy resource. The high temperatures during the summer increase the cooling load necessitating energy-efficient interventions to reduce over reliance on electricity.

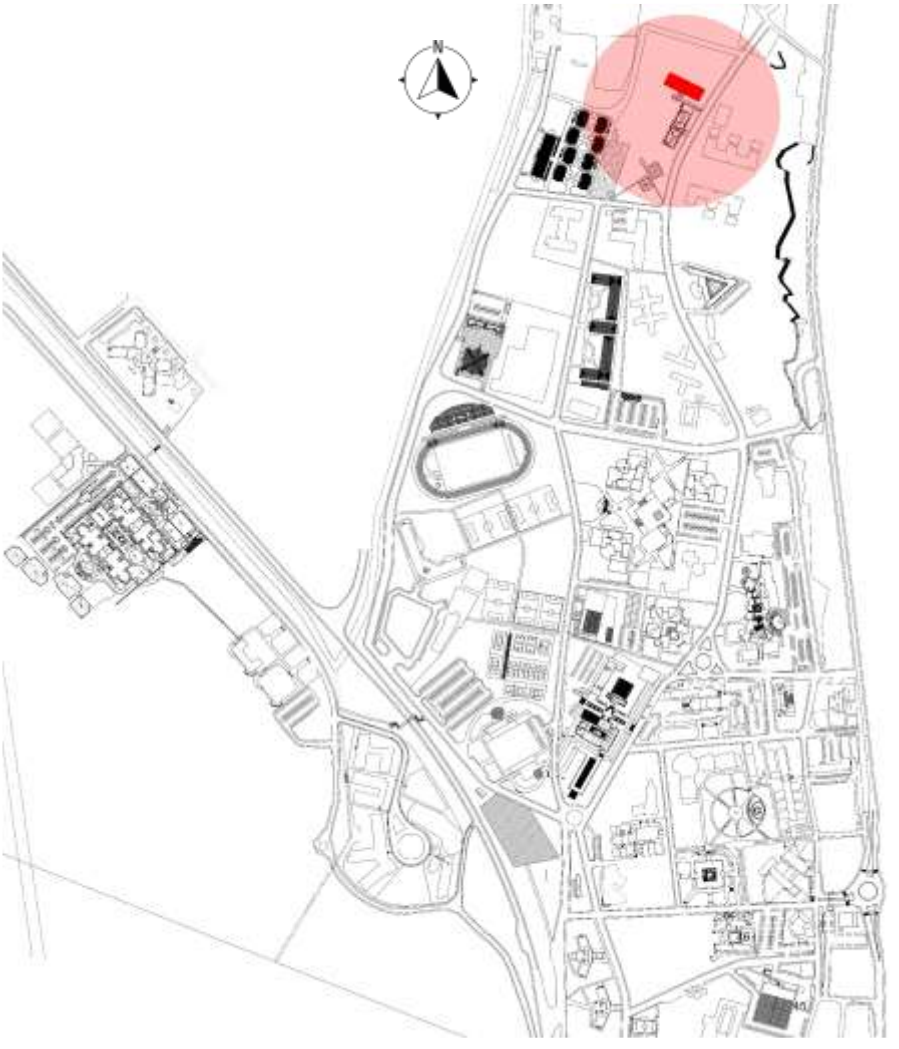

Fig. 1. Location of EMU Student Dormitory (DAÜ 6) (Source: EMU Project Affairs Directorate)

Analyses of sustainable energy planning in Northern Cyprus reveal that solar energy is one of priority renewable energy options due to its high potential and the need to reduce the reliance on fossil fuels presenting as an urgent issue [7,8]. Government statements also express intentions to build an island model based on green energy by 2030, thus highlighting the devotion to an energy shift by the region [9]. In addition to these domestic efforts, international development programmes with the aim of encouraging energy savings and the use of renewable energy among Turkish Cypriot citizens help in conducting wider sustainability efforts in accordance with SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) [14]. Therefore, the current research supports current sustainability efforts in Northern Cyprus and adds to the climate-responsive construction policies that should contribute to the improvement of the environmental performance over the long run and minimize emissions.

This paper adopts the concept of Climate Protection Buildings (CPBs) as a framework for evaluating how existing dormitories can be transformed through energy retrofits to the building facades and roof areas to introduce renewable energy solutions.

1.1. Climate protection buildings

Climate protection buildings (CPBs) are structures designed to minimize their contribution to global warming while simultaneously adapting to the existing risks of climate change. They draw from established practices of sustainable, resilient, and passive building design.

Focusing on two primary pillars, one being mitigation which is achieved by reducing the carbon footprint over time, and the other adaptation is accomplished through resilient design that incorporates several strategies and standards. In practice, one major steps toward achieving a CPB status is the retrofitting of building facades and roofs to reduce carbon impact and mitigate extreme heat, improving the operational energy efficiency, and enabling the integration of renewable energy systems [10,11,12]. Facade and roof upgrades are generally recognized as the starting point for climate-responsive retrofits. A step-by-step hierarchy, beginning with facade improvements, followed by passive systems, and finally active energy systems is an encouraged course of action to ensure efficiency of the later integrated systems [13].

This paper proposes practical, innovative renewable energy interventions for the façade and roof areas to reduce energy use and carbon emissions from EMU campus dormitories. Certain research questions will be answered to arrive at a solution:

1. What is the potential of the EMU student dormitory to achieve climate protection based on façade characteristics and roof areas?
2. Which renewable energy interventions are suitable for the student dormitory according to the existing façade characteristics and possible roof areas?
3. Which type of energy retrofit strategies can be applied for facades and roofs?

2. Methodology

This study employs a **qualitative methodology** to evaluate the potential conversion of an existing student dormitory (DAÜ 6) into a climate protection building (CPB) at EMU-Campus by means of facade-based strategies supporting renewable energy integration.

The methodology has three steps:

Step 1: Building Documentation and Façade and Roof Analysis

Architectural plans, sections, and elevations are examined to document the state of the building façade and roof. The analysis focuses on façade orientation, window distribution, window-to-wall ratio (WWR), roof form, and geometric features influencing solar exposure and shading. Construction typologies for walls, roofs, and glazing systems are deduced from the drawings and regional construction practices.

For early-stage feasibility assessment, the usable roof area was conservatively taken as approximately 80% of the primary unshaded surface, after accounting for circulation, maintenance access, and shading obstructions. This assumption follows common practice in feasibility studies, which exclude non-installable zones on flat roofs.

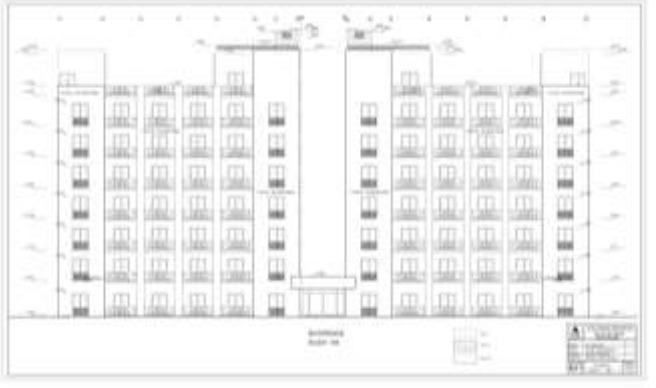

Fig. 2. South elevation of the student dormitory (DAÜ 6)
(Source: EMU Project Affairs Directorate)

Fig. 3. Photos of the student dormitory (DAÜ 6)
South facing façade (taken by author)

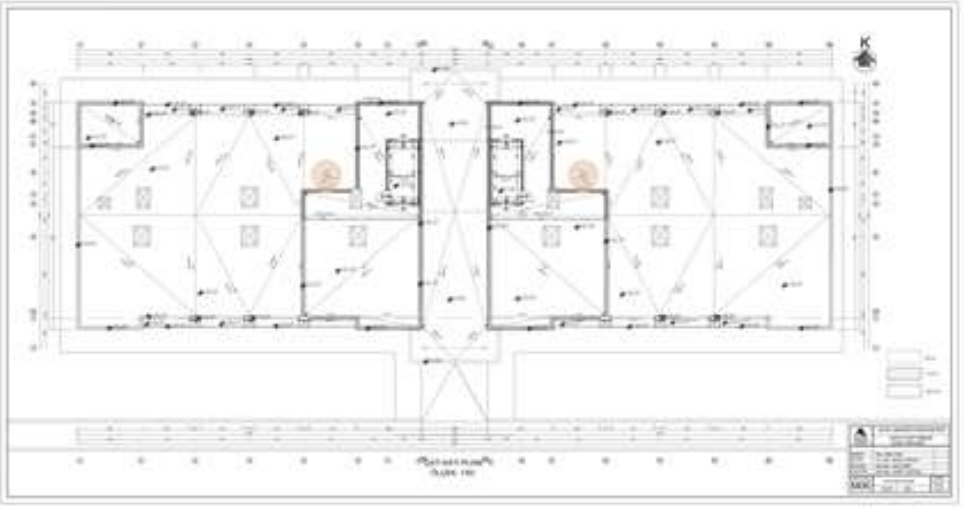

Fig. 4. Roof plan of the student dormitory (DAÜ 6) (Source: EMU Project Affairs Directorate)

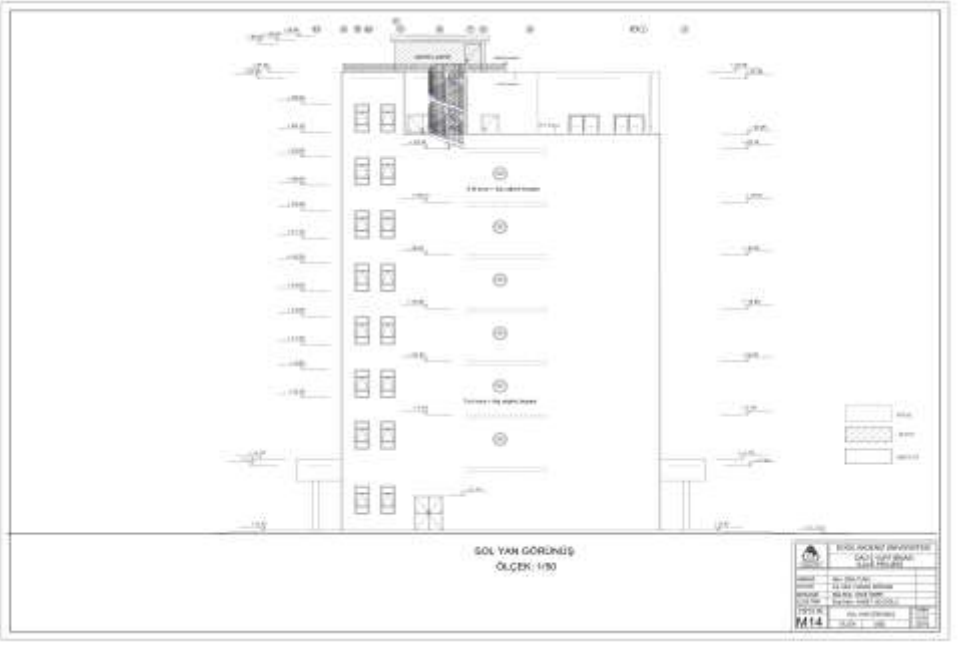

Fig. 5. West elevation of the student dormitory (DAÜ 6) (Source: EMU Project Affairs Directorate)

Step 2: On-site Observations

Field visits were conducted to verify and complement the drawing-based analysis. Observations focused on visible façade and roof characteristics, including glazing types, façade and roof materials, and the presence or absence of shading devices. These site-based findings were used to refine facade parameters and ensure that the analysis reflected the building's as-built condition rather than relying solely on drawing-based assumptions.

Step 3: Assessment of Façade and Roof Areas for Renewable Energy Technology Use

Findings from the drawing analysis and on-site observations were interpreted in relation to renewable energy technology use. Roof surfaces were evaluated for solar orientation and usable areas, applying the 80% adjustment defined in Step 1. Façades were assessed for photovoltaic integration opportunities, while the characteristics were linked to their influence on heating and cooling demand. These parameters were

qualitatively connected to the feasibility of photovoltaic systems, solar thermal collectors, and heat pumps. In line with climate-protective retrofit principles, passive demand-reduction opportunities were considered prior to the introduction of active renewable energy systems.

3. Results and findings

3.1. Geometrical and Morphological parameters

The building exhibits four primary facade orientations, with the longest elevations facing approximately 168° south and 12° north, and secondary facades oriented approximately 78° east and 282° west, as derived from plan-based azimuth measurements.

A facade-to-roof ratio of 4.7:1, indicating a higher proportion of facade area relative to roof area, and a total window-to-wall ratio (WWR) of 7.3:1 is noted. Table 1 shows the facade specific WWR values for later evaluation.

Table 1. Window-to-wall ratio (WWR) of facades

Façade	WWR
South -facing	4.2:1
North -facing	6.2:1
East and west-facing	19:1

The facades are articulated through subtle recessed balconies, each 0.61 m deep, arranged in a consistent rhythm. Juliet balconies, with no effective depth, are located at the building's extremities. The only observable projections are those of the entrance and exit roof overhangs, both 2.5 m offset.

3.2. Solar Control and Optical Properties

Based on the age of the building and glazing systems commonly used in student dormitories in North Cyprus at the time of construction and on-site observations, the existing glass windows and doors consist of conventional single glazing with no tint. Reported solar heat gain coefficient (SHGC) values for such systems are approximately 0.75-0.85. Additionally, the visible light transmittance (VLT) is assumed to be 80–90%, indicating poor daylighting and glare control.

3.3. Thermal mass and material properties.

The facades are predominantly finished in white-painted plaster, resulting in a uniform, light-colored surface finish. Structural elements, including floor slabs and balcony projections, contribute to the building's thermal mass.

3.4. Facade and Roof Suitability for Renewable Energy Technology Use

Continuous vertical building elements are separating the balconies on the south- and north-facing elevations, each 0.8 m wide and 23.7 m high, provide uninterrupted facades totaling 133.8 m² for each north- and south orientation. The remaining non-shaded facade areas represent an additional 444.5 m² (Fig. 6). The east and west elevations of the student dormitory (DAÜ 6) also contain extensive facade surfaces.

The roof is flat and predominantly unobstructed, with a total continuous area of 826 m². Roof areas were categorized into primary solar-suitable zones (Zone A), conditionally shaded zones (Zone B), and non-suitable zones (Zone C) (Fig. 7). Areas affected by prolonged east-west shading and self-shading from stepped roof levels were conservatively excluded from solar thermal calculations. To account for persistent shadowing under low solar altitude conditions, a setback distance of approximately 7 m was applied within Zone B.

The lowest roof level, shaded by the adjacent six-storey building masses for most of the day, was fully classified as non-suitable and excluded from further assessment. Leaving a usable roof area of approximately 432 m².

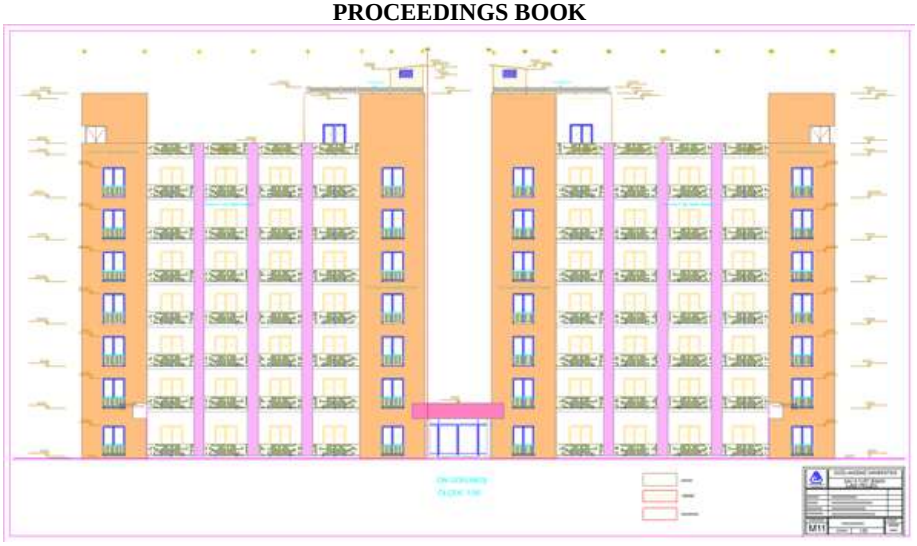

Fig. 6. South- facing non-shaded facade areas (in colour) for the integration of PV panels or solar collectors (developed by author)

Fig. 7. Potential roof area zones (in colour) for renewable energy technology use (developed by author)

4. Discussion

The façade and roof analysis of the selected student dormitory (DAÜ 6) highlights several features that shape both operational energy demand and the potential of renewable energy technology use. The predominance of single clear glazing (SHGC ≈ 0.75-0.85), combined with the absence of external shading devices, is likely to result in substantial solar heat admission during summer months. This intensifies cooling demand and increases reliance on electrically driven air conditioning systems. Similarly, the high visible light transmittance (VLT ≈ 80-90%) enhances daylight penetration but offers little control over it, contributing to glare risk and reinforcing the need for glazing upgrades and solar control strategies under Mediterranean climatic conditions before the integration of renewable energy solutions.

Building orientation plays a decisive role in renewable energy system suitability. Although, the east- and west oriented building facades provide larger gross facade areas, their exposure to low-angle solar radiation reduces effective energy yield. The north-facing building facade, receiving little to no solar exposure, offers negligible potential. These conditions highlight the relative advantage of south-oriented surfaces for

photovoltaic integration. The continuous vertical architectural elements on the south-facing facade (Fig. 10) provide uninterrupted surface that is well suited for building-integrated photovoltaic (BIPV) systems, requiring minimal alteration to the architectural character of the façade.

While the remaining facade areas are technically usable, their integration carries a risk of negatively affecting the building's aesthetic quality.

The flat roof configuration presents significant opportunities for solar energy technology use. In Famagusta, both flat-plate and evacuated tube collectors are technically viable, though each responds differently to climatic conditions. Flat-plate collectors, typically measuring about 2.0 m² per unit, perform well under strong sunlight and high ambient temperatures, making them suitable for summer-dominated domestic hot water demand in student dormitories. After accounting for circulation, maintenance access, and installation clearances, approximately 80% of the usable roof area was considered, consistent with early solar feasibility studies. This provides a theoretical allowance for up to 118 flat-plate collectors. Alternatively, evacuated tube collectors, with unit areas of 2.5-3.0 m², offer higher thermal efficiency under cooler conditions and during winter operation, enhancing year-round performance. Applying the same assumptions, the roof could accommodate approximately 96 evacuated tube collectors at the upper size range.

Heat pumps are a suitable eco-friendly option for space cooling, heating, and hot water for ground level and roof areas. The current building fabric exhibits high solar heat exposure, standard clear glass windows that increase solar heat admission, and limited external shading, leading to the increased cooling demand. This situation calls for larger air-source heat pump systems, which can impact their efficiency and overall energy performance. Enhancing the building envelope through upgrades like use of eco-friendly thermal insulation materials and energy-efficient windows and triple pane glazing with reduced solar heat absorption, better sealing against air leaks, and the installation of passive shading can directly cut down on the need for cooling, allowing for smaller system sizes and boosting the efficiency of heat pump operation.

When considering the layout of the building, outdoor units of air-source heat pumps can be positioned on flat roof areas that may not be suitable for solar panels due to shading or orientation issues i.e. zone B and Zone C. By making use of such spaces for heat pump equipment and locating the high-solar-value regions for solar technologies, a comprehensive renewable energy strategy can be implemented. Internal components like buffer tanks and hot water storage units within existing mechanical rooms or repurposed service areas, a contemporary and efficient system can be achieved.

Air-source heat pumps perform effectively for most of the year due to the climate, making them a fitting choice for both heating and cooling needs along with hot water provision. Combined with rooftop solar collectors and the facade BIPVs, heat pumps further aid in reducing emissions by shifting the energy demand to on-site renewable power generation.

This approach prioritizes the improvement of the façade and roofs to ensure that the integration of renewable systems not merely as standalone technological upgrades but rather part of a comprehensive retrofit strategy focused on climate protection. By aligning reduced thermal requirements, spatial considerations, and the use of renewable energy sources, this strategy aims to create a sustainable and efficient building environment.

5. Conclusions

This study demonstrates that façade and roof-based analysis offers a practical framework for assessing renewable energy potential in Mediterranean dormitories. Existing facade conditions; high solar gains, limited shading, and single glazing drive elevated cooling demand, highlighting the need for passive retrofits as a foundation for renewable integration. South-facing façades provide optimal surfaces for building-integrated photovoltaics, while flat roofs offer capacity for solar thermal collectors and air-source heat pumps to meet continuous hot water demand. Façade and roof upgrades, including improved glazing, shading, and airtightness, are also critical for effective air-source heat pump integration on the flat roof, enabling proper system sizing, higher seasonal efficiency, and strategic placement of outdoor units and auxiliary equipment.

Collectively, these measures underscore the role of facade retrofits as a prerequisite for low-carbon heating and cooling in student housing. More broadly, the findings position dormitories as a high-impact typology for campus-scale climate initiatives, establishing a transferable framework that can inform future simulations, system design, and wider application across Mediterranean universities.

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TRANSFORMING THE NON-PLACE: FROM TRANSIENCE TO A SENSE OF PLACE IN AIRPORTS – THE CHANGI EXAMPLE

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Abstract
Modern airports are massive transportation hubs through which millions of passengers pass. However, these structures often fit the definition of "non-place" as conceptualized by the French anthropologist Marc Augé. "Non-place" refers to temporary spaces where people are present anonymously for a short time, without a sense of identity or belonging. Airports also generally offer anonymous, monotonous, and transient experiences; passengers are simply directed from one place to another and cannot establish an emotional or cultural connection with the space they are in. This can lead to an experience where the sense of direction is weakened, stress is increased, and a feeling of "belonging nowhere" arises for passengers. This study examines architectural strategies aimed at reducing this sense of transience in airports and improving the passenger experience. Our research question is: How can the temporary and identity less "non-space" areas in airports be transformed into more meaningful and inviting spaces through architectural interventions, without disrupting passenger flow? The importance of this issue stems from the stress and sense of alienation experienced by passengers due to the frequent difficulties in navigation, monotonous corridors, and emotionally neutral environments in airports. Revealing the potential of architecture to improve the passenger experience through spatial organization and design is valuable both in academic literature and in practical design. In this context, this study focuses on the example of Singapore Changi Airport and analyses successful applications aimed at breaking the perception of "non-space." The study discusses ways to transform this "non-space" feeling through architectural strategies: under the headings of (i) sense of place (identity–context), (ii) scale–human scale, and (iii) sensory/experiential comfort, it presents a set of exemplary proposals for Singapore Changi Airport.
Key Words: *non-space; sense of place; airport architecture; experiential design; Changi Airport*

Introduction

In the age of globalization, airports are critically important structures used by billions of passengers annually. However, airports designed for functionality are often sterile, monotonous, and soulless spaces. This creates alienation, stress, and a feeling of "belonging nowhere" in users. Marc Augé's (1995) concept of "non-place" provides a theoretical framework for this phenomenon. Non-places are temporary spaces devoid of identity, history, and relationality, where users pass through anonymously. Airports, highways, and shopping malls are prime examples of this concept.

This study explores ways to break the anonymity and transitive nature of modern airports, transforming them from mere transit areas into spaces with identities that leave a lasting impression on memory. It is hypothesized that airports can transform from mere mechanical corridors guiding passengers to an aircraft gate into spatial experiences that tell stories, create connections, and stimulate the senses. Thus, an airport can become not just a place to pass through, but also a place to live in. The use of similar materials and the similar spatial organization schemes in many airport structures are discussed in the literature as "placelessness" (Relph, 1976). In placeless spaces, users have difficulty establishing emotional connections with their environment, and spaces become interchangeable, anonymous shells (Berber, 2011; Koçyiğit & Gorbon, 2012). In this context, this study seeks answers to the question: How can temporary "non-place" areas in airports be transformed into meaningful and comfortable "places" while maintaining operational efficiency, using which architectural strategies? Using Singapore Changi Airport as a case study, the study aims to analyse architectural strategies that reveal how a temporary stop with "non-place" characteristics can be transformed into a place. The main objective of the research is to emphasize design principles that approach the human scale, gain meaning through contextual elements, and transform the journey from a purely physical passage into an emotional experience. Thus, a new spatial approach is proposed for the future of airports, one that centres the passenger and strengthens the sense of place.

2. Theoretical Framework

2.1. The Concept of Non-Place and Non-Space

Augé (1995) defines temporary spaces in the modern world that lack a sense of identity, relationality, and history with the concept of "non-place." While traditionally, place is relational, historical, and loaded with identity, spaces that do not possess these qualities are called non-places. According to Augé (1995), super modernity is producing an ever-increasing network of non-places. Highways, shopping malls, hotel lobbies, and especially airports are concrete examples of this concept. In such spaces, users flow as anonymous passengers or customers without establishing a meaningful relationship with their surroundings; the result is a loss of the sense of place and spaces offering similar, monotonous experiences. Relph (1976) discusses this loss of quality in modern spaces with the concept of placelessness; The increasing similarity of urban areas and the built environment, the loss of unique identities in places, and the inability of people to develop a sense of belonging in these spaces are all issues. Berber (2011), by considering the concepts of non-place and displacement together, emphasizes how transience and the feeling of anonymity have become decisive in the contemporary spatial experience. Airports, with their intensely standardized designs and function-oriented anonymous environments, are among the structures where the phenomenon of non-place is most clearly seen. In this anonymous environment, the individual virtually suspends their identity, becoming merely a passenger with a passport or ticket number (Augé, 1995). The starting point of the study is to question whether architectural strategies that can strengthen the sense of place in airports are possible despite these non-place qualities.

2.2. Space, Place and Displacement

The concept of space is considered in social sciences and architectural theory both in opposition to and in relation to the concept of place. According to Lefebvre (1991), space is not merely a void or a neutral stage; Space is a historical product that is constantly reproduced through social practices. Space is a social production with both mental and physical dimensions; it actively contributes to the shaping of knowledge, actions, and relationships. In this context, the concept of place can be considered as the meaningful and identity-acquired state of space. Tuan (1977) states that "undifferentiated space transforms into place as we begin to understand it better and attribute value to it." In other words, space makes movement possible; place, on the other hand, is a pause in space (Tuan, 1977). For a space to become a place, it is possible only through the accumulation of experiences, memories, and values belonging to that space. In architecture, placelessness is the phenomenon where the architectural product cannot belong to any geographical region, cultural structure, intellectual system, or time; it does not matter whether it was produced here or there, at this time or that time; it cannot acquire a place for itself and cannot go beyond being a singular element (Koçyiğit & Gorbon, 2012). In modern architecture, displacement refers to the detachment of design from contextual identity. According to Koçyiğit and Gorbon (2012), displacement in architecture is the situation where an architectural product does not belong to any geographical region, cultural structure, or time; it does not matter whether it was produced "here" or "there," "at this time" or "at that time," it cannot acquire a place of its own and remains a singular object. Displaced structures use a universal anonymous language and do not carry traces of the spirit of their location. This situation can be observed in many airport terminals on a global scale: placeless spaces emerge, made of glass, concrete, and steel, resembling any other terminal in any city. On the other hand, Augé (1995) states that place and non-place are extremes of a spectrum; most real spaces oscillate between these two extremes. An airport, despite all its anonymity, may contain small clues about local culture or evoke a sense of belonging in the user through design interventions. Norberg Schulz (1980), with his concept of genius loci (spirit of place), argues that every place has its own unique identity and that architecture should reveal this spirit. This understanding requires emphasizing context and identity elements in design to counter the idea of placelessness.

3. Methodology

This study is qualitative descriptive-interpretive research supported by a theoretical framework, using Singapore Changi Airport as a singular case study. The research design is built upon Marc Augé's concept of "non-place" (Augé, 1995), Relph's discussions on "placelessness" (Relph, 1976), Lefebvre's approach to the social production of space (Lefebvre, 1991), and Tuan's analyses of the sense of place and location (Tuan, 1974, 1977). This theoretical background provides an analytical framework for understanding the architectural strategies that transform the "non-place" effect at Changi Airport. The methodology of the study progresses on the theoretical level, where the theoretical framework is established through a literature review, and on the other hand, on the case study level, where qualitative spatial analysis is carried out based on on-

site observation, documentation, and visual examination at Changi Airport.

3.1. Research Design and Data Collection Process

The research is structured as a case study focusing on Changi Airport, which is considered to be one of the examples that breaks the "no-place" quality of modern airports (Yin, 2014). Instead of quantitative performance measurements, a qualitative approach based on on-site observation, spatial description, and theoretical interpretation has been adopted. The data collection process consists of three main sources: literature review, documentation and visual examination, and on-site observation. Literature related to concepts such as no-place, place/belonging, displacement, the spirit of place (genius loci), the production of space, scale, and wayfinding has been reviewed; In particular, studies by Augé (1995), Relph (1976), Lefebvre (1991), Tuan (1974, 1977), Norberg Schulz (1980), Lynch (1960), Passini (1984), Kellert et al. (2008), Ulrich (1984), and Pallasmaa (2005) formed the theoretical background. In addition, architectural plans, sections and elevations, official websites, architectural office publications, operator reports, promotional videos, and photographic archives for Changi Airport and the Jewel Changi complex were examined; the macro-scale layout of the terminal, meso-scale zoning, and micro-scale spatial details (seating arrangements, niches, wayfinding elements, material usage, biophilic elements, etc.) were analysed through these documents (Lynch, 1960; Arthur & Passini, 1992). Finally, in situ observation was conducted at Changi Airport as part of the research; Internal terminal circulation, the use of waiting areas, and the functioning of biophilic pockets and quiet/sensory areas were observed in the field. Observations were conducted using a qualitative, semi-unstructured observational approach; passenger flows, spatial concentration points, seating preferences, and the usage patterns of quiet areas and micro-spaces were recorded by the researcher through field notes and photographs. The on-site observation findings served as a second layer of data, confirming and enriching the spatial interpretation obtained through documentation and visual analysis; they were not reported as quantitative data in the article, but rather considered as a qualitative basis for the interpretive analyses. With this methodological framework, the study examines Changi Airport not only through design drawings but also as a space experienced in situ; it conducts the discussion of the production of "place" from "no space" through both theoretical and field-based data.

3.2. Defining the Analytical Axes

As a result of the theoretical literature review and preliminary studies on Changi Airport, three fundamental criteria forming the analytical backbone of the study have been defined: (1) sense of place / identity (genius loci), (2) scale / human scale – spatial readability, and (3) sensory / ergonomic comfort. This tripartite structure was not created randomly, but rather to correspond to both the intersection points of theoretical discussions in the literature and the areas of rupture in the airport user experience that can be addressed through design. Three fundamental criteria were considered in determining the criteria. Firstly, when examining the discussions of non-place, displacement, and sense of place within the context of theoretical necessity, it is seen that the discussions concentrate on three common themes: meaning/identity (is this space a place or a non-place?), spatial organization and scale (can I understand where I am?), and sensory-psychological comfort (what does this space make me feel?) (Augé, 1995; Relph, 1976; Tuan, 1977; Norberg-Schulz, 1980; Pallasmaa, 2005). Secondly, it has been preferred that these three criteria correspond to areas where architectural design can directly intervene. Although elements such as security, operation, or infrastructure are factors affecting the airport experience, this study focuses only on dimensions that can be transformed by the architect's concrete decisions. Identity and sense of place, spatial scale and legibility, and sensory-ergonomic comfort are criteria that are under the architect's control through tools such as material selection, use of light, landscaping, interior zoning, and wayfinding systems. Thirdly, it has been observed that the positive examples highlighted in the literature, specifically regarding Changi Airport and the Jewel Changi complex, largely fall under these three headings: the translation of local identity and the "Garden City" image into space (A), the creation of legible flows by reducing large terminal volumes to a human scale (B), and the implementation of biophilic design, quiet/sensory rooms, and multi-sensory comfort strategies (C). Therefore, these three criteria, which directly coincide with both the theoretical literature and the Changi example, function as axes that carry the evaluation process. In other words, these criteria not only structure the analytical framework of the study but also function as interfaces that relate conceptual discussions to the concrete spatial strategies at Changi Airport. In this context, axis A focuses on the question "Where is this airport?", axis B on "Where am I in this airport?", and axis C on "What does this airport make me feel?", guiding the analysis with a holistic approach at both the theoretical and user experience levels.

Table 1. Main axes of the study, theoretical focuses, and dimensions examined in Changi

Axis	Analytical focus	Key concepts of the theoretical focus	Dimensions explored at Changi
A	Sense of place/ İdentity	Place-non-place, belonging, spirit of place, cultural reference, memory production	Local materials-colour-texture; culturally referenced art/installations; landmark focal points such as Rain Vortex and Forest Valley
B	Scale / Human scale – Readability	Spatial readability, human scale, mental mapping, wayfinding	Division of large openings into micro-spaces; thematic zoning; visual hierarchy; wayfinding through landmarks and axes
C	Sensory/ Ergonomic comfort	Biophilic design, sensory load management, neuroergonomics, comfort and stress	Integration of plants, water, and daylight; quiet/sensory rooms; resting niches; material-lighting-acoustics integration

These criteria allow for a systematic discussion on the extent to which spatial decisions, identified through on-site observation and documentation analysis at Changi, transform the perception of "non-space."

3.3. Design Parameters and Their Relationship with Terminal Flow

After theoretically defining the criteria, six design parameters were defined for Changi Airport. These parameters were conceived as tools that could be superimposed as micro-intervention layers on the airport's mandatory programmatic flow (check-in → security → duty-free / retail → common waiting → gate waiting → boarding) without disrupting this flow (Lynch, 1960; Passini, 1984; Kellert et al., 2008): Biophilic micro-spaces (forest-pocket), Culturally referenced markers (landmark-node), Human scale and thematic zoning, Readable wayfinding, Quiet/sensory rooms and "reset" niches, Material-lighting-acoustics. These six analysis parameters are designed as the concrete on-site manifestations of the three main criteria defined (sense of place/identity (A), scale-spatial readability (B), and sensory/ergonomic comfort (C)). The evaluation of Changi Airport was conducted using these parameters. For example, biophilic micro-spaces and quiet/sensory rooms primarily highlight criterion C (sensory and ergonomic comfort), while culturally referenced markers mainly activate criterion A (sense of place and identity), and human scale-thematic zoning and legible wayfinding primarily activate criterion B (scale and spatial readability). The material-lighting-acoustics triad is considered an intersectional parameter that directly feeds into criterion C and strengthens the spirit of the place in criterion A, and spatial hierarchy and sense of direction in criterion B. In this way, a consistent link is established between the theoretical axes and the on-site observation-based analysis (Table 2).

Table 2. Relationship of analysis parameters with three main criteria.

Analysis parameters	A – Sense of place / identity	B – Scale / readability	C – Sensory/ergonomic comfort	Description (brief)
Biophilic micro-spaces (forest pockets)	Medium	Low	High	Sensory relaxation and comfort through natural elements (C); also contributes to place identity by strengthening the "Garden City" image (A).
Culturally referenced landmarks (landmark nodes)	High	Medium	Low	It produces a sense of place by making local culture and urban image visible (A); it also helps with wayfinding as a landmark (B).
Human scale and thematic zoning	Medium	High	Medium	It increases readability by reducing the large terminal volume to a human scale (B); it also produces a sense of identity through themes (A).
Readable wayfinding	Low-Medium	High	Medium	Primarily spatial hierarchy and navigation (B); indirectly contributes to comfort through stress reduction (C).
Quiet/sensory rooms and "reset" niches	Low	Low	High	Areas directly focused on the C axis that provide mental and physical "reset" by reducing sensory load.
Material-lighting-acoustics trio	Medium	Medium	High	The combination of material, light and sound essentially establishes sensory comfort (C); it also supports the spirit of the place (A) and spatial hierarchy (B).

Table 3 presents the six analytical parameters used to analyse the current spatial configuration of Changi Airport. For each parameter, the table shows the spatial qualities it focuses on and the stages where it stands out within the terminal's mandatory programmatic flow; this allows for a systematic observation of where spatial focal points related to sense of place/identity, scale-readability, and sensory/ergonomic comfort are concentrated along passenger movement.

Table 3. Design parameters, foci, and positions within the terminal flow

Design Parameters	Description / Design Focuses	Stages where the design stands out within the terminal flow
Biophilic micro-spaces (forest-pocket)	Small-scale indoor gardens featuring plants, water, and daylight; rest stops focused on breathing and stress reduction	Post-security; duty-free area; common waiting areas; long passageways
Culturally referenced landmarks (landmark-node)	Art/installations referencing local culture; symbolic nodal points that generate memory	Terminal entrance halls; central atrium; terminal bridges
Human scale and thematic zoning	Division of large volumes into human-like sub-volumes; theme-based zoning; "neighbourhood"-like spatial configurations	Terminal entrance halls; central atrium; terminal bridges Check-in halls; large waiting areas; retail and recreation zones
Readable wayfinding	Integrated use of spatial hierarchy, landmarks, colour/texture coding, and hierarchical signage	Throughout the entire flow; especially junctions, terminal passages and gate group zones
Quiet/sensory rooms and "reset" niches	Calm areas designed with neutral light and natural textures, free from noise and visual clutter	Post-security; inter-terminal passageways; pre-boarding waiting areas
Materials – lighting – acoustics	Natural material palette, balanced use of daylight and artificial light, acoustic control, and white noise strategies	The entire terminal shell; especially main circulation areas and central atriums similar to Jewel

4. Spatial Experience and Sense of Place at Singapore Changi Airport

4.1. General Information

Singapore Changi Airport is one of the leading examples where modern airport architecture is redefined through the concepts of user experience and integration with nature. Changi is located on the eastern tip of Singapore Island, approximately 20 km from the city centre. Its terminals, built in different periods, were designed by different architectural firms: Terminals 1 and 2 by P&T Group and Takenaka Corporation; Terminal 3, focusing on the principles of environmental sustainability and spatial permeability, was completed in 2008 by a partnership between CPG Consultants and Skidmore, Owings & Merrill (SOM).

Figure 1. (a) an aerial map of the airport's runways and terminals.; (b) the iconic control tower standing next to the glass dome.; (c) an overhead view of the glass dome building and surrounding structures (Ekoyapı Dergisi (n.d.).; Concepts and Projects (2020).; Arkitera (n.d.)).

Opened in 2019, the Jewel Changi Airport complex is an iconic ring-shaped structure that redefines the airport typology. Designed by Moshe Safdie, Jewel is described as "the transformation of biophilic design into a public-scale experiential space" with its massive indoor waterfall called Rain Vortex and tropical vegetation. This structure has enabled the airport to function not just as a transit space but as an urban living space by bringing together shopping, recreation, and nature experiences; it has been interpreted in the literature as a new spatial paradigm of airport typology.

4.2. Biophilic micro-spaces (forest-pocket)

Changi Airport stands out with its biophilic design approaches that allow for the experience of nature in enclosed spaces. Forest Valley, located in the heart of Jewel, is conceived as a four-story terraced indoor garden. In this area, more than 900 trees and approximately 60,000 shrubs and plants are arranged to create a tropical "indoor forest" atmosphere. The garden features pedestrian walkways, winding paths, and "vertical canyon" passages offering varying levels of movement. Large openings in the roof allow natural daylight to filter through, while the play of light filtered by the vegetation creates a vibrant, natural feel.

Fig. 2. (a) Rain Vortex surrounded by lush indoor greenery.; (b) people walking through the Shiseido Forest Valley under the glass dome. ;(c) Hedge Maze, a garden attraction located on the top level (Ekoyapı Dergisi (n.d.); Author's personal archive (2024)).

These design approaches transform the airport from a modern structure "detached from nature" into one that incorporates nature. These micro-forest pockets integrated into the terminal corridors soften the cold and temporary terminal atmosphere, creating a breathing and resting area for passengers. Thus, an interior space expected to be entirely temporary becomes a place of belonging and a memorable experience for the user. Environmental psychology literature reveals the potential of green elements in interior spaces to reduce stress levels (Ulrich, 1984; Kellert et al., 2008). In the Changi example, this contact with vegetation eased the tense waiting of passengers and emotionally enriched the space.

4.3. Culturally Referential Landmarks (Landmark Nodes)

Changi Airport, and especially the Jewel complex, not only offers a visually impressive architectural production but also creates a powerful focal point, a "node," that translates Singapore's cultural identity into architecture. This approach is highly effective in breaking the often-anonymous character of airports, as it offers passengers authentic and contextual signs that make them say, "This is Singapore," instead of a commonplace and globalized transit experience. These cultural references, which allude to local identity, appear on three main levels. First, Singapore's "Garden City" identity is transformed from an abstract slogan into a tangible spatial experience at the airport. For example, Shiseido Forest Valley is not just an indoor plant exhibition; it's a stage that recreates Singapore's equatorial nature indoors with tropical flora, fog effects, characteristic scents, and acoustic arrangements, thereby constructing a place identity. This atmosphere allows the passenger to establish a visual, sensory, and emotional connection with their surroundings. Second, the Rain Vortex waterfall in the Jewel complex is not merely a technical structure or an aesthetic element, but a ritualistic threshold that reinterprets the meanings of purification and renewal carried by water in Southeast Asian cultures through a contemporary architectural language. Spending time in this area before a flight goes beyond a mere physical transition, creating a sense of symbolic stillness and preparation. Thus, the journey becomes not merely movement, but a meaningful transitional process. On the third level, Jewel's glass-domed atrium and the interior spaces designed for commerce, entertainment, and nature experiences make Singapore's identity as a modern Asian metropolis visible through different layers – technology, tourism, and global consumption. These areas offer the passenger a gradual cultural scenario: first, an encounter with nature, then a technological experience, followed by cultural consumption, and finally, travel. Thus, the passenger progresses through successive spatial scenes where they encounter the city and their identity. All these references break the airport's placelessness and anonymity, making the terminal an extension of its geography. The user feels a sense of identification with a unique place in the terminal, which is often conceived as a temporary transitional space belonging nowhere. In line with Norberg-Schulz's (1980) concept of "genius loci," these cultural markers at Changi create not only a sense of recognition but also an emotional connection for the user. Thus, the airport is now perceived not only as a functioning place, but also as a place that holds identity and memory.

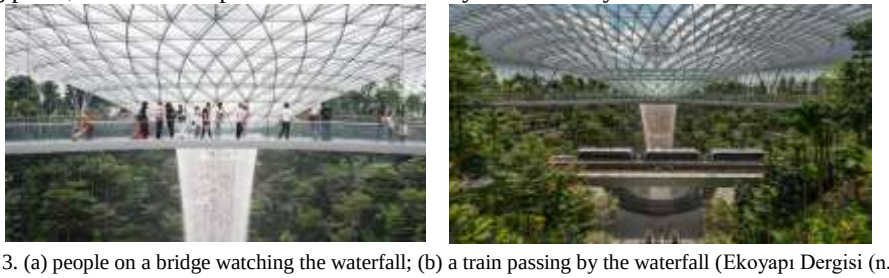

Fig. 3. (a) people on a bridge watching the waterfall; (b) a train passing by the waterfall (Ekoyapı Dergisi (n.d.)

4.4. Human Scale and Thematic Zoning

Large-scale airports are generally designed with very wide spans, long linear corridors, high ceilings, and uninterrupted orientation axes in line with infrastructure and capacity requirements. However, such spatial configurations often create two main effects on the user: alienation from the space and a feeling of loss of spatial control due to disorientation. Changi Airport, aiming to minimize these negative effects, has structured its terminal interior design as a series of scenes with a rhythm and emotional load that is in harmony with the human scale. The spaces that greet the user from the entrance are designed to present successive spatial scenes instead of a single giant hall; while the ceiling heights in the circulation areas give a feeling of large volume, a lower and more intimate atmosphere is created in the waiting and resting areas. In this way, the user moves in a more controlled and perceptible environment without being faced with numerous stimuli at the same time; they experience the space at a level where they can define it without experiencing mental fatigue (Gehl, 2010). At the same time, seating areas are not placed in single, linear rows at different points in the terminal, but rather in clustered small islands, creating micro-spaces that evoke a sense of "resting place." The warmth of the wooden surfaces, soft textile coverings, and planted corners create a feeling of security and comfort in the user, both visually and tactilely; thus, the terminal takes on the character of an interior space that allows not only a transitional scene but also a place to pause and linger, even if only briefly. This allows time to slow down perceptually, reducing the stress level that may occur on the user and significantly decreasing the feeling of alienation.

Fig. 4. (a) A sculptural play area at Changi Airport where soft forms and open layouts invite creative and active play for children.; (b) A wooden, animal-inspired play structure with integrated slides, encouraging imaginative and physical play in an indoor (environment. ;(c) A vibrant indoor slide integrated into a sculptural public space, transforming circulation into a playful experience.(Now Boarding – Changi Airport (n.d.); Playpoint Asia (n.d.)).

The airport's spatial design is responsive not only to the general user profile but also to user groups with diverse physical and social needs. Walking distances, ramp inclines, and the frequency of rest areas have been determined considering the needs of different groups, such as elderly individuals, users with mobility limitations, and families with children. Seating areas, accessible restrooms, and water stations are strategically placed throughout the terminal to accommodate the natural rhythm of the human body, creating a circulation pattern that allows users to move around without physical strain. This approach transforms the terminal from a mechanical infrastructure that "quickly directs everyone" into a flexible and responsive organism that "reads" the user's physical needs and pace. Thus, Changi offers an airport experience that is captivating in its scale but not tiring in its accessibility.

Fig. 5. (a) Changi Airport's inclusive design, showing accessible security gates that accommodate wheelchair users, families, and passengers of all ages with ease.;(b) An indoor children's play area that encourages free movement through nature-integrated design.(Mothership.sg (2022) Thrillophilia (n.d.)).

In terms of thematic zoning, it transforms the experience from a linear corridor into a gradual urban narrative. Different terminal areas have their own unique theme and atmosphere; as passengers move through the terminal, it's as if they are passing through different neighbourhoods.

Table 4. Thematic zoning and experience patterns at Changi Airport.

Theme (Atmosphere)	Spatial Content	Meaning evoked in the traveller	Behavioural outcomes
Nature – Encounter	Rain Vortex + Forest Valley	"This is Singapore."	Pausing, observing, determining direction
Exploration – Play	Canopy Park, walking bridges	"The place is communicating with me."	Wandering, exploring, experiencing
Cultural showcase	Locally themed retail and gastronomy areas	"I am in contact with the city."	Consumption, collecting memories
Withdrawal – *Reset*	Quiet rooms, meditation niches	"I have a space of my own."	Rest, reducing anxiety
Flight threshold	Entrance waiting areas	"I am ready for the journey."	Calming down, relieving stress

With this design, instead of following a monotonous route in the travel experience, it becomes a sequence consisting of different emotional and spatial atmospheres. Thematic zoning also facilitates mental mapping and supports wayfinding (Lynch, 1960).

4.5. Readable Wayfinding

Wayfinding at the terminal scale is a holistic communication system designed to enable the user to reach their destination without getting lost in the space and without experiencing excessive mental strain. While in the traditional approach wayfinding is solved with the intensive use of signage, in Changi wayfinding is not only done with graphic signs but is spread throughout the entire spatial language.

Fig. 6. (a) A minimalist exit sign integrated into a bamboo courtyard, blending wayfinding with the natural landscape. ;(b)A playful banana used as a warning sign, blending safety with humour in the public space (Author's personal archive (2024)).

A well-designed wayfinding system does not rely solely on graphic signs; instead, it creates a holistic structure supported by visual cues, spatial hierarchy, auditory and tactile elements, and cultural references (Passini, 1984; Arthur & Passini, 1992; Lynch, 1960). At Changi Airport, this holistic approach is carefully established on three levels. Firstly, spatial hierarchy and information density are distributed in a controlled manner. While the excessive use of signage, similar corridors, and information overload encountered in classic airports reinforce disorientation and a sense of "nowhere-to-where" for the user, at Changi, wayfinding information is presented in a gradual, scaled, and simple manner. On a macro scale, large focal points such as Jewel and Rain Vortex function as "north stars" of the terminal, helping the user determine their spatial location. At the meso level, physical elements such as the arrangement of doors, glass bridges, garden entrances, or skylights act as transition points that support directional intuition. On a micro scale, signage only comes into play at decision points, preventing visual noise and information overload. Furthermore, at Changi, the wayfinding process is designed not only with directional elements but also to support the user's mental mapping ability. For example, thanks to iconic spatial focal points such as Rain Vortex, Forest Valley, Canopy Walks, and Gateway Gardens, the user can create an invisible network of references within the terminal. This spatial memory allows the user to make intuitive inferences such as, "If I am near the waterfall, I am in the centre; if I am among the plants, I am in the garden zone; if I am on the glass bridge, I am on the overpass" (Lynch, 1960). Thus, wayfinding becomes a cognitive experience based not only on written information but also on recognizing and remembering the space. The sense of direction is supported not only by signs but also by light, materials, and rhythm. Light intensity increases as one approaches central areas; differences in floor and ceiling textures mark thresholds and intersections; and transitions in plant density guide the passenger by suggesting boundaries between public and semi-private spaces. When all these sensory layers are combined, the user begins to experience the space intuitively rather than simply reading signs. Architecture thus establishes a self-learning navigation language. This approach transforms wayfinding from a stressful task into an intuitive experience that occurs without even being aware

of it. The fact that a well-designed physical environment can guide user behaviour is also consistent with the environmental psychology literature (Arthur & Passini, 1992; Kuliga et al., 2015).

Fig. 7. (a) A light-filled promenade blending greenery with fluid architectural forms. ;(b) Wayfinding signage guiding passengers to departures, money exchange, and tax refund services ((Arkitera (n.d.); Changi Airport Group (2024)).

4.6. Quiet/Sensory Rooms and "Reset" Niches

A frequently neglected issue in modern airports is the sensory overload experienced by passengers and its management. Crowds, noise, announcements, artificial lights, and constant warnings are a significant source of cognitive stress, especially for passengers who spend long periods in the terminal.

Changi Airport has developed strategies to manage this sensory overload. At the heart of the strategy are quiet rooms, sensory detox zones, and small "reset" niches where the user can temporarily detach from the intense terminal flow and rebalance their nervous system. These special spaces reduce the mental and physical stress of the journey through an architectural filtering mechanism; thus, the airport becomes a place not only for movement but also for retreat and regrouping.

Fig. 8. "Calm Room – Facilities and Services Directory." (Changi Airport Group (2024)).

The quiet and sensory rooms at Changi Airport represent an innovative design paradigm that aims to manage the sensory load experienced by users in the busy terminal environment through a neuroergonomic approach. These special spaces function as restorative thresholds where passengers can temporarily escape the bombardment of noise, crowds, and artificial stimuli and rebalance their nervous systems: the reduction of environmental noise experienced by the passenger upon stepping inside curbs the stress response at a physiological level, the elimination of visual clutter alleviates the mental burden, and the use of natural materials such as wood, fabric, and plants, along with neutral lighting, reinforces a sense of security and tranquility. The architectural strategy offers passengers a brief opportunity to retreat and recharge even during the most challenging moments of their journey by tactically placing these quiet rooms at critical points throughout the terminal (e.g., after security control and before boarding gates) coinciding with the most stressful moments of the journey. The sensory layers of the design are structured around the goals of normalizing breathing rhythm by minimizing echo and noise through acoustic insulation, promoting relaxation by reducing brain activity with soft/pastel lighting, and creating a tactile sense of security with organic surface materials. Indeed, research has shown that this arrangement of sound and light levels significantly reduces user stress. Furthermore, by incorporating various usage scenarios such as family rooms, prayer/meditation areas, and small indoor garden niches into the interior program of the silent rooms, the experience of "silence" is transformed from a singular privilege into an inclusive norm that caters to all cultures and needs. In conclusion, in the case of Changi Airport, the silent and sensory rooms reflect a holistic design approach that transforms an anonymous and temporary structure like an airport into a user-centered spatial experience, reducing stress and reinforcing a sense of belonging.

4.7. Materials – Lighting – Acoustics

At Changi Airport, the character of the space is constructed not only by formal or functional features, but also by the holistic interaction of sensory elements such as material selection, lighting design, and acoustic arrangement. This tripartite approach transforms the passenger experience into a multi-dimensional spatial composition that is not only visual but also tactile, auditory, and kinesthetic, moving the terminal away from a "non-space" perception and turning it into a memory space that produces a sense of place (Pallasmaa,

2005). In the use of materials, warmth and a sense of security are created with wooden surfaces, topographical reference and spatial weight with stone floors, openness and transparency with glass facades, and biophilic contact with plant textures; this approach makes the space perceptible not only visually but also multisensory. Lighting design is used as a tool that both determines the spatial rhythm and reinforces the sense of direction. While natural daylight filters into the interior of the terminal through the Jewel dome and skylights, artificial light is kept higher in circulation areas and lower in rest and reset areas; Cool tones are preferred during decision-making moments, and warm tones during waiting periods, creating an atmosphere that is in harmony with the body's rhythm (Boyce, 2014). The acoustic design focuses not only on suppressing noise but also on spatially generating silence. Plant surfaces and acoustic panels, along with the white noise created by Rain Vortex, work together to balance the chaotic sound environment of the terminal; the passenger moves into a space where silence is felt not only audibly but also physically (Alvarsson et al., 2010). This holistic approach reduces the sensory burden on the passenger, transforming the terminal space from a purely functional transit area into an experience that engages the senses and psychologically creates a sense of place.

Fig.9 (a) ; (b) Jewel Changi Airport's interior is a fluid public space where play and architecture intertwine, with a circulation element integrated with a slide (Playpoint Asia (n.d.); Ekoyapı Dergisi (n.d.)).

4.8 General Assessment Based on Three Key Criteria

The analysis findings show that Changi Airport's design strategies are successful in terms of three key criteria. Thanks to architectural interventions, the airport has transformed from a "non-place" into a space that enriches the user experience in terms of sense of place/identity (A), scale/readability (B), and sensory/ergonomic comfort (C). Changi's design successfully reflects Singapore's local identity and the "Garden City" theme, creating a strong sense of belonging among passengers. Iconic elements such as the Rain Vortex waterfall inside Jewel and the Shiseido Forest Valley tropical garden, along with art/installations referencing local culture, have given the airport a unique character. Thanks to these cultural focal points, the airport is perceived as a "place carrying identity and memory," rather than an anonymous transit point. Passengers clearly feel that they belong to Singapore and are able to establish an emotional connection with the space. The airport has maximized spatial readability by dividing its massive terminal structure into human-scale, understandable sections. The subdivision of large volumes into smaller sections, each with a different thematic atmosphere, allows passengers to experience the space not as a chaotic void, but as a meaningful collection of 'neighbourhoods.' Furthermore, intuitive wayfinding elements integrated into the architectural design (landmark focal points, visual hierarchy, differences in light and texture) allow passengers to easily determine their location and destination. While graphic signage is kept to a minimum, the self-reading structure of the space minimizes the fear of getting lost and reduces passenger stress. As a result, Changi offers users a coherent, understandable, and reliable spatial experience in terms of scale and wayfinding. The airport's design prioritizes the physical and mental comfort of passengers. Biophilic micro-spaces throughout the terminal, along with vegetation, water features, and natural daylight, reduce passenger stress levels and make the time spent in the terminal emotionally meaningful. Similarly, quiet/sensory rooms, free from noise and visual clutter, offer passengers the opportunity for a "mental and physical reset," even if only for a short time; thus, the airport becomes not only a transit point but also a place for rest and recovery. The harmony of materials, lighting, and acoustics has also significantly contributed to the comfort criterion: Natural materials, soft lighting, and the effect of white noise have made the terminal atmosphere calmer and warmer, creating a sense of comfort and security for users. All these sensory ergonomic initiatives allow passengers to relax even during long waits and contribute to a positive perception of the airport experience.

5. Conclusion and Recommendations

This comprehensive spatial analysis conducted on Changi Airport proves that the "non-place" effect, frequently encountered in the hyper-mobile transit hubs of the globalized world, is neither absolute nor

inevitable. The integration of city-specific cultural/natural elements and intuitive wayfinding systems creates a sense of belonging and a positive experience for passengers (Gresham Smith, n.d.). In this context, intuitive wayfinding systems that enhance spatial readability and human-scaled "micro-neighborhood" concepts strengthen the cognitive bond the passenger forms with the space. Furthermore, holistic sensory and ergonomic comfort strategies—supported by natural daylight, water acoustics, and biophilic design—minimize passenger stress and soothe travel anxiety, transforming these temporary areas into points of "mental reset" (SET Science, n.d.; Chin et al., 2023). The most striking theoretical outcome of the study is its validation of French anthropologist Marc Augé's concepts, illustrating that "place" and "non-place"—often perceived as a rigid dichotomy in traditional literature—actually exist on a dynamic, continuously interacting spectrum (Placeness, n.d.). The Changi example demonstrates that a space's acquisition of "place" status and its ability to generate memory depend on conscious, user-centric design rather than mere geographical permanence. Therefore, when designing the large-scale transit structures of the future, architectural strategies that repair the human-space relationship must be adopted over de-identified, purely transit-oriented engineering solutions.

Furthermore, this study contributes to the architecture and spatial design literature by proposing an analytical framework structured upon three interrelated axes: the sense of place/identity, spatial readability/human scale, and sensory/ergonomic comfort. This framework reveals that architectural design can play an active, mediating role in transforming transit spaces—traditionally defined as "non-places"—into meaningful and experiential "places." Beyond the example of Changi Airport, these findings offer applicable and transferable design principles for other large-scale transportation infrastructures and global transit spaces.

Based on these theoretical and practical insights, strategic approaches recommended for the architectural and experiential design of large-scale transit areas come to the forefront. Primarily, sterile and anonymous spatial configurations should be avoided by integrating city-specific cultural, artistic, and natural elements into the design; thus, the area should be elevated from a mere transit point to an authentic extension of the host city. Simultaneously, to enhance spatial readability, massive and overwhelming terminal structures should be divided into comprehensible, human-scaled sub-zones or 'neighborhoods,' and intuitive wayfinding systems relying on architectural cues—such as lighting, material changes, and focal points—should be implemented instead of depending heavily on graphic signage. Finally, by prioritizing sensory and ergonomic comfort, the physical and mental well-being of passengers should be safeguarded through biophilic elements (vegetation, water features), maximum natural daylight, and quiet zones; as these interventions provide passengers with critical opportunities to "mentally reset" amidst the chaotic nature of travel.

In conclusion, 21st-century transportation nodes must be reimagined not merely as functional machines that mechanically transfer passengers from point A to point B, but as 'living spaces' that nourish human psychology, reflect the spirit of the city, and leave lasting impressions even in the most transient of moments.

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THE SUSTAINABILITY POTENTIAL OF VERNACULAR ARCHITECTURE: HOUSEALUATION OF THE TRADITIONAL ARCHITECTURE OF TİRİLYE WITHIN THE FRAMEWORK OF THE VERSUS PRINCIPLES

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ABSTRACT
In the 21st century, global crises such as climate change and the depletion of natural resources have made it imperative to redefine the discipline of architecture within the framework of sustainability principles. Considering the critical role of the construction sector in energy consumption and carbon emissions, the dHouseelopment of sustainable architectural solutions is of great importance. In this context, vernacular architecture represents a long- term accumulation of knowledge shaped by its interaction with climate, geography, and social structures, offering important lessons for sustainable design.This study aims to Housealuate the sustainability potential of the vernacular architecture of the historical Tirilye (Zeytinbağı) settlement in the Mudanya district of Bursa province within the framework of VerSus (Vernacular Heritage Sustainable Architecture) principles. Three traditional structures selected for the research (the Olive Oil Factory, Dündar House, and Güverte House) and the settlement pattern were analyzed in detail, taking into account environmental, socio-cultural, and socio-economic sustainability dimensions. The findings show that Tirilye's vernacular architecture is highly consistent with VerSus sustainability principles. The structures provide strong examples in terms of the use of local and minimally processed materials, passive climate control strategies, the preservation of cultural values, and the continuation of local construction techniques. The study rHouseeals that vernacular architecture is not only a static heritage element that needs to be preserved, but also a dynamic source of knowledge that can inform contemporary architectural design and conservation approaches.
Keywords: *Vernacular architecture, sustainability, VerSus principles, Tirilye, traditional architecture, cultural heritage*

1.INTRODUCTION

Since the beginning of the 21st century, humanity has faced multidimensional crises such as climate change, the rapid depletion of natural resources, increased energy consumption, and environmental degradation. These global issues have forced architecture to be redefined within the framework of sustainability principles, moving it beyond being a discipline concerned solely with aesthetics or functionality. The construction sector, one of the sectors with the largest share in terms of energy consumption and carbon emissions, plays a critical role in this transformation process (UNEP, 2020). High-tech solutions and active energy systems, often emphasized in contemporary architectural practice, frequently disregard local knowledge, traditional construction techniques, material culture, and socio-cultural context. This approach treats sustainability as a technical problem, neglecting the complex relationships architecture establishes with social, cultural, and environmental contexts. HowHouseer, for a sustainable future, architecture must consider not only energy efficiency but also dimensions such as cultural continuity, social justice, and the strengthening of local economies.

In contrast, vernacular architecture represents a long-standing body of knowledge shaped by continuous interaction with climate, geography, and social structures. DHouseeloped through observation, adaptation, and intergenerational transfer of experience, this architectural approach offers important lessons for sustainable design by demonstrating that environmental comfort, resource efficiency, and cultural continuity can be achiHouseed without dependence on high-energy-consuming technologies (Oliver, 2006; Rapoport, 1969).

In contemporary architectural discourse, vernacular architecture has regained importance as an alternative knowledge system that aligns with sustainability goals. Unlike industrialized and standardized modern construction practices, vernacular structures are mostly built with local and minimally processed materials, utilize passive climate control strategies, and stand out for their long structural lifespans. These characteristics contribute to reducing embodied energy and environmental impact while also supporting economic resilience and social cohesion (Oliver, 2007).

Rapoport (1969) emphasizes that vernacular architecture should be considered not only as a formal or typological category but as an environmental control system shaped by cultural values and Houseeryday life practices. Similarly, Fathy (1986) notes that traditional architecture can provide thermal comfort by utilizing natural energy flows and Housealuates this approach as a critical reference for contemporary sustainable design. From a socio-cultural perspective, vernacular architecture, as a carrier that reflects collective memory, local identity, and building culture in space, creates a strong sense of place against the homogenizing effects of globalization (Frampton, 1983; UNESCO, 2019).

The main objective of this study is to Housealuate the sustainability potential of the vernacular architecture of the historical Tirilye (Zeytinbağı) settlement in the Mudanya district of Bursa province within the framework of the VerSus (Vernacular Heritage Sustainable Architecture) principles. The traditional structures and settlement

patterns selected for the study were analyzed considering environmental, socio-cultural, and socio-economic sustainability dimensions.

The research approaches vernacular architecture not only as a static heritage element that needs to be preserved, but also as a dynamic source of knowledge that can inform contemporary architectural design and conservation approaches. By applying the VerSus framework, the study aims to rHouseeal how the principles of vernacular architecture can be systematically interpreted and translated into the current discourse on sustainability.
In this context, the study focuses on the following research questions:

- To what extent does the vernacular architecture of Tirilye align with VerSus sustainability principles?
- How do environmental, socio-cultural, and socio-economic sustainability dimensions emerge in the selected examples?
- Can the settlement of Tirilye serve as a transferable reference in terms of contemporary sustainable architectural design and the preservation of cultural heritage?

2. THE RELATIONSHIP BETWEEN VERNACULAR ARCHITECTURE AND SUSTAINABILITY

Vernacular architecture is defined as an anonymous and collective production discipline shaped by interaction with the climatic data, topographic characteristics, and local material ecosystem of a specific geographical context; directly linked to social life practices and cultural codes. This architectural tradition follows a dHouseelopment process based on the experiential knowledge (tacit knowledge) accumulated by local communities over generations, independent of institutionalized architectural education and professional design processes (Oliver, 2006).
In academic literature, vernacular architecture is characterized not only as a physical typology of shelter but also as a complex environmental control system and local knowledge mechanism (Rapoport, 1969). Contrary to the universal, typological, and standardized approaches offered by modern architecture, vernacular production offers a heterogeneous spatial organization model that responds to the specific conditions of its location (genius loci). The balance with the natural environment displayed from the construction process to the lifetime of the building, low-energy construction techniques, and resource efficiency make this architectural school one of the fundamental reference points of the current sustainability paradigm.
The fundamental characteristics that distinguish vernacular architecture from modern or monumental architecture and make it valuable in terms of sustainability form an interconnected system:
The VerSus (Vernacular Heritage for Sustainable Architecture) Project is an international research initiative dHouseeloped to systematically Housealuate the sustainability potential of vernacular architecture and transfer this knowledge to contemporary architectural practice. Comparatively analyzing more than 150 traditional building examples selected from different regions of Portugal, Spain, France, and Italy, the project has identified 15 fundamental principles in the areas of environmental, socio-economic, and cultural sustainability (Correia et al., 2014). These principles address the sustainability potential of traditional architecture from a holistic perspective and offer concrete strategies for modern applications.
The VerSus Project has not only documented the technical characteristics of traditional structures; it has also examined in detail the socio-cultural and economic contexts in which these structures exist. By systematically analyzing the rich vernacular architectural heritage of the Mediterranean basin, the project team has identified multidimensional sustainability strategies such as adaptation to local climatic conditions, material economy, social solidarity, and cultural identity. This approach has demonstrated that vernacular architecture is not merely a "heritage of the past," but also a valuable source of knowledge for contemporary sustainability pursuits.
The VerSus methodology aims to Housealuate the sustainability performance of vernacular buildings in an objective, systematic, and comparable manner. In this regard, buildings are scored from 1 to 5 based on the sub-strategies and criteria defined under each principle:

- **1 point:** The principle is not met or is met very poorly
- **2 points:** Partial and inadequate fulfillment of the principle
- **3 points:** Moderate fulfillment of the principle
- **4 points:** The principle is well met
- **5 points:** The principle is met at an excellent lHouseel

This scoring system enables a comparative analysis of vernacular structures from different geographical areas, different typologies, and different periods. Furthermore, synergies and potential conflicts between the principles are analyzed to provide a comprehensive assessment. For example, while there is a strong synergy between the use of local materials (Principle 3) and the transmission of building cultures (Principle 7), a balanced approach may be required between creative interventions (Principle 8) and the preservation of the cultural landscape (Principle 6). The assessment process adopts a multi-method approach that includes on-site observation, photographic documentation, user interviews, historical research, and technical analysis. Specific questions are asked for each principle: How is this principle manifested in the structure? What techniques, materials, or design strategies have been used? What is the current situation? What threats or opportunities exist?
The VerSus Project addresses sustainability in three fundamental dimensions and defines five principles under each dimension. This structure systematically rHouseeals the multi-layered sustainability value of vernacular architecture.

No	Principle	Dimension	Brief Description
1	Respect for Nature	Environmental	Ensuring the structure is compatible with the natural ecosystem and has a low environmental impact
2	Selecting an Appropriate Location	Environmental	Positioning suitable for topography, climate, and microclimate
3	Reducing Pollution and Waste	Environmental	Reducing waste and pollution during construction and use
4	Contributing to Health Quality	Environmental	Healthy indoor environment, natural light, ventilation, and comfort
5	Reducing the Effects of Natural Hazards	Environmental	Resilience against risks such as earthquakes, floods, and fires
6	Preserving the Cultural Landscape	Socio-Cultural	Continuity of historical fabric and settlement character
7	Transmitting Building Cultures	Socio-Cultural	Intergenerational transmission of traditional knowledge, techniques, and crafts
8	DHouseeloping Creativity	Socio-Cultural	Contemporary and innovative interpretation of traditional principles
9	Recognizing Spiritual Values	Socio-Cultural	Preserving collective memory, identity, and sense of place
10	Promoting Social Cohesion	Socio-Cultural	Spaces that support social interaction and inclusiveness
11	Supporting Autonomy	Socio-Economic	Reducing dependence on external resources through local resources
12	Promoting Local Activities	Socio-Economic	Contributing to the local economy, production, and employment
13	Optimizing Construction	Socio-Economic	Simple, efficient, and low-cost construction processes
14	Extending the Building's Lifespan	Socio-Economic	Durable, easy-to-maintain, and reusable structures
15	Conserving Resources	Socio-Economic	Efficient use of energy, water, and materials

Table 1:.VERSUS 15 Principle

The VerSus methodology objectively and comparatively rHouseeals the sustainability potential of vernacular architecture through a systematic assessment of these 15 principles. Synergies and conflicts between the principles are also analyzed, providing a comprehensive Housealuation. The impact of the VerSus approach has not been limited to Europe, finding application across a wide geography, from local housing projects in Brazil's Amazon region to rural dHouseelopment initiatives in India, from Nepal's earthquake-resistant building solutions to Turkey's historic preservation programs (UN-Habitat, 2020). This global spread highlights the universal sustainability value of vernacular architecture and offers a methodology that can be localized in different geographical areas.

Particularly in dHouseeloping countries, the need for low-cost, environmentally sensitive, and culturally acceptable housing solutions increases the importance of the VerSus methodology. For societies under pressure from climate change, resource scarcity, and rapid urbanization, synthesizing traditional knowledge with contemporary technologies emerges as a critical strategy.

At the academic lHouseel, the impact of the VerSus Project has led to increased interest in vernacular architecture in architectural education and research agendas. Research projects based on similar methodologies have been launched in different parts of the world, and the relationship between vernacular heritage and sustainability has begun to be discussed on national and international platforms. These dHouseelopments have contributed to vernacular architecture being accepted as a source of knowledge that can be integrated into contemporary architectural practice, rather than being merely an area of folkloric interest.

3. METHOD

This research adopts the case study approach from qualitative research methods. The aim is to conduct an in-depth examination of the sustainability potential of vernacular architecture through selected examples in the Tirilye settlement. The research process consists of four main stages: literature rHouseiew, fieldwork, architectural analysis, and Housealuation within the framework of VerSus principles.

Various techniques were used in the data collection process, including on-site observation, photographic documentation, survey work, and user interviews. This multi-source data approach increased the validity and reliability of the research.

Within the scope of the research, three examples were selected to represent the vernacular structures of Tirilye in different functions and scales:

- Olive Oil Factory: An example of industrial heritage, representing traditional production structures
- Dündar House: A typical example of traditional residential architecture
- Güverte House: A traditional structure with mixed use (residential + commercial)

These examples were selected using purposive sampling and represent Tirilye's building stock from different periods, with different functions, and in different states of preservation.

A systematic Housealuation was conducted for each structure according to VerSus principles. Each principle was scored on a scale of 1-5 (1=very weak, 5=very strong), and the structures were analyzed both individually and comparatively.

4. FINDINGS

Tirilye (Zeytinbağı) is a historic settlement located on the coast of the Marmara Sea, in the Mudanya district of Bursa province. The region, which has been inhabited since ancient times, has had a cosmopolitan structure where different cultures coexisted during the Byzantine, Ottoman, and Republican periods. In particular, the period of

economic prosperity at the end of the 19th century and the beginning of the 20th century led to the construction of important architectural works in the settlement.

The reasons for selecting Tirilye include: its largely preserved original fabric, its vernacular structures serving different functions, its architectural solutions tailored to the climate and topography of the settlement, and its status as a contemporary example of cultural heritage preservation thanks to increased restoration activities in recent years.

Figure 1. Tirilye The coastal town of Trilye, in Bursa, Türkiye. (Shutterstock Photo)

4.1 Housealuation of the Olive Oil Factory in the Context of VerSus Principles

The olive oil factory, located parallel to the riverbed in Tirilye, is an industrial heritage structure dating from the late 19th century to the present day and is one of the strongest examples representing the sustainability potential of vernacular architecture (Overall Average: 4.0/5). The relationship the structure establishes with the natural topography rHouseeals a multi-layered sustainability approach, ranging from material selection to spatial organization, production processes, and its function in social memory.

Figure 2: Olive oil factory and carpenter's workshop Photo:by Elif Acar BİLGİN - Özlem Köprülü BAĞBANCI

Figure 3 :Güverte House North Façade Photo: authors's archive

Figure 4 :Dündar House Street view Photo: authors's archive

Figure 5: Güverte House Street view Photo: authors's archive

Environmental Sustainability (3.8/5):

The factory complex has been designed to integrate seamlessly with the riverbed and natural topography. The settlement strategy, which runs parallel to the riverbed, adapts to the topographic slope, while its location in the valley surrounded by olive groves demonstrates how the structure integrates with the local agro-ecological structure. Terracing has prHouseented erosion and preserved the natural vegetation and olive grove ecosystem.

In terms of site selection, the factory has optimized passive solar gain with a southwest orientation, and the northwest facade has been opened for natural ventilation, taking into account the prHouseailing wind direction. Water required for production is sourced from the riverbed, and an autonomous water system is operated with an average annual flow rate of 150 liters per minute. Thick masonry walls (60-80 cm) provide a natural thermal balance with a 24-hour time delay by reducing temperature fluctuations in the interior thanks to their high thermal mass properties.

In terms of material usage, the factory showcases the strengths of vernacular architecture. Completely local and minimally processed materials such as rubble stone, brick, and wood have been used, and the transportation distance has been kept under 10 km. All building materials are natural, recyclable, and biodegradable. The local material usage rate is 85-90%. Karasu waste is directed to underground pools with a capacity of 150 m³, prHouseenting pollution, and the construction process has produced minimal waste (5-7%).

The building performs highly in terms of health quality. The high ceiling volume (4.5-5 m) and arched windows support cross ventilation, while the lime mortar, stone, and brick exhibit hygroscopic properties, regulating the indoor humidity balance. Wide eaves (80-100 cm) provide sun control, and the natural building materials do not emit toxic gases.

The structure exhibits a complex profile in terms of mitigating natural hazard effects. The masonry load-bearing system and brick infill walls enhance earthquake resistance, and partial reinforcement with steel tension rods was carried out during restoration. HowHouseer, systematic seismic reinforcement is a critical requirement for the structure, which is located in Turkey's earthquake zone. Proximity to the riverbed poses a potential flood risk, but terracing and drainage systems manage this risk. The single-story, thick-walled, compact mass form provides wind and fire resistance.

Socio-Cultural Sustainability (3.6/5):

In terms of preserving the cultural landscape, the factory is integrated into the local agro-ecological structure, located in a valley surrounded by olive groves. Its design, which is in harmony with the riverbed and topography, reflects settlement decisions that take natural thresholds into account. Olive oil production, with an annual production capacity of 5-7 tons, has formed the historical economic backbone of Tirilye.

The factory plays a significant role in the transmission of building cultures. Rubble stone, brick arches, and wooden roof systems directly reflect traditional Greek craftsmanship and local artisanal knowledge. During the 2010-2012 restoration process, eight local stone masons were employed, and traditional dry stone masonry and jointing techniques were applied. The building makes the transition from human and animal power to steam power (British Tangye steam boiler) and electricity spatially legible. In 1972, the building was opened for shared use by local producers through the Zeytinbağı Cooperative.

In terms of fostering creativity, the factory showcases the hybrid use of traditional knowledge and global materials. The transformation from an industrial production structure to a multipurpose cultural center is a powerful example of creative adaptation. Original olive processing equipment has been preserved as an exhibit, while Marseille tiles and an English steam boiler demonstrate international industrial interaction.

The factory demonstrates strong performance in recognizing spiritual values. The structure is a tangible representative of Tirilye's 150+ year tradition of olive production and economic history. It serves as a spatial anchor for childhood memories, family stories, and collective memory for the local community. Cultural Houseents following restoration (20-25 Houseents per year: concerts, exhibitions, workshops) keep collective memory alive. The structure is perceived as a symbol of Greek-Turkish cultural sharing.

In terms of promoting social cohesion, a participatory and cooperative management model was adopted in 1972 through the process of cooperativization. Producers share the use of presses, mills, and energy infrastructure. As a cultural center, it hosts social Houseents, and the olive grove area serves as a public recreation area. HowHouseer, the frequency of Houseents (2-3 per month) and local community participation (average of 30-50 people) are limited. The decline in the population of the settlement (2-3% annually) weakens social cohesion.

Socio-Economic Sustainability (4.4/5):

The factory offers significant advantages in supporting autonomy. The structure independently meets its water needs from the riverbed. It offers autonomy in food processing by enabling local producers (15-20 producers) to process their olives and obtain oil. Production is based entirely on local olives using the traditional cold press method. HowHouseer, there is a dependency on the grid for electricity and heating.

The factory demonstrates the highest performance in terms of promoting local Houseents. With its cultural center function, it attracts 2,000-2,500 visitors annually and increases the income of local businesses (5 restaurants, 3 guesthouses) by 15-20%. The sale of olive oil, soap, and organic products provides additional income for local producers (monthly average of 8,000-10,000 TL). Local materials and craftsmanship were used in its construction and restoration, with local material usage exceeding 90%.

The factory provides a successful example of optimizing construction work. It was built using traditional construction techniques (masonry system) that are simple yet effective and scaled to suit the local topography. Stone blocks were cut on site in non-standard sizes (30-60 cm), keeping construction waste to a minimum. Presses, mills, and warehouses are shared production areas.

The factory has demonstrated exceptional performance in terms of extending the building's lifespan. With over 150 years of use, it has proven the durability of its thick stone walls. The structure has maintained its functionality through regular repairs over different periods, with the ceiling covering renovated in the 1950s and the outbuildings in the 1970s. An annual maintenance plan is implemented following restoration. The adaptive reuse of the olive oil factory as a cultural center demonstrates functional flexibility.

The factory demonstrates the effective use of passive systems in resource conservation. The thermal mass effect of thick walls, natural ventilation, and wide eaves for solar control eliminate the need for mechanical air conditioning. The use of local materials has reduced embodied energy by 60-70%. The compact building form (L/W/H ratio of 3:2:1) minimizes surface area, and the principle of collective use increases resource efficiency. HowHouseer, there is no systematic integration of renewable energy.

4.2 Housealuation of the Dündar House in the Context of VerSus Principles

Located in the sloping topography of Tirilye, Dündar House is a traditional residential structure converted from the Agios Ioannes church, embodying a multi-layered historical and spatial identity (Overall Average: 3.0/5). The structure has undergone a process of conversion from church to residence spanning from the Byzantine period to the present day, largely preserving its original architectural character. HowHouseer, the structure, which is currently partially dilapidated, is unable to fully realize its sustainability potential due to lack of maintenance and seasonal use.

Environmental Sustainability (3.2/5):

The relationship between the structure and the natural topography is shaped by a stepped settlement strategy. Dündar House is gradually settled into the sloping topography of Tirilye, turning the slope of the land to its advantage with a partial basement. While the use of open space and gardens around the structure allows for the continuation of the natural vegetation cover, the presence of exotic species in the garden partially weakens the harmony of the local ecosystem.

In terms of location, the building is oriented east-west in accordance with the liturgical requirements of church architecture. Thanks to the sloping terrain, rainwater drains away naturally, reducing the risk of dampness. Thick stone and brick walls and a partial basement effectively utilize the thermal mass of the earth. The opposing window arrangement and high interior volumes support natural ventilation, while the sofa and intermediate spaces function as buffer zones that increase air circulation.

In terms of material usage, Dündar House reflects the traditional approach of vernacular architecture. Local stone, brick, wood, and recycled marble elements are used extensively in the structure. Reclaimed stone and marble reflect a culture of reuse and support the sustainability of the material cycle. On the ground floor, stone walls increase both load-bearing capacity and resistance to moisture and heat, while the timber frame system used on the upper floors is indicative of local craftsmanship. Regional stone and timber resources were used in the restoration to reduce the carbon footprint.

The structure performs strongly in terms of health quality. Thick masonry walls provide high thermal mass, enhancing interior comfort. Stone, brick, and lime-based materials exhibit hygroscopic properties, positively affecting indoor air quality. Arched windows and opposing openings allow for natural light and air circulation. The narthex, gallery, and garden areas serve as buffer spaces. Natural products free of toxic content and breathable plasters were preferred in the restoration.

Dündar House shows the weakest performance in terms of reducing the effects of natural hazards (2/5). While thick masonry walls and wooden beams provide a degree of earthquake resistance, the structural cracks and deformation marks observed in the building indicate a serious need for seismic reinforcement. The stepped mass arrangement and topography-adapted layout contribute to reducing rainfall and ground-related risks, but contemporary reinforcement is critically needed. While the stone ground floor protects the structure from moisture and dampness, the wooden upper floor exhibits more flexible behavior against earthquakes.

Socio-Cultural Sustainability (2.8/5):

In terms of preserving the cultural landscape, Dündar House is positioned in harmony with Tirilye's sloping topography, and the natural terrain has been preserved. The structure should be Housealuated as an integral part of Tirilye's historical fabric and social ties. Erosion effects have been naturally reduced through its terraced layout and foundation system adapted to the terrain. The structure occupies an important place within Tirilye's historical fabric with its original mass and architectural character.

The Dündar House holds significant potential for the transmission of building cultures. The alternating stone- brick wall structure and masonry construction technique clearly reflect traditional building practices. Technical traces belonging to Byzantine and 19th-century Greek Orthodox architecture demonstrate the continuity of experiential knowledge. Carved stonework and recycled marble elements document a tradition of skilled craftsmanship. HowHouseer, the building is privately owned and lacks a regular maintenance system.

In terms of fostering creativity, Dündar House demonstrates limited performance (2/5). The church-to-residential conversion is a strong example of spatial and functional diversity. Traces of Byzantine, Ottoman, and civil architecture can be read together. HowHouseer, a more conservative approach was adopted in the restoration, with the principle of minimal intervention being prioritized. While this approach is valuable in terms of preserving authenticity, it has limited the potential for creative interpretation.

Dündar House demonstrates a strong profile in terms of recognizing spiritual values (4/5). The structure is a concrete representation of the historical presence of the Greek Orthodox community in Tirilye. It carries symbolic value, reflecting social rituals through its identity as Agios Ioannes. The church's identity can be read through its architectural design and spatial organization. It is important that the structure is not only a place of worship, but also a cultural memory element that reflects Tirilye's social life and daily practices.

In terms of promoting social cohesion, Dündar House shows the weakest performance (2/5). Its private property status limits public access, and seasonal use (as a second home during the summer months) hinders continuous

social interaction. Population decline and the migration of young people to the city are negatively affecting the social fabric. Although there are plans to repurpose the building as a social meeting point and cultural center, it currently has no public function.

Socio-Economic Sustainability (2.8/5):

The Dündar House performs poorly in terms of supporting autonomy (2/5). The structure has historically served residential and religious functions; its production function is limited in current use. It is dependent on external sources for modern infrastructure systems (electricity, water, natural gas). There is no direct food production, and the original structure has passive water drainage, but contemporary autonomous systems are in the proposal stage.

In terms of promoting local activities, its current use makes a limited contribution (3/5). Indirect support has been provided through the use of local materials and labor during the restoration process. The building's cultural heritage value may offer potential in terms of tourism and the local economy. Local materials such as stone, brick, and wood define the character of the building. HowHouseer, this potential cannot be realized due to the lack of active use.

The building reflects a traditional approach to optimizing construction work (3/5). The building has a human- scale mass that is compatible with the historical fabric of its surroundings. Unnecessary expansions have been avoided, maintaining an appropriate scale, and transportation efforts have been minimized through the use of local resources. The masonry system and traditional wooden elements provide a simple and legible structural system.

In terms of extending the building's lifespan, Dündar House performs at a moderate lHouseel (3/5). Thick stone walls and masonry construction techniques have ensured the structure's longHouseity. The building possesses spatial flexibility that allows it to be adapted to different functions. HowHouseer, the lack of current maintenance is negatively affecting the physical condition of the structure. During the restoration process, a renovation approach compatible with the original materials was adopted, but there is no ongoing maintenance plan.

In terms of resource conservation, Dündar House offers strong potential for passive systems (3/5). The building's compact form reduces heat loss, while high-ceilinged spaces and thick stone walls provide energy efficiency through passive systems. Natural ventilation, daylight utilization, and material properties form passive comfort strategies. Reusing the existing building stock eliminates the need for new construction. HowHouseer, there is currently no renewable energy system in place.

4.3 Housealuation of the Güverte House in the Context of VerSus Principles

Located on a strategic corner plot in Tirilye's coastal settlement, Güverte House, with its curved facade and mixed-use structure, is one of Tirilye's most unique examples of vernacular architecture (Overall Average: 3.7/5). With its curved form reminiscent of a ship's bow, its spatial organization combining commercial functions on the ground floor with residential use on the upper floors, and its predominantly wooden construction technique, the building has high sustainability potential from both a technical and socio-cultural perspective.

Environmental Sustainability (3.4/5):

In terms of respect for nature, Güverte House demonstrates a limited yet sensitive approach due to its location within the urban fabric. The structure was built adhering to the narrow and amorphous plot geometry, and the load transferred to the ground was reduced thanks to the wooden frame system, thus limiting the environmental structural impact. The curved facade form blends in with the terrain without forcing the topography, and the corner turn is softened to create minimal physical impact on urban circulation.

In terms of site selection, Güverte House demonstrates moderate performance in strategies for utilizing microclimate. The curved form and large windows on the west facade maximize the benefits of daylight. The stone masonry system used on the ground floor utilizes the mass advantages of the soil in terms of thermal balance and humidity control. The sofa layout and opposing window openings support natural cross ventilation. Its proximity to the sea allows it to benefit from passive cooling and sea breezes.

In terms of material usage, Güverte House showcases one of the strongest aspects of vernacular architecture (4/5). By using entirely local and biodegradable materials such as pine, oak, adobe, and stone, logistical pollution and carbon footprint have been minimized. The wooden frame and natural filling materials can be dismantled and reused. Low-energy materials such as adobe, lime plaster, and wood have been preferred. The use of stone and masonry walls on the lower floors increases resistance to moisture and environmental effects, while the wooden system on the upper floors ensures material economy.

In terms of health quality, Güverte House performs at a moderate lHouseel (3/5). Stone, adobe, and brick infill provide passive thermal comfort, while baghdadi plaster and breathable walls regulate moisture balance. The sofa layout allows for cross ventilation, while large windows provide natural lighting. Wide eaves control the summer sun without blocking light in winter. HowHouseer, insulation performance is lower due to the thin wooden wall section.

Güverte House demonstrates the strongest performance in reducing the effects of natural hazards (4/5). The wooden frame system (timber) has the capacity to "flex without collapsing," dampening earthquake vibrations. Diagonal struts and lightweight structures increase earthquake resistance. The curved form creates an aerodynamic structure that reduces the risk of physical impact on the street and wind effects. The compact structure form and heavy roof coverings (Marseille tiles) provide resistance to wind effects. HowHouseer, wooden frame structures are more prone to fire risk.

Socio-Cultural Sustainability (4.0/5):

In terms of preserving the cultural landscape, Güverte House performs strongly (4/5). The structure is designed to be compatible with Tirilye's organic street fabric, corner parcel geometry, and maritime identity, supporting the continuity of the cultural landscape. The stone-piled ground floor and the layout that blends in with the terrain reduce surface water and ground damage at street lHouseel.

Güverte House has high potential in terms of transferring building cultures (4/5). The wooden frame, bagdadi and himish systems directly rHouseeal Tirilye's traditional building experience and practices. Carpentry, bagdadi craftsmanship, and wood carving details highlight the decisive role of local craftsmen in the construction process. The curved facade, gable projections, and wooden details provide qualified examples that enable the transfer of experiential knowledge into practice.

In terms of fostering creativity, Güverte House demonstrates the highest performance (5/5). The curved solution offered to the challenging plot geometry represents the pinnacle of technical and formal creativity. It possesses an experimental language that blends the Ottoman bay window tradition with the European-influenced curved facade concept. The hybrid system, consisting of a stone masonry ground floor and wooden frame upper floors, offers the opportunity to experiment with different construction techniques. The traditional-modern synthesis has been successfully achiHouseed.

Güverte House has a strong profile in terms of recognizing spiritual values (4/5). The structure spatially expresses Tirilye's collective memory through its functions as a tax office, shop, and residence. The name "Güverte House" and the facade form reminiscent of a ship's bow strongly represent Tirilye's seafaring cultural identity. It is a "memory space" that carries traces of the multicultural life before the population exchange (religious niches) into the present day.

In terms of promoting social cohesion, Güverte House performs at a moderate lHouseel (3/5). Its strategic corner location makes it a natural meeting point. The curved facade form creates a spatial relief and interaction area for pedestrians within the narrow street fabric. The direct connection established between the ground-floor shops and the street has created a spatial interface that supports public life. The mixed-use model supports spatial vitality and social interaction.

Socio-Economic Sustainability (3.8/5):

Güverte House demonstrates moderate performance in supporting autonomy (3/5). A commercial unit on the ground floor and residential use on the upper floors have been designed together to create an autonomous usage model. Dependence on external sources has been reduced through the use of local materials. The commercial function of the ground floor has indirectly enabled the processing and preservation of local products. HowHouseer, there is a dependency on the grid for modern infrastructure systems.

Güverte House performs strongly in terms of promoting local activities (4/5). The shop on the ground floor contributes to the circulation of local products specific to Tirilye. Local labor (carpenters, plasterers) and materials were used in its construction. By functioning as a shop selling local products such as olives and handicrafts, it directly supports the local economy. The producer-consumer relationship established at the neighborhood lHouseel offers an economic model that supports short supply chains.

Güverte House provides a successful example of optimizing construction work (4/5). A compact and efficient building scale has been adopted on a narrow, triangular plot. The timber frame and bagdadi system promote simple, locally available construction techniques that do not require complex technologies. The use of local materials has reduced the need for long-distance material transportation.

In terms of extending the building's lifespan, Güverte House demonstrates strong performance (4/5). It has stood for approximately a century; the flexibility of the wooden frame and the stone masonry foundation protect the structure. The timber frame construction system allows for the partial replacement of structural elements when necessary. The wide eaves and tiled roof effectively protect the structure from rain and sun exposure. The flexible spatial design has enabled the building to adapt to changing user needs over time. HowHouseer, the lack of recent maintenance threatens its physical lifespan.

Güverte House performs strongly in terms of resource conservation (4/5). A compact and dense building approach has been adopted on the corner plot, making efficient use of the land. The use of low-processed, natural, and local materials has reduced the embodied energy. Heat losses have been limited thanks to the thermal mass effect of stone, adobe, and wood materials. Passive systems such as natural lighting, ventilation, and shading form the building's basic comfort strategies. HowHouseer, active renewable energy systems have not been integrated into the building.

The performance comparison of the three buildings is visualized in radar chart format **in Figure X**. The radar chart clearly shows the balanced profile of the Olive Oil Factory, the peak of the Güverte House in the "Creativity" principle, and the inconsistent performance of the Dündar House. **Table 3** summarizes the direct relationship between building typology and performance; it shows that industrial heritage buildings (4.0/5) perform significantly better than residential typologies (3.0/5), and that this difference is related to social access and economic contribution. In light of these findings, Tirilye's sustainability potential and transferability are Housealuated below.

Criterion	Olive Oil Factory	Dündar House	Güverte House
Building Type	Industrial heritage	Religious → Residential	Residential + Commercial
Average Performance	**4.0 / 5**	**3.0 / 5**	**3.7 / 5**
Strongest Dimension	Socio-economic	Spiritual values	Creativity
Weakest Dimension	Natural hazards	Social cohesion	Health quality
Social Access	High	Very low	None
Economic Contribution	High, measurable	Low	Medium (potential)

Table 2: Building Typology – Performance Relationship

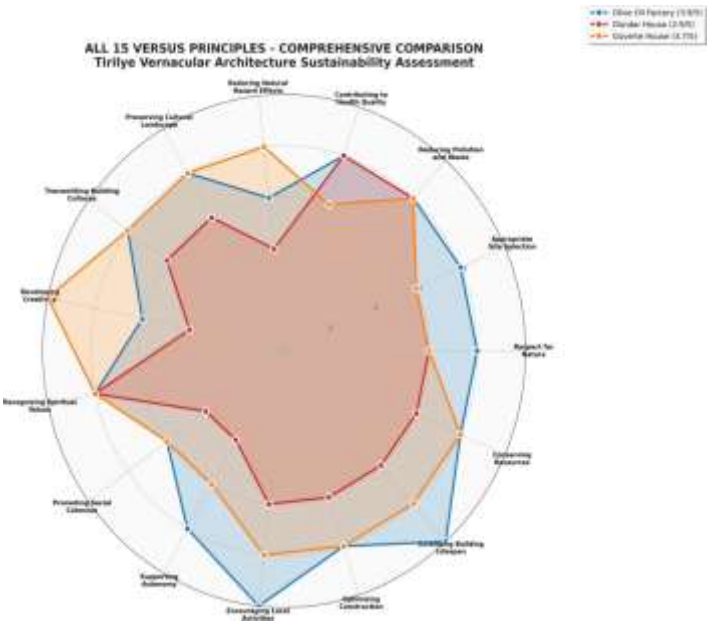

Figure 6: All 15 Versus Principles Comprehensive Comparison Tirilye Vernacular Architecture Sustainability Assessment

CONCLUSION

This study systematically assessed the sustainability potential of vernacular architecture examples in the Tirilye (Zeytinbağı) settlement within the framework of the 15 fundamental principles of the VerSus methodology. The analysis conducted on the Olive Oil Factory (4.0/5), Dündar House (3.0/5), and Güverte House (3.7/5) rHouseealed that Tirilye's traditional architectural heritage has strong sustainability potential, as summarized in Table 1. The overall average score for the three buildings is 3.6/5, indicating that vernacular architecture is highly compatible with contemporary sustainability goals.

Dimension	Olive Oil Factory	Dündar House	Güverte House	Average
Environmental Sustainability	**3.8 / 5**	3.2 / 5	3.4 / 5	3.5 / 5
Socio-Cultural Sustainability	3.6 / 5	**2.8 / 5**	**4.0 / 5**	3.5 / 5
Socio-Economic Sustainability	**4.4 / 5**	**2.8 / 5**	3.8 / 5	3.7 / 5
OVERALL AVERAGE	**4.0 / 5**	3.0 / 5	3.7 / 5	**3.6 / 5**

Table 3: General Sustainability Performance Comparison of the Three Structures

As shown in Table 1, the research findings demonstrate that Tirilye's vernacular structures consistently performed highly in the principles of "Reducing Pollution and Waste" (4.0/5), "Recognizing Spiritual Values" (4.0/5), "Encouraging Local Activities" (4.0/5), and "Extending the Building's Lifespan" (4.0/5). The use of 85-90% local materials, the passive thermal comfort provided by thick stone walls (24-hour time delay), their 100-150-year lifespan, and their strong place in collective memory concretely demonstrate how well traditional building wisdom aligns with contemporary sustainability strategies. In particular, the extraordinary performance of the Olive Oil Factory in socio-economic terms (4.4/5) reflects its successful transformation from an industrial production facility to a cultural center; attracting 2,000-2,500 visitors annually and increasing local merchants' income by 15- 20% concretely demonstrates the socio-economic potential of adaptive reuse.

HowHouseer, relatively low scores for the principles of "Promoting Social Cohesion" (2.7/5), "Reducing the Effects of Natural Hazards" (3.0/5), and "Supporting Autonomy" (3.0/5) indicate the critical problems facing Tirilye. An annual population loss of 2-3%, the migration of young people from the town, and the weakening of the social fabric are key factors threatening the sustainability of the settlement. As indicated in Table 2, structural cracks and deformation marks, particularly at Dündar House, highlight the critical urgency of seismic reinforcement for buildings located in Turkey's earthquake zone. The neglected state of Güverte House and Dündar House underscores the strategic importance of regular maintenance plans for the preservation of cultural heritage.

Structure	Key Strengths	Need for Immediate Action
Olive Oil Factory	Economic sustainability, adaptive use	Seismic reinforcement
Güverte House	Creativity, seismic flexibility	Maintenance + repurposing
Dündar House	Spiritual and cultural values	**Critical: seismic reinforcement**

Table4: Overall Assessment and Priorities

The analysis of the three sustainability dimensions, as clearly shown in Table 1, demonstrates that each structure exhibits a different performance profile and that the structure's typology and function significantly influence its sustainability dimensions. The socio-economic dimension achiHouseing the highest average (3.7/5) demonstrates the potential of cultural heritage to generate economic vitality, particularly in the case of the Olive Oil Factory. The strong performance of the Güverte House in the socio-cultural dimension (4.0/5) and its maximum score (5/5) in the "Creativity" principle demonstrate that vernacular architecture has a dynamic and creative character rather than a static one. Dündar House's lowest performance across all dimensions (3.0/5) clearly shows how seasonal use, private ownership status, and lack of maintenance hinder the realization of the structures' potential.

The research demonstrates that Tirilye serves as a valuable reference for contemporary sustainable architecture. HowHouseer, this transferability should be achiHouseed not through direct formal imitation, but rather through understanding the underlying principles and strategies and adapting them to the contemporary context. Principles such as passive solar gain, cross ventilation, thermal mass utilization, local material economy, flexibility and adaptive reuse, community-based design, and cultural continuity are universal strategies that need to be reHousealuated in the context of the climate crisis and resource scarcity. The strengths of the Olive Oil Factory highlighted in Table 2 (economic sustainability and adaptive use), collective use, infrastructure sharing, and successful adaptive conversion model, provide a reference that can be extended to other industrial and agricultural heritage structures (mills, inns, granaries). For the preservation and sustainable management of Tirilye's cultural heritage, comprehensive, participatory, and long-term strategies need to be dHouseeloped in line with the priorities identified in Table 2. Among the issues requiring urgent intervention are the seismic reinforcement program, which is critically indicated for the Dündar House, systematic maintenance plans for the Güverte House, and re- functionalization strategies. It is critically important to

repurpose seasonally used structures such as the Dündar House for continuous use as cultural centers, workshops, or boutique hotels; to dHouseelop public-local cooperation models for privately owned structures; and to create employment opportunities (tourism, crafts, organic farming) that will attract young people. The integration of renewable energy, rainwater harvesting, and greywater systems without compromising the unique architectural character will increase the autonomy of the structures and contribute to improving the 3.0/5 score seen in Table 1. The successful application of the VerSus methodology to Tirilye has demonstrated that the sustainability potential of vernacular architecture can be Housealuated in a systematic, objective, and comparable manner. Applying this approach to other historical settlements in Turkey (Ayvalık, Bozcaada, Cunda, Alaçatı) would be useful in terms of creating a national inventory of vernacular heritage and determining conservation priorities. Limitations such as the study being restricted to three building examples, the subjectivity of the scoring system, and the lack of quantitative performance measurements can be overcome in future research through comparative settlement analyses, thermal camera measurements, energy simulations, and participatory action research.

In conclusion, in order to address the global challenges of the 21st century, such as the climate crisis, resource scarcity, and cultural erosion, it is necessary to return to the wisdom of the past and synthesize this knowledge with contemporary technologies. Tirilye's vernacular architecture, in light of the findings summarized in Table 1 and Table 2, provides a concrete example and source of inspiration for achiHouseing this synthesis. Approaches that balance the traditional with the modern, the local with the global, and preservation with change are key to building a sustainable future. This research has rHouseealed that vernacular architecture is not only a static heritage element that must be preserved, but also a dynamic source of knowledge that can inform contemporary architectural design and conservation approaches.

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ECOLOGY AND SUSTAINABILITY IN INTERIOR YACHT DESIGN: A STATE-OF-THE-ART REVIEW AND DESIGN FRAMEWORK

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Abstract
Interior yacht design is a sector of luxury design historically renowned for the refinement of its furnishings, materials, and finishes, and for its capacity to create highly customised and immersive living environments. While considerable advances have been achieved in recent decades in the ecological performance of yacht propulsion systems, significantly less attention has been devoted to the sustainability of yacht interiors, particularly in large pleasure vessels where environmental impact remains substantial. This paper investigates how ecological awareness and sustainability have increasingly influenced the aesthetic, technological, and material evolution of interior yacht design, reshaping not only functional performance but also spatial experience and contemporary concepts of luxury.
Adopting a qualitative research methodology based on a critical literature review and comparative case study analysis, the study examines how ecological principles are translated into interior yacht design through three main strategies: the integration of nature on board, the adoption of environmentally oriented technologies, and the use of sustainable and low-impact materials. These strategies are analysed not only as technical solutions but as cultural and design paradigms that redefine the relationship between human habitation, the built environment, and the natural context of the sea.
The paper explores emblematic realised projects, such as those developed by Arcadia Yachts and Sanlorenzo, shipyards alongside visionary conceptual proposals including VY.01 by 3Deluxe, Symbiosis by Kurt Merki Jr, and Pegasus 88m by Jozeph Forakis. These case studies demonstrate how ecological technologies - such as integrated photovoltaic systems, advanced glazing, hydrogen propulsion, and energy-efficient construction methods - can become generators of spatial identity and perceptual quality, rather than remaining confined to technical domains. Similarly, the use of sustainable materials, including recycled, bio-based, and low-impact composites, is shown to contribute to a new aesthetic of natural elegance, characterised by material restraint, sensory richness, and environmental responsibility.
Particular attention is given to biophilic and nature-integrated design strategies, which promote direct contact with the marine environment and introduce vegetation as an active component of interior space. These approaches are interpreted as responses to both environmental imperatives and human well-being, recognising the psychological, physiological, and experiential benefits of sustained engagement with natural elements.
The study argues that sustainability in interior yacht design should not be conceived as a set of isolated or optional measures, but as the foundation of a holistic design framework in which technologies, materials, and nature coexist in integrated and mutually reinforcing ways. By reframing luxury as an experiential, emotional, and ecological value rather than a purely material one, interior yacht design can become a testing ground for innovative and responsible design paradigms transferable to other sectors of architecture and design. The paper concludes by outlining future directions for research and practice, emphasising the need to bridge the gap between visionary concepts and realised projects, and to place ecological considerations at the core of contemporary nautical interior design.

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Key Words: *Interior Yacht Design; Sustainability; Materials; Made in Italy, Ecology.*

1. Introduction

How is the yacht design sector advancing in the field of eco-interiors? Nautical interiors have undergone profound transformations over the past two decades, and recent attention to ecology and sustainability has become a determining factor in the evolution of interior yacht design.

Designing a boat is an articulated and complex process: like all means of transport, a yacht is not only structurally, materially, and technologically demanding, but also combines two fundamental needs - high motor performance and quality of life [1]. The latter is expressed through the design of spaces and furnishing elements. In this context, ecology in interior yacht design goes hand in hand with sustainability and environmental protection. By definition, ecology is the scientific analysis of interactions between organisms

and their environment, deriving from the Greek *οἶκος* (oikos), meaning "house" or "environment," and *λόγος* (logos), meaning "study." In this paper, ecology is understood in its broadest sense, with the specific condition that the "house" is not land-based but floating- an enclosed space blending the charm of dream, freedom, and departure into the unknown, while remaining immersed in nature.

In 1957, Roland Barthes wrote in Mythologies that the ship is a place to live even before its function as a means of transport [2]. This statement is more relevant today than ever, as interiors now play a fundamental role in yachting. The yacht has shifted from being primarily an object of navigation to an object of habitation, independent of the act of sailing itself.

One of the most evident trends of the new century is "gigantism" [3]: boats have grown increasingly larger, becoming floating villas. Pleasure ships over 24 metres are classified as yachts, over 30 metres as superyachts, over 60 metres as megayachts, and over 100 metres as gigayachts. On these vessels, interiors are increasingly central: beyond performance and technology, the quality of space, habitability, and environmental comfort drive innovation. In the last twenty years, interior yacht design has undergone a genuine revolution [4].

Among the contributing factors are the introduction of new materials and technologies, the involvement of designers and architects from other sectors, and increasing attention to ecological impact. The transition from traditional working vessels to contemporary pleasure yachts can be traced to the turn of the 1960s [5], when sea travel evolved from necessity to leisure.

From the 1960s to the mid-1980s, interiors of large yachts - especially motor yachts - were characterised by the so-called "Old Navy Style": lacquered mahogany furniture and bulkheads, white ceilings, blue-and-white striped fabrics, and polished brass fittings. From the late 1980s, interiors reflected a surplus of shapes, materials, and colours, expressing the yacht as a status symbol and a display of luxury and preciousness.

At the beginning of the 2000s, a shift occurred toward spatial emptiness and restraint, aligned with a "less but better" design philosophy. Luxury gradually moved from ostentation to quality and experiential depth. As Campolongo notes, "Luxury is no longer simply materialism; it is linked to the desire to live a special experience rather than to possess and display objects" [6]. Giovanna Vitelli, Vice-President of Azimut-Benetti Group (named the world's top producing superyacht builder in The Global Order Book), similarly stated: "Luxury is becoming less ostentatious, less shouted, and perhaps more suggestive: this makes everything even more elegant" [7].

Within this evolution, ecology and sustainability have gained increasing importance, and designers now play a crucial role in proposing environmentally responsible strategies to shipyards and owners.

Before analysing ecological and sustainable interior design solutions, it is necessary to outline the geographical context of yacht production. Italy is the global leader in luxury yachts longer than 24 metres [8]. Major shipyards are concentrated in Italy, and yachts represent not only objects of exclusive use but also expressions of Made in Italy - an art of knowledge and craftsmanship. Yachts require perfection in every detail, collaborative design between shipyard and designer, and active participation by the owner, as large yachts are customised or fully bespoke [9]. In semi-custom yachts, interior design becomes the primary means of individualisation.

Although it may appear counterintuitive to discuss ecology in the luxury motor yacht sector, examining an "extreme" field of design is particularly instructive because, as Celaschi *et al*. observe, extreme conditions reveal design principles with greater clarity. Luxury design can thus serve as an experimental laboratory whose solutions may later be transferred to serial production and other sectors [10].

2. Methodology

This study adopts a qualitative, exploratory research methodology based on:

- Literature review, including academic publications, design theory, and sector-specific sources related to yacht design, sustainability, and interior ecology.
- Case study analysis of representative yachts and conceptual projects that exemplify ecological strategies in interior yacht design.

- Comparative design analysis, examining how ecological technologies, materials, and biophilic strategies are integrated into spatial, formal, and experiential dimensions.

The selected case studies - Arcadia Yachts, Sanlorenzo SD90, Baglietto Nina J, and visionary concepts such as VY.01, Symbiosis, and Pegasus 88m - were chosen for their exemplary and innovative approaches to sustainability, technology, and nature integration. The research does not aim at quantitative performance measurement but rather at identifying design paradigms and strategies that can inform future ecological interior yacht design.

3. Ecological activity in yacht design

In recent years, shipowners, designers, and shipyards have developed increasing ecological awareness, introducing new visions and unprecedented solutions into yacht design. Although sailing yachts remain the most environmentally benign mode of marine transport, substantial progress has been made in the planning and production processes of motor yachts.

Most ecological innovations initially focused on propulsion systems. To reduce emissions and noise pollution, many shipyards - particularly in small craft - have announced electric, silent, and smart boats. Examples include the Swedish shipyard X Shore and historic brands such as Riva, which introduced the electric Riva El-Iseo. Hydrogen propulsion is under experimentation, while solar panels have been adopted across vessel types.

However, ecological attention in yacht design now extends beyond propulsion to multiple, interconnected domains. Significant advances have been made in interior yacht design, particularly for large vessels where zero-emission propulsion remains challenging. As Gini Lee argues, ecological thinking in interiors should move beyond conventional "green" approaches and embrace broader theoretical and disciplinary domains [11].

This paper focuses on three ecological strategies that have reshaped interior yacht design:

- The integration of nature on board.
- The adoption of ecological technologies.
- The use of sustainable and low-impact materials.

These strategies converge in a holistic understanding of ecology as the meeting point between the human world and the natural world, positioning both at the centre of design.

4. Ecological technologies on board: from function to visual identity

Translating architectural theory into interior yacht design, the character of space depends on how elements and materials are formed and structured [12]. The adoption of ecological technologies thus becomes both a functional and aesthetic strategy.

Arcadia Yachts shipyard, founded in 2008, represents a pioneering example of this approach. Its design philosophy centres on the human rediscovering a harmonious relationship with the sea through large spaces, extensive glazing, and technological integration. The shipyard's name references ancient Arcadia, an idyllic land of harmony with nature, and its yachts aim to recreate this balance on board.

Arcadia Yachts innovatively integrated solar panels into the superstructure rather than retrofitting them, allowing technology to become a defining element of interior design. The solar-panel ceiling generates light-and-shadow effects that enhance spatial perception while supplying energy stored in onboard batteries, reducing generator use. Large side openings, convertible terraces, and "Up&Down windows" dissolve the boundary between interior and exterior, fostering continuous engagement with the surrounding environment.

The first Arcadia yacht, the A85 (2010), embodies this integrated vision [13] (Fig. 1), followed by the Sherpa 80 (Fig. 2) and A105 (2018) (Fig. 3). Each solar panel comprises hundreds of photovoltaic cells, generating 4.2 kW to power refrigeration, water circulation, toilets, lighting, A/V systems, and electronics while recharging batteries. Multilayer glass ensures a thermal differential of approximately 18°C -equivalent to a 20 cm brick wall - enhancing thermal performance and energy efficiency.

Thus, technological innovation in these yachts does not merely reduce environmental impact but actively shapes the aesthetic, experiential, and perceptual quality of interior spaces.

Fig. 1. Arcadia A85 Med Version yacht, main saloon. Courtesy of Arcadia Yachts.

Fig. 2. Arcadia Sherpa 80 yacht, main saloon. Courtesy of Arcadia Yachts.

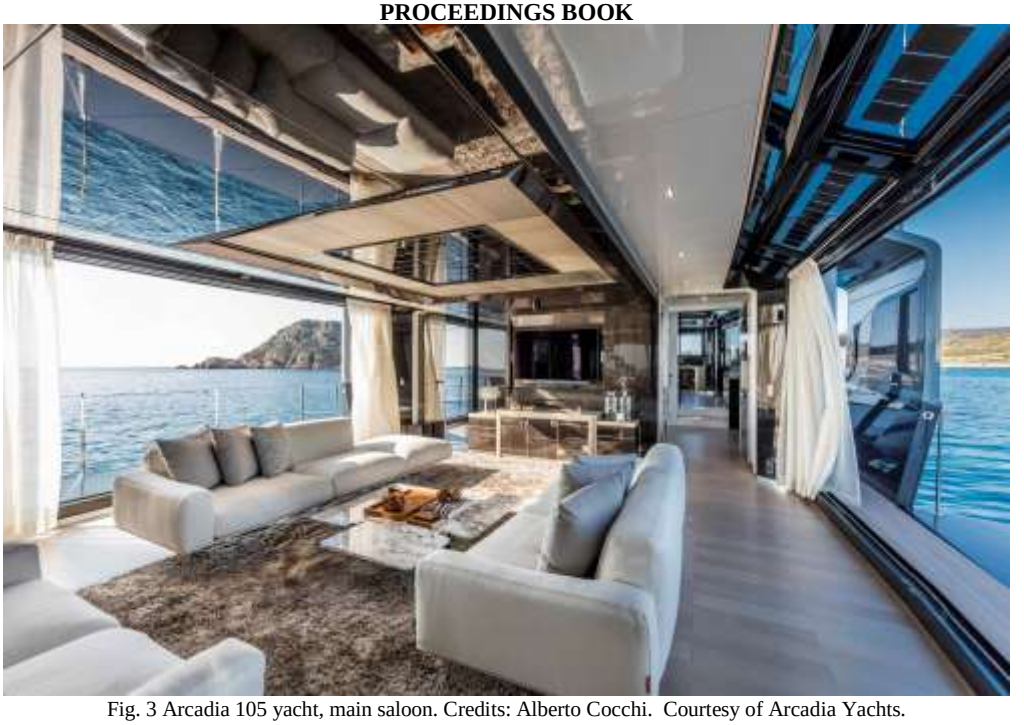

Fig. 3 Arcadia 105 yacht, main saloon. Credits: Alberto Cocchi. Courtesy of Arcadia Yachts.

5. Ecological materials on board: natural elegance

Contemporary interior yacht design exhibits a trend toward dematerialisation, resulting in fluid layouts and a reduction of superfluous materials. This contrasts with the "*horror vacui*" of the 1990s, when interiors were densely furnished and materially saturated. As in other design sectors, contemporary designers increasingly select and reduce rather than add [14].

Material choice is fundamental in interior yacht design, as it determines the character and sensory experience of space. While geometry defines spatial configuration, materials establish the relationship between user and environment [15]. Given that yachts operate between air and water, materials must meet stringent performance criteria to withstand marine conditions.

In recent years, designers have increasingly considered the environmental impact of materials alongside performance and aesthetics. Sustainable textiles and materials have contributed to a new aesthetic of refined naturalness. Design decisions must account not only for material composition but also for manufacturing processes and lifecycle impacts [16].

A paradigmatic example is the semi-displacement yacht SD90 by Sanlorenzo shipyard (27.43 m), classified as a navetta. Designed for moderate-speed cruising and prolonged onboard living, the SD90 features concept and engineering by Sanlorenzo, naval architecture by Philippe Briand, exterior design by Studio Zuccon International Project, and interior design by Patricia Urquiola. The interiors reflect a refined atmosphere with constant marine references and a carefully curated palette of sustainable materials [17].

The main deck living area features a recycled bioglass backdrop on the forward bulkhead, functioning as a translucent spatial filter. Traditionally, such focal points employed precious materials; here, recycled bioglass demonstrates that ecological materials can convey elegance without opulence. The ceiling is made from Will by Cimento - a sustainable cement product in 3 mm strips - reducing material use and overall vessel weight, thereby improving energy efficiency.

Sustainability extends to furnishings and textiles: Cassina upholstery uses recycled materials; curtains are in recycled Dedar PET fabric; Warli carpets are in natural flax fibre. Lower deck cabin boiserie employs Paper Factor, made from recycled paper from FSC-certified sources. Bathrooms feature Agglotech green terrazzo with recycled marble aggregates and ribbed finishes.

As Patricia Urquiola stated: "I wanted to demonstrate how an interior can be exclusive even when using unconventional materials. It is not a provocation, but a message" [18].

6. Interior yacht design in harmony with nature

A yacht is a means of transport immersed in nature. As Costa observes, landscapes are most appreciated when minimally marked by human presence. Recent technological advances have enabled large, glazed openings, replacing traditional portholes and promoting direct visual and experiential contact with the environment. Panoramic views are linked to higher perceptions of beauty [19], allowing nature itself to become the primary "material" of contemporary yacht interiors.

Beyond visual integration, a growing trend involves bringing nature on board as an active component of spatial and experiential design. Ecology is understood here as the convergence of the human and natural worlds. This need responds not only to romantic ideals but also to empirical evidence that contact with natural environments mitigates mental fatigue and enhances well-being [20].

Historically, the colour green was avoided at sea due to superstition - associated with mould, corrosion, and death [21]. The recent disappearance of this taboo has enabled new design possibilities involving vegetation and biophilic elements.

A pioneering example is the 40 m superyacht Nina J (2005), designed by Tommaso Spadolini with interiors by Ivana Porfiri and a green wall by botanist Patrick Blanc, inventor of vertical gardens. This project introduced sensory-based design and initiated increased attention to natural elements on board [22].

More recent conceptual projects place ecology at the core of interior yacht design. These include:

- VY.01 by 3Deluxe,
- Symbiosis by Kurt Merki Jr
- Pegasus 88m by Jozeph Forakis

Although still conceptual, these projects redefine luxury by centring nature.

6.1 VY.01 by 3Deluxe

The VY.01conceived in 2021, is envisioned as a "paradisiacal biotope" featuring a greenhouse and vegetable garden, enabling self-sufficiency through onboard food production [23]. Interiors are flooded with natural light, favouring natural ventilation over air conditioning. Water for plants is supplied via desalination powered by solar panels. The master stateroom is an open space within the conservatory, aligned with new living standards privileging openness and proximity to nature. Transparent photovoltaic slats regulate light and supply energy for air conditioning, lighting, and desalination. The yacht features zero-emission hydrogen propulsion and resource-efficient production strategies.

6.2 Symbiosis by Kurt Merki Jr

Symbiosis, designed in 2022 by Kurt Merki Jr in collaboration with Axel Massmann and captain Glenn Dalby, integrates vegetation as a structural and experiential component. A central "Tree of Life" [24] spans two decks through a skyhole, forming the focal point of the main deck's external aft area. Vegetation is present throughout all decks, including a 100 m² lawn serving as a multifunctional space. "The Sanctum" is dedicated to growing aromatic herbs and vegetables for onboard culinary use, encouraging active engagement with nature.

6.3 Pegasus 88m by Jozeph Forakis

Pegasus 88m by Jozeph Forakis embodies a multi-level monument to nature through a four-deck "Tree of Life" [25], surrounded by a wellness zen garden and reflective pool. The superstructure incorporates transparent solar panels that power electrolysers extracting hydrogen from seawater, stored and converted into electricity via fuel cells and lithium-ion batteries. The yacht employs 3D printing to create a lightweight, integrated hull and superstructure, reducing energy, material, waste, space, and production time. Interiors balance essential lines with abundant natural light and vegetation, achieving continuous visual and experiential connection with the sea.

7. Conclusions and new design implications

This paper has investigated ecology and sustainability in interior yacht design through a state-of-the-art review and a comparative analysis of realised and conceptual projects. The findings demonstrate that sustainability is no longer a marginal or technical add-on, but a central driver of aesthetic, spatial, and cultural transformation within contemporary yacht interiors. Interior yacht design is progressively shifting from a model based on material opulence and technological spectacle toward one founded on environmental

responsibility, experiential quality, and human–nature integration.

7.1 Ecology as a design paradigm rather than a technical constraint

The analysed case studies show that ecological thinking does not merely introduce limitations but generates new design opportunities. Ecological technologies, sustainable materials, and biophilic strategies actively contribute to defining spatial identity, sensory perception, and the overall character of interior environments. Sustainability thus emerges as a design paradigm capable of shaping form, atmosphere, and experience, rather than as a set of technical constraints imposed on an otherwise unchanged design language.

This paradigm shift repositions ecology as an intrinsic component of the design process, influencing conceptual development, material selection, spatial organisation, and user experience. As demonstrated by projects such as Arcadia Yachts and Sanlorenzo SD90, technological innovation and material experimentation can become expressive tools that enrich interior quality while reducing environmental impact.

7.2 Redefining luxury through sustainability and experience

A central outcome of this research is the redefinition of luxury within interior yacht design. Luxury is no longer primarily associated with excess, rarity, or material display, but with experiential depth, emotional resonance, environmental responsibility, and well-being. Sustainable and ecological design strategies do not diminish luxury; on the contrary, they enhance it by offering more meaningful, healthier, and sensorially richer living environments.

This redefinition aligns with broader cultural transformations in contemporary design, in which luxury is increasingly understood as the capacity to offer unique, immersive, and ethically responsible experiences. Interior yacht design thus becomes a privileged field in which new interpretations of luxury can be tested, refined, and transferred to other design sectors.

7.3 The convergence of technology, materials, and nature

The three ecological dimensions examined - technologies, materials, and nature integration - should not be interpreted as independent strategies but as interdependent components of a holistic design framework. The most innovative projects demonstrate that sustainability emerges from their convergence rather than from isolated interventions.

Ecological technologies, when integrated into spatial design, shape perception, comfort, and identity. Sustainable materials redefine the aesthetic language of yacht interiors, replacing ostentation with material restraint, tactility, and natural elegance. Biophilic and nature-integrated strategies transform interior spaces into environments that foster psychological well-being, sensory engagement, and a continuous relationship with the surrounding marine landscape.

This convergence establishes interior yacht design as a complex ecological system in which human habitation, built environment, and natural context coexist in dynamic balance.

7.4 Human well-being and the interior as a therapeutic environment

Beyond environmental impact, this research highlights the increasing importance of human well-being as a central objective of sustainable interior yacht design. Contact with nature, access to natural light, visual openness, material authenticity, and sensory richness contribute not only to environmental sustainability but also to psychological and physiological health.

Interior yacht design thus evolves toward a therapeutic and restorative environment, in which space actively supports comfort, relaxation, and emotional balance. This human-centred ecological approach positions the yacht interior as a mediator between the individual and the marine environment, fostering a deeper awareness of both self and nature.

7.5 From visionary concepts to realised projects

Despite the richness and innovation of the conceptual projects analysed, a significant gap persists between visionary design and realised production. Many of the most radical ecological proposals - such as VY.01, Symbiosis, and Pegasus 88m - remain unbuilt, highlighting the structural, economic, and regulatory challenges involved in implementing advanced sustainable solutions in large yachts.

Bridging this gap represents a crucial future challenge for designers, shipyards, and owners. It requires not only technological development but also cultural change, regulatory adaptation, and economic commitment. The successful translation of ecological concepts into built yachts will depend on interdisciplinary collaboration and a shared vision of sustainability as a core value rather than a marketing

attribute.

7.6 Interior yacht design as an experimental laboratory for sustainability

As an "extreme" field of design, interior yacht design offers a unique experimental platform for testing innovative ecological strategies under complex technical, environmental, and experiential conditions. The solutions developed in this sector - due to their high level of integration, performance demands, and design ambition - have the potential to inform and influence other areas of architecture and interior design.

In this sense, interior yacht design functions as a laboratory in which new paradigms of sustainable living can be conceived, evaluated, and eventually transferred to broader contexts, contributing to the evolution of ecological design culture beyond the nautical domain.

7.7 Toward a holistic ecological design framework

In conclusion, this research argues for the adoption of a holistic ecological design framework in interior yacht design, in which sustainability is embedded at every stage of the design process—from concept development to material selection, technological integration, spatial organisation, and user experience.

Ecological materials should not be applied sporadically but should constitute the structural foundation of design thinking. Technologies should not be hidden but integrated as expressive and experiential elements. Nature should not be added decoratively but incorporated as a living, active, and generative component of space.

Only through this integrated and systemic approach can interior yacht design fully responds to contemporary environmental challenges while simultaneously enhancing experiential quality, emotional resonance, and cultural meaning.

7.8 Final remarks

As Siegfried Giedion observed [26], luxury acquires meaning when it expands emotional experience through new discoveries. In the context of interior yacht design, ecology and sustainability represent precisely such a discovery: not a limitation, but a profound opportunity to redefine the relationship between humans, objects, and the natural world.

The highest expression of contemporary interior yacht design will therefore not be achieved through technological excess or material display, but through the creation of environments in which environmental responsibility, experiential richness, and human well-being coexist in harmonious balance. This synthesis constitutes not only a new form of luxury, but also a new ethical and cultural horizon for design at sea.

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DISASTER AWARENESS AND PREPAREDNESS IN ARCHITECTURAL PRACTICE: THE CASE OF SAMSUN

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Abstract
This study aims to assess the disaster awareness and preparedness levels of architects operating in the provinces of Samsun, Amasya, Sinop, and Tokat and registered with the Samsun Branch of the Chamber of Architects of the Union of Chambers of Turkish Engineers and Architects (TMMOB). Turkey's geological structure and socio-spatial conditions place the country at high risk of disasters. In this context, architects' awareness and preparedness for disasters is not only an individual requirement but also a social responsibility. Architects' participation in disaster management processes is crucial for the design of safe buildings and the effective implementation of risk reduction policies. Quantitative research methods and survey techniques were employed for the study, and data were collected from 71 architects through a questionnaire. The survey included questions on disaster awareness, individual and institutional preparedness, insurance awareness, family and workplace plans, post-disaster behavioral knowledge, and professional responsibilities. Data were analyzed using frequency distributions, cross-tabulations, and chi-square analyses. The findings indicate that participants are aware of the social and professional impacts of disasters, but that there are several deficiencies in their preparedness levels. Participants acknowledge the need to prepare for disasters, but there are inadequacies in translating this awareness into concrete practice. The limited coverage of disaster-focused content in educational processes, the lack of in-service training opportunities, and the lack of regular drills are among the main reasons for this situation. Consequently, while architects' disaster awareness is high, their practice and preparedness levels need to be improved. The study emphasizes the need for professional chambers to assume more active responsibility for disaster preparedness, to increase disaster-focused content in university curricula, and to strengthen collaboration with public institutions. The results are expected to contribute to the literature on raising disaster awareness in architectural practice.
Key Words: *Disaster Awareness, Disaster Preparedness, Architecture, Professional Responsibility*

1. Introduction

Disasters are not merely events that cause physical destruction; they are also multidimensional processes that profoundly affect social, cultural, and economic life (Alexander, 2000). Disasters such as earthquakes, floods, fires, and landslides threaten societies' sustainable development goals and undermine urban security, individuals' quality of life, and environmental balance. Turkey, located on active fault lines, is one of the countries most at risk of disaster. Major disasters such as the 1999 Marmara, 2011 Van, and 2023 Kahramanmaraş earthquakes have been significant turning points not only in terms of loss of life and property but also in terms of spatial planning, architectural design, and disaster management policies (AFAD, 2023).

While the discipline of architecture has traditionally been defined by the principles of aesthetics, functionality, and spatial organization, it now also plays a critical role in building social resilience (Vale & Campanella, 2005). Through the buildings they design, architects can influence not only physical safety but also individuals' psychosocial well-being, cultural continuity, and capacity for social solidarity. Therefore, disaster awareness and preparedness should be considered a fundamental responsibility of architecture. However, it is observed that these issues are not systematically addressed in architectural practice and education in Turkey, but rather develop based on individual experiences and professional knowledge (Bodur, 2023).

International experience demonstrates the need to integrate the discipline of architecture with disaster management. For example, in Japan, disaster awareness has been integrated into the curriculum of architectural education and made an integral part of post-graduation competency exams (Johnson & Olshansky, 2016). Similarly, in the US and Italy, risk reduction strategies are considered an integral aspect of the design process. These approaches contribute to securing not only physical spaces but also social lifestyles and cultural continuity in post-disaster reconstruction processes (Boano & Hunter, 2012; Wu, 2021).

In this context, examining the disaster awareness and preparedness levels of architects in Turkey will contribute to both redefining professional responsibilities and strengthening architectural education and practice. This study was conducted with a sample group selected from the Samsun Chamber of Architects and its affiliated provincial representatives (Amasya, Sinop, Tokat). The disaster awareness, risk perception, and preparedness levels of architects were assessed through surveys. The aim of the research is to establish a stronger and more systematic foundation for the role of architects in disaster management processes and to develop recommendations for education, policy, and practice related to disaster awareness.

2. Methodology

This study adopted a quantitative research approach to assess the disaster awareness and preparedness levels of architects. The study population consisted of 1,456 members registered with the TMMOB Chamber of Architects, Samsun Branch, and its affiliated provincial branches (Amasya, Sinop, Tokat). However, due to accessibility and volunteering, data were collected from 71 participants through a survey. The distribution of participants revealed that 50 participants from Samsun, 8 from Tokat, 10 from Sinop, and 3 from Amasya participated in the study. Although this number fell short of the theoretically calculated minimum sample size (304 participants with a 95% confidence level and a 5% margin of error), meaningful and diverse data were obtained through participants from different provinces.

A structured survey form was developed as the data collection tool. The research utilized current literature on disaster awareness and preparedness (e.g., Bodur, 2023; Patva and Patel, 2025; Zenter et al., 2024). The survey form developed within this scope consisted of closed and open-ended questions aimed at measuring the knowledge level, awareness, preparedness practices, and perception of professional responsibility of architects who are members of professional chambers. The survey consisted of five main sections: (1) demographic information (age, gender, education, professional status, household size), (2) housing evaluations (physical structure, spatial use, perception of resilience, satisfaction), (3) environmental conditions (infrastructure, security, environmental health), (4) access to services (transportation, utilities, social facilities), and (5) disaster awareness and preparedness level. The final section addressed questions regarding participants' disaster knowledge, risk perception, preparedness plans, early warning systems, and insurance status. The questions were prepared with a four-point response scale with the options "Yes," "No," "Don't Know," and "Partially." Data collection was conducted through both face-to-face and telephone interviews, and announcements were also made through the Chamber of Architects' Samsun Branch email lists and social media groups. Despite this, participation remained limited, revealing that members of the profession are not only less likely to participate in academic research but also in the chamber's regular meetings and events. The data were transferred to SPSS and analyzed using descriptive statistics, crosstabs, and chi-square tests. The analysis revealed similarities and differences in disaster awareness and preparedness levels among participants in different provinces, and the findings were compared with the literature.

3. Findings

The findings are examined within the framework of participants' demographic and professional characteristics, disaster awareness and risk perceptions, preparedness levels, and evaluations of individual and institutional practices. The results are systematically presented in line with the research questions and hypotheses. The key findings are summarized below.

Demographic and professional characteristics:

The demographic and socio-spatial characteristics of the participants were analyzed based on key variables such as city of residence, age, gender, education level, employment status, housing type, and ownership status. Most participants resided in Samsun (70.4%), followed by Sinop (14.1%), Tokat (11.3%), and Amasya (4.2%), reflecting Samsun's dominant role as a regional and professional center (Table 1).

Table 1. Responses to the Statement: "Province you live in."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Samsun	50	70,4	70,4	70,4
	Amasya	3	4,2	4,2	74,6
	Sinop	10	14,1	14,1	88,7
	Tokat	8	11,3	11,3	100,0
	Total	71	100,0	100,0	

The age distribution indicated a balanced representation of young and middle-aged architects, with the largest group aged 26–35 (46.5%). Gender distribution was nearly equal, with 50.7% female and 49.3% male participants. Most participants held a bachelor's degree (77.5%), while a smaller proportion had postgraduate qualifications.

In terms of professional practice, the majority were self-employed architects (57.7%), followed by private sector employees, academics, retirees, and public sector workers. Most participants lived in apartment buildings (83.1%) and were homeowners (75.7%), indicating relatively stable housing conditions.

Overall, these demographic and professional characteristics provide a multi-dimensional framework for interpreting disaster awareness and preparedness levels. Variables such as professional status, education, housing type, and ownership status are critical determinants of individual and institutional disaster awareness, and the findings offer valuable insights for professional training policies, planning regulations, and post-disaster reconstruction strategies.

Disaster awareness and risk perceptions, levels of preparedness, and evaluations of individual and institutional practices:

The analysis of professional and academic experience shows that the sample includes architects with diverse levels of experience, enhancing the representativeness of the study. Participants were relatively evenly distributed across experience categories, ranging from early-career architects (0–5 years) to highly experienced professionals with over 21 years of practice (32.4%). This distribution allows for a comparative assessment of disaster awareness and preparedness across different career stages.

Findings indicate significant gaps in disaster-related education. Only 30% of participants reported having taken courses on disaster awareness and preparedness during their architectural education, while the majority had no formal training in this area. Participation in post-graduate education, seminars, or certification programs related to disasters was also limited (37.1%), pointing to deficiencies in continuing professional development (Table 2).

Table 2. Responses to the Statement: "Any training, seminar, or certificate related to disaster awareness after undergraduate education."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	26	36,6	37,1	37,1
	No	44	62,0	62,9	100,0
	Total	70	98,6	100,0	
Missing	System	1	1,4		
Total		71	100,0		

Institutional preparedness was found to be particularly weak. Workplace-based disaster drills were extremely rare, with over 90% of participants reporting no such activities. Similarly, architects' involvement

in post-disaster building assessment or damage evaluation processes was limited, with only a small proportion participating either professionally or voluntarily.

Overall, the findings reveal that both architectural education and professional practice inadequately address disaster awareness and preparedness. Strengthening disaster-focused curricula, expanding continuing education opportunities, and encouraging architects' active involvement in post-disaster processes are essential steps toward fostering a more resilient and risk-aware architectural practice.

The analysis of general disaster awareness and risk perception reveals important insights into architects' subjective evaluations, attitudes, and perceived responsibilities regarding disasters. While a majority of participants identified themselves as disaster-aware (57.1%), nearly one-third reported only partial awareness or uncertainty, indicating notable gaps in confidence and knowledge despite their professional roles (Table 3).

Table 3. Responses to the Statement: "I am aware of disaster-related issues."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	40	56,3	57,1	57,1
	No	5	7,0	7,1	64,3
	Not aware	6	8,5	8,6	72,9
	Partially	19	26,8	27,1	100,0
	Total	70	98,6	100,0	
Missing	System	1	1,4		
Total		71	100,0		

Similarly, although 60% of participants stated that they know how to act during the first moments of a disaster, a substantial proportion reported only partial knowledge, suggesting that emergency response behaviors are not fully internalized. Concern about potential disasters was high, with over three-quarters of participants expressing anxiety, and an even larger proportion (85.7%) perceiving disasters as a realistic personal and familial risk. These findings indicate that disasters are viewed not as abstract threats but as concrete risks affecting everyday life.

Professional responsibility emerged as a strong theme, with 81.7% of participants acknowledging the need for greater preparedness in their role as architects. Additionally, a majority reported that past disasters experienced in the country contributed to their increased awareness, highlighting the influence of lived and collective disaster experiences on professional consciousness.

Overall, the findings suggest a clear discrepancy between high levels of risk perception and concern, and comparatively lower levels of concrete knowledge and preparedness behaviors. This gap underscores the need to strengthen disaster awareness not only at the level of perception but also through behavioral, educational, and professional responsibility frameworks, integrating disaster risk as a core component of architectural ethics, education, and practice.

The findings on disaster-related knowledge, communication, and awareness sources reveal that architects' engagement with disaster information remains uneven and largely informal. Only 44.9% of participants reported regularly attending disaster-related meetings, while 30.4% stated that they did not participate at all, and 18.8% reported only partial participation. Similarly, 49.3% indicated that they regularly read disaster-related books, journals, or similar sources, whereas 26.1% reported no engagement with written materials.

Participation in disaster drills was relatively low: only 26.1% of participants had taken part in drills, while 43.5% had never participated and 18.8% reported partial involvement. These findings point to a significant gap in practice-based disaster preparedness despite moderate levels of informational engagement (Table 4).

Table 4. Responses to the Statement: "I participate in disaster drills."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	18	25,4	26,1	26,1
	No	30	42,3	43,5	69,6
	Not aware	8	11,3	11,6	81,2
	Partially	13	18,3	18,8	100,0
	Total	69	97,2	100,0	
Missing	System	2	2,8		
Total		71	100,0		

In contrast, interest in disaster-related news was very high, with 85.1% of participants stating that disaster news attracts their attention. However, this media-driven awareness does not appear to translate into consistent preparedness actions. Disaster-related discussions were reported more frequently in domestic settings (73.9%) than in workplaces (65.2%), indicating that disaster awareness is more embedded in family life than in professional environments.

Regarding post-disaster communication planning, only 50.0% of participants stated that they had identified a person who could be contacted after a disaster, while 36.8% reported having no such arrangement. This result highlights deficiencies in basic communication preparedness.

Overall, although architects demonstrate high levels of interest in disaster-related information and media content, participation rates in meetings, drills, and structured communication planning remain comparatively low. This imbalance suggests that disaster awareness among architects is largely perceptual and discursive rather than practice-oriented, underscoring the need for institutionalized training, practical preparedness activities, and professionally embedded communication strategies.

The findings regarding disaster-related infrastructure and support mechanisms indicate significant deficiencies in both physical preparedness and institutional awareness within the participants' living environments. Only 5.8% of respondents stated that an early warning system exists in their area, while 58.0% reported that no such system is available and 34.8% indicated that they were unaware of its existence. These results suggest that early warning systems—one of the key components of pre-disaster risk reduction—are insufficient in terms of both availability and public visibility (Table 5).

Table 5. Responses to the Statement: "There is an early warning system for disasters in the area we live in."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	5,6	5,8	5,8
	No	40	56,3	58,0	63,8
	Not aware	24	33,8	34,8	98,6
	Partially	1	1,4	1,4	100,0
	Total	69	97,2	100,0	
Missing	System	2	2,8		
Total		71	100,0		

Knowledge of institutions and organizations that could provide assistance during and after a disaster was extremely limited. Only 1.4% of participants reported having clear knowledge of such institutions, whereas

54.3% were uncertain and 25.7% reported no knowledge at all; an additional 18.6% indicated partial awareness. This highlights serious shortcomings in institutional communication and public engagement processes.

Awareness of post-disaster assembly areas at the neighborhood scale was also limited. While 38.6% of participants stated that an assembly area exists in their neighborhood, 40.0% reported that no such area exists and 12.9% were unaware of it, indicating both spatial and informational gaps in emergency planning.

Perceptions of environmental safety were predominantly negative: only 23.5% of participants reported feeling safe in their current living environment with respect to disasters, whereas 58.8% perceived their surroundings as unsafe. Evaluations of institutional effectiveness further reflected low confidence levels. Only 20.3% of participants considered public institutions effective in disaster preparedness, while 49.3% viewed them as ineffective. Perceptions of civil society organizations were even more critical, with only 11.6% of participants rating them as effective and 46.4% perceiving them as ineffective (Table 6).

Table 6. Responses to the Statement: "Non-governmental organizations in the surrounding area are very active in disaster-related issues."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	11,3	11,6	11,6
	No	32	45,1	46,4	58,0
	Not aware	16	22,5	23,2	81,2
	Partially	13	18,3	18,8	100,0
	Total	69	97,2	100,0	
Missing	System	2	2,8		
Total		71	100,0		

Overall, these findings demonstrate that disaster resilience is shaped not only by physical infrastructure but also by deficiencies in institutional capacity, information dissemination, and community organization. The fact that even professional architects report significant gaps in safety, knowledge, and institutional support suggests that disaster preparedness at the broader societal level may be even more limited, underscoring the urgent need for improved communication strategies, awareness campaigns, and capacity-building mechanisms.

The findings on building safety and insurance awareness indicate notable gaps between architects' professional knowledge and their individual housing conditions. A large majority of participants (78.6%) reported living in neighborhoods developed in accordance with zoning plans, suggesting a high prevalence of planned urban environments. However, 7.1% stated that their neighborhoods were not plan-compliant, while 14.3% reported partial knowledge or uncertainty, pointing to ongoing ambiguities regarding zoning awareness at the user level (Table 7).

Table 7. Responses to the Statement: "I live in a neighborhood that has been developed in accordance with zoning plans."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	55	77,5	78,6	78,6
	No	5	7,0	7,1	85,7
	Not aware	6	8,5	8,6	94,3
	Partially	4	5,6	5,7	100,0
	Total	70	98,6	100,0	
Missing	System	1	1,4		
Total		71	100,0		

In professional practice, a high proportion of participants (82.6%) stated that they consider disaster management and risk reduction principles in their projects, reflecting a strong sense of professional responsibility. Nevertheless, 17.4% reported either not applying these principles or doing so only partially, indicating the need for more comprehensive and mandatory disaster-oriented design frameworks.

Regarding insurance awareness, 65.2% of participants reported having compulsory earthquake insurance (DASK), while 26.1% were uninsured and 8.7% were uncertain or partially covered. Coverage through private insurance was considerably lower, with only 18.8% reporting private insurance and 72.5% lacking any additional coverage. These figures highlight limited individual-level strategies for mitigating post-disaster economic losses (Table 8).

Table 8. Responses to the Statement: "The home we live in is insured against disasters through the Turkish Catastrophe Insurance Pool (DASK)."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	45	63,4	65,2	65,2
	No	18	25,4	26,1	91,3
	Not aware	4	5,6	5,8	97,1
	Partially	2	2,8	2,9	100,0
	Total	69	97,2	100,0	
Missing	System	2	2,8		
Total		71	100,0		

Perceptions of structural safety were relatively weak. Only 48.6% of participants considered the ground conditions of their buildings to be safe, while 27.1% perceived them as unsafe and 24.3% reported partial knowledge or uncertainty. Similarly, only 34.8% believed that their buildings were resilient to disasters, whereas 29.0% were uncertain and 36.2% assessed their buildings as unsafe or only partially safe.

Overall, the findings reveal significant gaps in architects' awareness and practices regarding building safety, insurance coverage, and structural resilience in their personal living environments. Despite their professional expertise, assessments of ground safety and building resilience remain subjective and insufficiently informed. These results underline the need for enhanced professional training and awareness programs focusing on building safety, disaster insurance, and risk-informed housing choices, not only in professional practice but also in everyday life.

The findings on disaster preparedness plans and precautionary measures reveal substantial gaps between awareness and actual preparedness at both individual and institutional levels. Only 33.3% of participants

reported having a disaster and emergency family plan for their homes, while 44.9% stated that no such plan exists, 18.8% reported partial planning, and 2.9% were uncertain. These figures indicate that pre-disaster preparedness at the household level remains limited, even among professional architects (Table 9).

Table 9. Responses to the Statement: "We have a family disaster and emergency preparedness plan for the home we live in."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	23	32,4	33,3	33,3
	No	31	43,7	44,9	78,3
	Not aware	2	2,8	2,9	81,2
	Partially	13	18,3	18,8	100,0
	Total	69	97,2	100,0	
Missing	System	2	2,8		
Total		71	100,0		

A similar pattern was observed at the workplace level. Only 20.3% of participants reported the existence of a disaster and emergency plan at their workplaces, whereas 62.3% indicated that no such plan had been prepared. An additional 17.4% reported either partial planning or lack of knowledge, underscoring the absence of systematic and institutionalized disaster preparedness practices in professional environments.

Preparedness regarding actions to be taken by individuals and family members during a potential disaster was also low. Only 24.6% of participants reported having a clear plan, while 49.3% stated that no preparation had been made, and 21.7% reported partial preparedness. This highlights the need to strengthen family-based disaster planning, particularly in relation to communication, role distribution, and assembly points.

In contrast, awareness of the necessity of preparing a disaster and emergency kit was notably high. A large majority of participants (88.6%) agreed that an emergency kit should be prepared, while only 5.7% disagreed and 5.7% expressed partial agreement or uncertainty. This finding suggests that disaster awareness exists at a conceptual level, but is not consistently translated into concrete preparedness behaviors.

Overall, despite relatively high levels of disaster awareness, architects demonstrate low levels of practical preparedness in both personal and institutional contexts. These results emphasize the need for disaster education and training programs that go beyond information provision and actively promote the implementation of preparedness plans through drills, applied exercises, and institutional support mechanisms.

4. Discussion and Conclusion

This research aimed to reveal the disaster awareness and preparedness levels of architects operating in the provinces of Samsun, Amasya, Sinop, and Tokat, and the findings revealed different dimensions of awareness among professionals on this issue. Overall, the findings indicate that participants' risk perception in the face of disasters is high, and potential disasters are viewed as a realistic threat at both the individual and family levels. However, it is noteworthy that this perception is not fully reflected in practical preparations and concrete measures.

A large portion of architects acknowledge that their professional responsibilities are directly related to disaster preparedness and state that they consider risk reduction principles in their projects. However, the low participation rates in disaster meetings, drills, and professional awareness events indicate that knowledge-based awareness is not sufficiently reflected in practice. In particular, the lack of knowledge regarding post-disaster aid mechanisms, early warning systems, and assembly areas points to a disconnect between institutional and individual awareness in disaster management. Data obtained regarding insurance coverage and building safety reveal that protective mechanisms against disasters are partially adopted. While DASK insurance appears to be widespread, the low preference for private insurance and limited confidence in the durability of buildings raise questions about the reliability of the region's building stock. Furthermore,

the limited availability of emergency plans for families and businesses indicates the need for improved individual and institutional preparedness.

Consequently, while the architects participating in the study possess a disaster awareness, it appears that this awareness has not been sufficiently translated into practical preparations and ongoing training and drills. This finding highlights the need for more comprehensive and ongoing training programs, drills, and awareness campaigns, in collaboration with professional organizations, local governments, and universities. It is particularly important to develop policies that will enable architects to play a more active role in disaster management processes, not only as designers but also as risk mitigators.

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BETWEEN CAPITAL SPACE AND PUBLIC DEMAND: A CRITICAL OUTLOOK ON THE TERMINAL KADIKÖY PROJECT

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Abstract
In globalizing cities, public spaces are increasingly being transformed from collective interaction zones into capital-oriented spatial strategies. This study critically examines the Terminal Kadıköy project, located at the Söğütlüçeşme transportation hub in Istanbul, as a manifestation of the tension between public demand and capital accumulation. The primary objective of the research is to evaluate whether the project serves as a genuine public gain or an exclusive enclave that prioritizes private profit over the "Right to the City."
The methodology of the study is built upon a multi-axial "Publicness Assessment Matrix." This theoretical framework integrates the "space of appearance" of Hannah Arendt, the "refeudalization" warnings of Jürgen Habermas, Jan Gehl's "social living room" concept, and Kevin Lynch's "legibility" criteria. The project is further analyzed through the lens of local strategic goals, specifically the Istanbul Vision 2050 Strategy Document and the Kadıköy Municipality 2025-2029 Strategic Plan, focusing on accessibility, climate resilience, and disaster safety. The evaluation is supported by document reviews, on-site observations, and an analysis of objections raised by civil society initiatives and professional chambers. The results of the study reveal significant discrepancies between the project's marketing narratives and its spatial reality. Findings indicate that the project was developed through top-down decision-making processes that excluded democratic participation. Although the site functions as a major transit node, the transformation has replaced essential urban "voids" and green cover with commercialized zones, effectively redefining citizens as mere consumers. Managerially, the space is dominated by private interests, with ticketed or consumption-based access limiting its inclusivity. Furthermore, despite claims of sustainability, the project lacks essential disaster resilience infrastructure, failing to provide the urgent assembly areas required by the district's high earthquake risk. In conclusion, the Terminal Kadıköy project serves as a concrete example of the systematic privatization of public land, highlighting the necessity for participatory governance and scientific prioritization in reclaiming the city's democratic and ecological commons.
Key Words: *Public Space; Terminal Kadıköy; Urban Transformation; Capital; Right to the City.*

1. Introduction

In globalizing cities, public spaces are more than just empty spaces where individuals physically gather; they are dynamic arenas where capital accumulation processes, technological transformations, and social demands clash. Particularly in urban areas where urban planning strategies are weak and social demands are not represented through democratic participation channels, these spaces are shifting away from producing social benefits and transforming into capital-oriented spatial strategies. Historically, public spaces that have hosted political actions, collective protests, and mass cultural events are being suppressed by the sterile and controlled spatial designs of the new world order.

In today's globalized world, a new order is emerging where profit-driven motives increasingly sideline the collective good. This shift is most visible in our large cities, where public spaces are being reclaimed by capital. We are witnessing a systematic transformation: areas with high land value, which should belong to the community, are being redesigned to serve private interests instead. In this process, the people who use these spaces are no longer treated as citizens, but rather as mere consumers. These deliberate interventions do more than just change the physical face of our cities; they stifle public life and erode the vital 'breathing spaces' that allow both the city and its residents to thrive.

The 'Terminal Kadıköy' project in Kadıköy, one of Istanbul's most vibrant social hubs, is one of the most concrete examples of this tension. This transformation cannot be viewed in isolation from the process of stripping Haydarpaşa Station—the symbol of the city's primary transport memory—of its original function and folding it into capital-driven projects. As stated in the objections raised by Haydarpaşa Solidarity, the Kadıköy City Initiative, and the Kadıköy Municipality, with the liquidation of Haydarpaşa, the Söğütlüçeşme station has been subjected to an intensity load that exceeds its technical and spatial capacity. Therefore, the transformation of the spaces under the viaducts in Söğütlüçeşme from an urban 'threshold' into a defined

focus of consumption and technology is not merely an architectural choice; it is a top-down reconstruction of the city's definition of publicness. This unique 'sub-space' created by the viaducts stands in a fragile balance between the fluidity of the city and the desire of fixed capital to settle. This study aims to question whether Terminal Kadıköy is a collective gain for the people of Kadıköy, or an exclusive enclave where public rights are narrowed in favor of capital, in light of fundamental criteria such as accessibility, inclusivity, and ownership.

2. Publicness: A Conceptual Background

Public space is a historical concept fundamentally rooted in the Ancient Greek distinction between polis (the public realm/koine) and oikos (the private realm/idia). It reached its maturity in the 18th century through what Jürgen Habermas famously termed the "bourgeois public sphere"—a stage for rational-critical debate. Throughout its evolution, the concept adopted literary and representative forms before shedding these skins to function within the tension between the state and society, eventually evolving into a political public. By the standards and criteria of modernity, public space is a dynamic arena of interaction; it is where democratic legitimacy is forged through pluralism, the active participation of civil society, and an atmosphere of free discourse. Today, it has transcended national borders to become a global phenomenon, shifting its focus from physical boundaries to the quality of communication. However, this new structure emerged under the influence of globalization often overlooks the criteria that safeguard the public interest [1]. Instead, it has evolved into a construct that utilizes public space—whether through physical urban settings or digital realms like the media—primarily in favor of capital. This section of the study examines the scientific definitions and criteria of public space in literature to establish a fundamental framework for evaluating the Terminal Kadıköy project.

To understand the essence of this arena, we must first look to Hannah Arendt, who reminds us that the public sphere is, above all, a "space of appearance"—a common world where individuals reveal themselves to others through speech and action. This space is built on a foundation of freedom and equality, liberated from the biological necessities of life and sustained by the principle of plurality. For Arendt, public space is not merely a physical location; it is a manifestation zone where people establish relationships through words and deeds, constructing a political world capable of resisting the transience of life [2]. Building on this, Jürgen Habermas defines publicness as a critical realm where private individuals use reason and deliberation to hold public authority accountable, filtering power through the sieve of intellect. While this sphere ideally operates on the principle of publicity (transparency) among equals, Habermas warns of a "refeudalization" process in the modern era. He argues that as the lines between public and private blur, the structure of the public sphere collapses, and genuine critical debate is replaced by staged spectacles designed to manipulate the masses [3].

Bridging the gap between theory and the physical environment, Uysal describes publicness as a multidisciplinary "common ground" that is open to all segments of society and governed by shared social rules. By examining the interaction between people, environment, and space, Uysal posits that these areas are not just physical compositions but "communicative spaces" where diverse perspectives meet through face-to-face interaction and daily life practices. The key to successful publicness, therefore, lies in the harmony between the physical qualities of urban open spaces and the behavioral demands of their users [4]. In a similar vein, Kevin Lynch identifies these spaces as strategic "Nodes" in the city's mental map—focal points where movement and activity intensify. Lynch argues that the success of these nodes is determined not just by their physical form, but by their "legibility" and "imageability," which allow them to find a strong, coherent resonance in the human mind. For Lynch, public spaces are dynamic centers of connection that make the city meaningful through their distinct boundaries, unique identities, and the rich opportunities for interaction they provide [5].

Expanding on this human-centric view, Jan Gehl describes public space as a "social living room"—a realm that encompasses the real life flowing between buildings rather than the buildings' physical forms. Gehl measures the quality of a space by the time people spend there and, specifically, by the density of "optional and social activities" as opposed to mandatory ones. A successful public space, with its "soft edges" and inviting nature, encourages people to linger and engage rather than pass through, creating a dynamic stage where urban vitality sustains itself. Ultimately, for Gehl, public space is a living social fabric based on the fundamental human need to see and hear one another [6]. Praliya and Garg reinforce this by viewing public spaces as vital urban components that strengthen a city's image, biodiversity, and local economy while

providing psychological relief to individuals. They treat public space as a multidimensional platform for service and interaction, where success is measured through accessibility, inclusivity, safety, comfort, and the variety of activities offered. They argue that public space must be managed strategically as a dynamic center of interaction, focusing on continuous maintenance to enhance urban livability [7].

The structural complexity of these spaces is further analyzed by Ali Madanipour, who sees public space as a relational platform that mediates between private realms and falls outside the boundaries of individual control. Madanipour makes a crucial terminological distinction between the physical "public space" and the broader "public sphere" that encompasses the whole of social life. Evaluating the degree of publicness through three dimensions—access, agency, and interest—he views these areas as dynamic structures where strangers interact and social reality is constructed. For Madanipour, the public space is a symbolic ground that allows an individual to recognize both themselves and "the other" [8]. Similarly, Nëmeth and Schmidt propose a three-dimensional model defined by the complex interactions between ownership, management, and users. They define publicness as a multi-axial relationship rather than a linear one, suggesting a "publicness index" to compare supportive features with restrictive control mechanisms. They particularly highlight the "hard" and "soft" control techniques found in Privately Owned Public Spaces (POPS), arguing that true publicness is constantly reshaped by exclusionary management practices and user diversity, regardless of ownership [9].

Finally, Neşe Gürallar offers a broad perspective by defining public space as an arena of interaction built on accessibility, publicity, and commonality, transcending the rigid boundaries of property. To her, the fundamental criterion for a space to be considered "public" is not that it is state-owned, but that it is open to all and offers a "common world" where people can remain visible and audible to one another. In this context, she argues that not every public building (state property) is necessarily a public space; conversely, private properties can acquire a public character as long as they provide genuine accessibility. Gürallar's historical arc stretches from the traditional coffeehouses and mosque courtyards of the Ottoman era to the "defective" public spaces of modernity, such as highly controlled shopping malls, defining them all through the lens of civil and social publicity [10].

Table1: Publicness Assessment Matrix

Analysis Dimension	Criterion Detail (Area of Inquiry)	Theoretical Foundation (Author/Source)
Political & Performative	The opportunity for individuals to express themselves as "citizens," to be visible, and to discuss social issues.	Arendt (Visibility), Habermas (Reasoning), Gürallar (Publicity).
Managerial & Legal	Focus on whose interest the space is managed for (rather than mere ownership); the severity of security and surveillance.	Nëmeth & Schmidt (Publicness Index), Madanipour (Agency/Interest).
Physical & Perceptual	The clarity and legibility of the space within the city's mental map; its power to form a physical focal point.	Lynch (Legibility/Node), Uysal (Physical Components).
Social & Behavioral	Intensity of "optional" activities, encounters with strangers, and the duration of social interaction.	Gehl (Life Between Buildings), Uysal (Behavioral Harmony), Madanipour (Interaction).
Access & Inclusivity	Absence of physical, visual, and economic barriers; accepting all segments of society as "mere humans."	Gürallar (Accessibility), Habermas (Equality), Nëmeth & Schmidt (Inclusivity).
Functional & Technical	Comfort, cleanliness, and the sense of psychological relief/safety provided to the user.	Gehl (Soft Edges), Praliya & Garg (Livability).

3. Local Context: Kadıköy and Public Space Requirement Analysis

In the process of functionalizing and reclaiming urban voids and derelict spaces, there are numerous elements to consider across various scales and layers. Elements such as the location of the urban void (its proximity to transportation axes, relationship with residential areas, etc.), its physical characteristics (under-viaduct spaces, parks, open areas, etc.), the demographic structure of the region, and the benefit of all stakeholders (local administrations, civil society, users, etc.) must be identified through a detailed study—tailored to the scale and context—prior to any intervention to ensure the most appropriate use is determined. However, it is a reality that major cities remain inadequate and stalled regarding even the most fundamental and priority issues, such as earthquake assembly areas, green space per capita, and accessibility, due to the pressures and challenges brought by globalization. The fact that the new global order, which fuels these problems, now makes its impact felt even in neighborhood-scale interventions necessitates addressing such transformations through a broader perspective and a set of priorities. Therefore, this study is framed not merely through the specific lens of the Söğütlüçeşme district, where the Terminal Kadıköy project is located, but through the priorities of Istanbul and Kadıköy as a whole. Accordingly, the scope of the study regarding regional needs is delineated by the 'Istanbul Vision 2050 Strategy Document' [11] prepared by the IMM (Istanbul Metropolitan Municipality) and the '2025-2029 Strategic Plan' [12] prepared by the Kadıköy Municipality.

3.1. Istanbul Vision 2050 Strategy Document

The Istanbul Vision 2050 Strategy Document focuses on six priority areas (income equality, urban amenities, demographic transformation, transportation, the climate crisis, and disasters) to address the city's chronic issues, manifesting these solutions through 7 main themes, 38 objectives, and 246 targets. Within the Strategy Document, Kadıköy—emphasized for its identity as a 'First-Tier Center' and a 'Focus of Creativity'—is defined as one of the most critical regions representing the innovative spaces of the future, where traditional production and historical-cultural heritage blend with technological transformation. In this context, public space projects in the region (such as Terminal Kadıköy) should be envisioned not merely as physical spaces, but as 'Mobility Hubs' that are resilient to the climate crisis, reinforce social justice, and comply with 'Low Emission Zone' criteria. Specifically, the density of the population aged 65 and over in Kadıköy, combined with the urban heat island effect, necessitates the prioritization of concrete goals such as 'cooling zones' and 'age-friendly applications' in public space designs. The table below outlines the priority targets for Kadıköy within the framework of these seven main themes [11].

Table2: Priority Targets for Kadıköy

Main Theme	Strategic Goal (Kadıköy Focused)
1. Protecting the Environment and Adapting to Climate Change	Ensuring Climate Justice and Managing the Urban Heat Island Effect
2. Effective and Inclusive Mobility	Developing Integrated Transport Systems and Mobility Hubs
3. Integrated and Smart Infrastructure Systems	Establishing Disaster-Prepared and Safe Urban Infrastructure
4. Vibrant and Responsive Spaces Providing Good Life	Developing Dynamic Public Spaces and Bio-cultural Conservation
5. Transformative and Resilient Economy	Promoting Creative Industries and Technology-Oriented Development
6. Accessible and Fair Urban Facilities for All	Ensuring Fair and Balanced Use of Cultural Heritage
7. Equal and Free Society	Strengthening Participatory Governance and the Civic Sphere

3.2. Kadıköy Municipality 2025-2029 Strategic Plan

The Kadıköy Municipality 2025-2029 Strategic Plan presents a roadmap based on a 'resilience' approach to generate solutions for the district's current urban, social, and ecological crises. The strategic plan emphasizes that public spaces should not merely be physical locations, but 'safe zones that enhance the quality of life'. According to the document, Kadıköy's Public Space Strategic Objectives can be listed as follows:

- **Accessibility and Inclusive Design:** In Kadıköy, which has the highest elderly population rate in Istanbul (19.34%), the goal is to eliminate physical and social barriers for all disadvantaged groups—particularly individuals aged 65 and over, people with disabilities, and children—while removing economic barriers for all stakeholders. In this context, the application of universal design principles in all parks and squares is a fundamental expectation.
- **Climate Resilience and Heat Island Management:** Public spaces are intended to function as "cooling zones," particularly in areas where the urban heat island effect is intensely felt, such as Rıhtım, Söğütlüçeşme, Fikirtepe, and Uzunçayır. Increasing the quantity and quality of green spaces, implementing rainwater harvesting, and using permeable surfaces are integral parts of ecological development.
- **Reducing Motor Vehicle Pressure and Walkability:** The objective is to reclaim public spaces from automobile encroachment, expand pedestrianization projects, and connect these areas through safe pedestrian and bicycle routes. At the heart of this strategy is the creation of "mobility hubs" where micromobility vehicles are integrated with public transportation systems.
- **Disaster Safety and Resilience:** It is expected that the amount of public open space be preserved during urban transformation processes and that these areas serve as logistics and shelter focal points within the framework of community-based disaster management. A critical criterion is ensuring that social reinforcement areas and open spaces are not reduced while the existing building stock is being renewed.
- **Social Interaction and Neighborhood Culture:** Public spaces are aimed to be more than just transit points; they should be equipped with activities that strengthen neighborhood culture and a sense of belonging. The infiltration of cultural and artistic activities into parks and the neighborhood scale is a key component of this goal.
- **Participatory Design and Governance:** It is a strategic necessity to design and manage public space projects starting from the most local scale, with the participation of neighborhood councils, non-governmental organizations, and volunteers. Transparency, accountability, and meeting stakeholder expectations are prioritized in this process [12].

4. The Publicness of Terminal Kadıköy

4.1. Terminal Kadıköy Project Process

The Terminal Kadıköy project began with the opening of the viaduct area surrounding the Söğütlüçeşme Train Station—owned by the Republic of Türkiye State Railways (TCDD) and partially by the Istanbul Metropolitan Municipality (İBB) —for construction to build a shopping mall. Originally announced as the "AVM-Gar" (Mall-Station) project, the plan utilized a build-operate-transfer model to create a series of commercial spaces in exchange for the construction of an additional viaduct for rail transport. The process, initiated in 2019 when the Ministry of Environment and Urbanization declared the area a "Mass Transit Station Site," faced significant legal hurdles. In 2020, following lawsuits filed by the Kadıköy Municipality and professional chambers, along with objections from civil initiatives like the Haydarpaşa Solidarity, the court ruled the project contrary to urban planning principles. Zoning plans were cancelled, citing uncertainties regarding the location and size of commercial areas, the potential for new traffic congestion, and risks related to earthquake safety in 2021. The Ministry and TCDD submitted a revised plan aiming to address these legal concerns on paper in 2022. To avoid the "AVM-Gar" criticisms, the project was rebranded as "Terminal Kadıköy" and "Viaduct Strengthening." Instead of the massive building designs proposed in 2019, a structure utilizing the spaces under the viaducts—featuring single-story or mezzanine levels similar to a "Mercado" (marketplace) concept—was proposed to weaken technical objections regarding "dense

construction." Once the new plans were finalized during the legal process, construction accelerated, and the project officially opened on May 1, 2025. Designed by Tabanlıoğlu Architects, Terminal Kadıköy spans a 45,000-square-meter area with 16,000 square meters of leasable retail space. The project, totaling a 70 million Euro investment under the build-operate-transfer model, is operated by Akfen Tourism. Currently, the site functions as a hybrid structure housing gastronomy units, e-sports centers, and cultural-artistic spaces [13], [14]. The Terminal Kadıköy project is subject to intense criticism regarding its new function, its relationship with the planned transformation of Haydarpaşa Station, the complexities of its development process, and the manner of its implementation. A sharp debate persists between the corporate perspective—which frames the project as an "urban regeneration and social life center"—and a critical approach that characterizes it as "capital-oriented gentrification and the appropriation of public space."

The investor and operating firm claim that the area has been rescued from its formerly "derelict" and "unsafe" state to become a secure, sustainable, and accessible hub for everyone. They argue it serves as a meeting point in the heart of Kadıköy that integrates gastronomy, culture, art, and sports. Furthermore, they maintain that through significant investment in landscaping, green spaces have been increased, turning the site into a critical transportation node at the intersection of Marmaray, High-Speed Train (YHT), and Metrobus lines, supported by social amenities. Marketing narratives also emphasize that the investment will bolster the local economy [15].

In contrast, numerous stakeholders—most notably Haydarpaşa Solidarity and the Kadıköy Urban Initiative—argue that the project is not a public space but a profit-driven "gentrification center" that redefines citizens merely as "consumers." The reasons for this critical stance are summarized below:

- **Privatization of Public Land:** The allocation of public land to private capital for 29 years under a build-operate-transfer model.
- **Lack of Environmental Oversight:** Despite all efforts by the Kadıköy Municipality and professional chambers, the project proceeded without an Environmental Impact Assessment (EIA/ÇED) report.
- **Legal Discrepancies:** The initial plans were annulled by the courts for violating urban planning principles; however, the 108 shops included in the annulled plan remained unchanged in the final implementation.
- **Ecological Destruction:** The destruction of nearly 500 fruit trees registered in the TCDD inventory and the loss of valuable green cover during the construction of the viaducts.
- **Operational Inadequacy:** Since the maintenance areas, repair structures, and depots essential for a terminal station—currently located at Haydarpaşa—cannot be accommodated at Söğütlüçeşme, the project fails to meet railway requirements while placing an overwhelming burden on the local infrastructure.
- **Legitimizing Haydarpaşa's Transformation:** By attempting to assume Haydarpaşa's role as a terminal, the project is seen as a tool to justify the commercial transformation of the historic Haydarpaşa Station [16], [17].

4.2. Terminal Kadıköy Publicness Evaluation

The evaluation of the publicness of the Terminal Kadıköy project is based on the theoretical framework established in the second and third sections. It is observed that the definitions and criteria of public space presented in the second section align with the priority needs and objectives at the Istanbul and Kadıköy scales discussed in the third section. From these criteria and goals, specific evaluation dimensions (Table 3) for Terminal Kadıköy have been identified, and the extent to which the project fulfills these dimensions has been analyzed. This analysis is based on an extensive evaluation of the project process—incorporating technical documents, media reports, interviews, critical essays, and official announcements from the Chamber of Architects and the municipality—complemented by on-site observations of the project area.

Table3: Terminal Kadıköy Evaluation Matrix

Evaluation Dimension	Theoretical Criteria	Strategic Expectations and Local Targets

Political and Performance	Opportunity for individuals to express themselves, be visible, and discuss social issues.	Participatory Governance: Inclusion of neighborhood councils, NGOs, and volunteers in decision-making processes starting from the policy production stage.
Managerial and Legal	For whose interest the space is managed and the level of rigidity in control mechanisms (security, surveillance).	Transparent and Decentralized Management: Adoption of a "public partnership" model that transcends property boundaries.
Physical and Perceptual	The clarity and legibility of the space within the urban mental map, and its power to create a physical focal point.	Mobility Hub: Designing Söğütlüçeşme not merely as a transit area, but as a defined urban focal point living 7/24.
Social and Behavioral	Intensity of optional social activities and duration of encounter/interaction with strangers.	Neighborhood Culture and Interaction: The space functions as a "social living room" to strengthen the sense of social belonging and neighborhood culture.
Access and Inclusivity	Level of being free from physical, visual, and economic barriers.	Spatial Justice: Preventing economic and class segregation; providing age-friendly and barrier-free access options catering to all income groups.
Ecological and Climate Resilience	The space's contribution to biological diversity and ecology.	Climate Resilience: Increasing green spaces, providing "cooling zones" to reduce the urban heat island effect, rainwater harvesting, and meeting low-emission zone standards.
Disaster and Resilience	The space being a safe, sustainable interaction center and an urban infrastructure component.	Community-Based Disaster Management: Preserving the space as a logistics and shelter hub (assembly area) in a potential disaster and increasing infrastructural resilience.

Political and Performative: From the initial rezoning to the project's completion, the transformation process was conducted exclusively between investors and state institutions (such as the Ministry and TCDD), completely excluding other stakeholders. On the contrary, objections from the municipality, professional chambers, and civil initiatives were largely ignored, bypassed through legal maneuvers. Beyond the commercial units, the remaining areas function merely as transit corridors. The space has not been designed with assembly areas that would allow citizens to "be visible" or "make their voices heard"; thus, it lacks the performative essence of a true public sphere.

Managerial and Legal: As a major transit hub fed by Marmaray, High-Speed Train (YHT), and Metrobus, the site lacks a controlled security perimeter for general entry. However, except for the central open-air dining area known as "Yedi de Yedi," all venues have established their own boundaries and specific entry points. While these spaces are technically as "public" as any standard restaurant, their usage is strictly tied to commercial consumption. The "Paribu Art" structure, intended as a cultural hub, will operate on a ticketed and controlled basis, similar to any private performance center. Ultimately, no stakeholder other than the operator holds any decision-making power in the management of the space.

Physical and Perceptual: Söğütlüçeşme Station was already a significant urban focal point before the project. While the structures beneath the viaduct and the Paribu Art building contribute to this focal power, the construction itself has fundamentally altered the area's identity by eradicating the "void" and green tissue—assets of immense value for Kadıköy. Although the new architecture possesses internal consistency, it feels like a "top-down" image imposed on the district. Despite its high connectivity, the terminal fails to establish strong pedestrian links with its immediate surroundings. Furthermore, the repetitive nature of the structures and circulation paths hinders easy "legibility" or mental mapping. Even the "Yedi de Yedi" area, the project's most public-facing element, is physically cordoned off with iron gates after a certain hour.

Social and Behavioral: The space is dominated by food and beverage units, leaving little room for social activities outside of the performance center and "Platform" event spaces. Interaction with strangers is possible, but it rarely transcends "co-presence"; the design does not foster meaningful social encounters. Neither the physical layout nor the provided functions support a sense of local belonging or neighborhood culture. It functions more as a commercial destination than a "social living room."

Access and Inclusivity: While there are no physical barriers to entry, the project remains far from being truly "public." The fact that activities are pay-walled, and the venues cater to a specific economic and social stratum, reveals a space serving capital rather than the community. The lack of dedicated arrangements for children and the elderly reinforces the critiques that this is a project of exclusion.

Ecological and Climate Resilience: The developers market the use of radiant heating, energy-efficient lighting, permeable surfaces, and 5,000 m2 of landscaping as "sustainability." They even frame the reuse of the viaduct structure as a carbon-reduction strategy. However, introducing intense construction to this site is inherently anti-ecological compared to preserving it as a public green space. Given the trees removed during construction, the claim of sustainability feels like "greenwashing." Repurposing an existing structure for a shopping mall—rather than exploring functions that genuinely serve the local ecosystem—is fundamentally at odds with true climate resilience.

Disaster and Resilience: One of Istanbul's most urgent needs is the provision of disaster assembly areas. In a densely built district like Kadıköy, a public space should prioritize infrastructural resilience and serve as a logistics hub during a disaster. This project offers no such provision. Despite being marketed with terms like "neighborhood," "neighborliness," and "community," the site does not provide even a single square meter where residents can gather to discuss, let alone manage, such a vital survival issue.

5. Conclusion

The pressure of capital and rent, driven by globalization, manifests itself aggressively in large cities, from the urban scale down to the neighborhood level. Under the influence of the new world order, societies struggling with economic and social hardships are rapidly being stripped of their "Right to the City"—one of their most fundamental rights—through regulations tailored in favor of capital. The Terminal Kadıköy project stands as one of the most recent examples of this trend. When considered alongside the transformation of Haydarpaşa Train Station, it reveals a systematic pattern of urban conversion.

Initially, the project's proposed vertical density was legally blocked due to rising public objections. However, the current application has maintained its original intent by merely updating physical forms and square meters through various adjustments. This second project, now implemented, fails to address almost any of the initial concerns. By marketing its functions and spaces to a specific socio-economic stratum while using slogans that evoke publicness—such as *"neighborhood, friendship, sharing, coming together, celebrating the city's spirit"*—the project manages to garner support from a particular segment of society. Yet, when examined under the light of scientific data and the priority needs of local governments, it is clear that the project lacks any genuine concern for publicness. In societies where democratic and legal processes are dysfunctional, it is common to see idle public lands occupied under the guise of "security" and repurposed with functions that serve anything but the public interest. The way to prevent this is to demand requirements derived from scientific evidence and to maintain the pressure for democratic processes by supporting civil initiatives, professional chambers, and local governments that oppose such encroachments. These requirements, in their most fundamental and simple form, can be summarized as follows:

- **Participation:** Ensuring the involvement of all stakeholders at every stage of public space projects (from design to usage) and conducting processes transparently and democratically in the light of scientific data.
- **Accessibility:** Ensuring that public space is free from all forms of economic, social, and physical barriers.
- **Belonging:** Maintaining physical, social, and cultural harmony with the local identity.
- **Diversity:** Providing usage areas that offer fairness, diversity, and commonality for all living beings.
- **Sustainability:** Incorporating the most efficient ecological, economic, and social solutions that contribute to the region.
- **Resilience:** Possessing the infrastructure to resist disasters or similar crises in accordance with the region's priorities.

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AWARENESS OF PUBLIC SPACES IN SCHOOL ENVIRONMENTS: THE CASE OF ATAKUM

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Abstract
In today's cities, where urbanization processes are accelerating, children's access to public spaces that support their physical, social, and psychological development is becoming increasingly complex. Public spaces, especially around schools, are frequently used by children throughout the day but often pose various risks due to traffic congestion, access difficulties, inadequate green spaces, and child-unfriendly spatial arrangements. This study aims to analyze school zones and their surrounding public spaces within the framework of child-friendly spatial principles and to develop solution proposals for these areas. For this, three school zones (including seven public schools) in the Atakum district of Samsun were selected as the sample, a workshop involving architecture and urban planning students was held to analyze existing spatial conditions and evaluate children's core needs, including safety, accessibility, social interaction, and environmental comfort. In this context, observation forms, mapping studies, spatial analysis drawings, and creative design proposals based on user experience were produced. The workshops focused on a child-friendly approach to the city and rethinking school-area spaces to raise awareness and generate solutions. The primary objective of the study was to raise awareness about how to design public spaces around schools, which children frequently use in their daily lives, in a safer, more inclusive, and more child-friendly way, and to engage a broad range of stakeholders, from local governments to educational institutions, in this process. In this respect, the study offers an exemplary application experience at the academic levels, presenting an approach that centers children's needs in urban space through a child-focused analytical and design-based perspective.
Key Words: *Child-Friendly City, School Environment, Public Space, Inclusive Design*

1. Introduction

Accelerating urbanization and increasing population density have led to a lack of safe, accessible, and child-friendly public spaces, especially in children's neighborhoods. Public spaces around schools are important spaces where children participate in educational activities and socialize through play, rest, and physical activities. However, the design of these spaces often overlooks the specific needs of children across age groups. Inadequate security measures, traffic congestion, a lack of playgrounds, accessibility issues, and limited natural elements (e.g., green spaces) in areas around schools prevent children from safely and effectively enjoying these spaces. This leads to restrictions on children's physical activity, reduced opportunities for social interaction, and negatively impacts their psychosocial development. The design of safe and accessible public spaces is necessary to improve the quality of life for children, their families, and other members of society.

The primary objective of this study is to reassess the public spaces surrounding primary, secondary, and high schools with a child-friendly approach and to offer solutions for redesigning these spaces to ensure they are safe, accessible, and supportive of children's physical, social, and cognitive development. This study aims to create spaces where children of different age groups can safely move, play, socialize, and interact with an environment that supports their educational process. Three schools in Samsun-Atakum were selected as a sample for the study, and the situational analysis of the public spaces surrounding the respective schools was conducted. Multidimensional factors such as traffic safety, accessibility, and green space use, children's play and recreation needs, environmental design elements, and opportunities for social interaction were evaluated. Recommendations were developed for redesigning these spaces with an inclusive design approach, explicitly considering different age groups' physical and social needs.

2. Child-Friendly City Approach

Cities have historically been shaped mainly by adult needs and economic priorities, while children have become invisible users of this process. However, children's participation in urban life is a multifaceted issue that is not limited to their physical safety but also requires social, psychological, and emotional support. In this context, a "child-friendly city" represents an inclusive approach to urban development that prioritizes children's rights.

The United Nations Convention on the Rights of the Child defines children's rights to life, development, protection, and participation. It considers the consideration of children in urban planning as a rights-based approach. The United Nations International Children's Emergency Fund's (UNICEF) "Child Friendly Cities Initiative" (CFCI), developed in line with this convention, aims to ensure children's participation in decision-making processes in their communities, safe mobility, the right to play, and access to social services [1].

In the literature, the most fundamental principles of the child-friendly city approach include safety, accessibility, inclusiveness, belonging, and participation [2, 3]. These principles necessitate transforming the physical environment (e.g., street design, green spaces, playgrounds) and the social structure (e.g., school-family-community relationships) in line with children's well-being. The foundation of this approach is recognizing children not merely as objectified users but also as agents capable of perceiving, experiencing, and influencing their environment [4].

Increasing traffic congestion, unsafe school routes, inadequate green spaces, and unsupervised play spaces in today's cities limit children's independent mobility and negatively impact their physical and psychological development [5, 6]. In this context, child-friendly cities are well-designed physical environments and social systems where children's voices are heard and actively included in decision-making processes.

3. Methodology

This multi-phase, interdisciplinary study is conducted to evaluate and design-improve child-friendly public spaces around schools. The research process was structured around a qualitative approach, including spatial observation, fieldwork, workshop, and design development practices.

The research area was determined as three different school neighborhoods in the Atakum district of Samsun, Türkiye. Atakum offers a significant sample size for child-friendly planning due to its socio-spatial diversity, high population density, and pressures of urbanization. The sample selection was made to encompass different educational levels (primary, middle and high school levels), and the diversity of physical components such as traffic routes, pedestrian paths, green spaces, playgrounds, and parking lots within the school neighborhoods was also considered.

Labeled area 1: Onur Ateş Anatolian High School - Atakum Primary School - Atakum Middle School and its surroundings; Labeled area 2: Bayındır Primary School – Fatih Sultan Mehmet Middle School and its surrounding area; and marked area 3 consists of Fahrettin Ulusoy Primary School – Recep Tanrıverdi Middle School and its surrounding area (Figure 1). These areas were selected to represent the diverse spatial characteristics of the Atakum district, aiming to provide a multi-dimensional examination of public spaces surrounding the school within the framework of child-friendly design principles.

Fig. 1. Selected areas for the study (marked on Google Maps).

This study process consists of six phases. In the first phase, student groups were formed. A total of 30 volunteer undergraduate students from the Architecture and Urban and Regional Planning departments of Ondokuz Mayıs University in Samsun participated in the workshop. The students were divided into three equally matched groups of 10 students.

Phase 2 involves the introduction and explanation of child-friendly urban design criteria and spatial assessment requirements. Before the fieldwork, information seminars were organized for student groups to clarify the conceptual framework and methodological scope of the workshop.

Phase 3 consists of field observations conducted at different times of the day to capture changes in usage intensity and spatial conditions. In the data collection phase of the study, qualitative research techniques such as direct field observation, photographic and video recordings, map analysis, and spatial representations of user experiences were used instead of traditional survey and interview methods. Observations were made at different times in the designated school districts, taking into account the child-centered design criteria explained in seminars for each area (social and physical safety, sense of belonging, accessibility, inclusivity, interaction, ecological balance, etc.). Analyses were carried out with the assistance of two researchers accompanying each group, and solution proposals were discussed.

Phase 4 is an analytical desk-based study. Following the completion of field observations, each group that completed the fieldwork classified the identified problems within the framework of child-friendly design criteria based on the collected data and subjected them to spatial analysis. The problems identified for the study areas were spatially mapped.

Phase 5 is the development of site-specific design proposals addressing the identified problems. Based on the findings, original design proposals were developed to support children's rights to a safe and inclusive environment. At the end of the workshop, the problem and solution plans prepared for each area were discussed with instructors and students.

In the final phase of this study, a comparative analysis of three case study areas was conducted using qualitative criteria-based and analytical evaluation frameworks. To reduce interpretive subjectivity, a threshold-based evaluation framework focusing on the presence or absence of essential child-friendly spatial features was used in the analysis. Additionally, a comparative analytical matrix was used to synthesize the

spatial problems, strengths, and potentials observed in the case study areas. This matrix supports inter-case comparisons without hierarchical ranking.

4. Findings

This section assesses the current status of child-friendly public spaces based on data obtained through field studies, spatial observations, and a workshop conducted in three public school districts (seven different public schools) in the Atakum district of Samsun. The study analyzed the physical, social, and safety adequacy of pedestrian paths, playgrounds, social interaction spaces, and green spaces around the schools. The findings are compared with key concepts in literature, such as children's access to public spaces, spatial justice, and social exclusion.

4.1 Onur Ateş Anatolian High School - Atakum Elementary School - Atakum Middle School and Its Surroundings

Group 1 analyzed the surroundings of Onur Ateş Anatolian High School, Atakum Elementary School, and Atakum Middle School, -three schools located in close proximity within the Atakum district-, were analyzed per the principles of child-friendly public spaces (Figure 2). The research revealed that this educational triangle's physical and social environment presents serious deficiencies regarding children's safety, interaction, and development. Despite three school buildings, seven parking areas, and two religious buildings within the study area, the area's public capacity remains inadequate to meet child-friendly city criteria.

Fig. 2. Land use in the Onur Ateş Anatolian High School-Atakum Elementary School-Atakum Middle School area

Analysis conducted in the area revealed that the most significant problem is the inadequacy of playgrounds for children. While existing parks appear sufficient in quantity, they exhibit serious quality deficiencies. Factors such as a lack of play equipment, facilities that fail to accommodate age-group differences, and unsafe areas prevent children from thoroughly enjoying these spaces. Transportation safety stands out as another fundamental problem in the area analyzed. The lack of crosswalks to ensure safe pedestrian passage in school areas, sidewalk continuity, and uncontrolled vehicular traffic seriously threatens children's safety (Figure 3). Inadequate "school zone" signage and a lack of physical measures to slow drivers down (e.g., speed bumps, warning floor textures) put student and pedestrian mobility at risk.

Fig. 3. The Relationship Between Transportation Infrastructure and Social Facilities

The lack of interactive design elements makes it difficult for users to connect emotionally with the space, leading to a lack of ownership. Lack of lighting and uncontrolled corners lead to abandoned evening areas and the loss of public functions. Furthermore, there are serious deficiencies in the relationship between the space and the natural environment. The disconnection from green spaces and the scarcity of spaces for interaction with natural elements limit students' opportunities to connect with nature and develop ecological awareness. It has also been determined that these areas lack infrastructure to support artistic production and cultural interaction. The absence of creative public elements such as open-air stages, free-painting walls, and street installations deprives children of their cultural expression.

The design proposals developed by the Group 1 offer important clues for transforming the school environment into a child-friendly, multifunctional, and inclusive public space (Figure 4). These suggestions: It aims to holistically address diverse needs, including safety, accessibility, learning, psychological relaxation, interaction with nature, and cultural production.

A pedestrian-first design approach has been adopted around schools to ensure transportation safety. A traffic plan has been established to ensure controlled vehicle traffic during specific hours (especially school start and end times). Clear pedestrian crossings, "school zone" signs, speed bumps, and tactile surface design for visually impaired individuals have been proposed in these areas. Rubber-surface playgrounds, catering to different age groups, have been planned to encourage physical activity, while educational elements such as interactive panels have also been incorporated to support cognitive development.

Fig. 4. The design approach was developed by Group 1

Small-scale green areas, seating elements, and book reading areas were designed to enhance interaction with nature for psychological relaxation and individual retreat. Hobby gardens suitable for growing vegetables or flowers were proposed to foster children's environmental awareness and sense of responsibility. Creative public elements such as free-painting walls and small-scale stage areas were introduced for artistic expression and cultural engagement, emphasizing the importance of these spaces for children to showcase

their creativity and develop social skills. All these proposals were designed to support not only children's physical development but also their emotional, social, and cognitive development. These proposals suggest a holistic transformation based on physical arrangements and a child-centered and participatory understanding of public spaces.

4.2 Bayındır Primary School – Fatih Sultan Mehmet Middle School and Surroundings

In the second sample area, Group 2 analyzed the Bayındır Primary School – Fatih Sultan Mehmet Middle School area was analyzed per the principles of child-friendly public spaces. The most significant problem is the inadequate infrastructure for safe pedestrian access around the school. Crosswalks are incomplete, sidewalks are not continuous, and vehicle traffic is uncontrolled. This weakens the connection between the school and important open spaces, such as Alparslan Boulevard, Emek Park, and Atakum 100th Year Square, limiting children's independent mobility. The tram line is a physical barrier, disrupting the area's integrity. Overpasses create obstacles rather than facilitating access, restricting the use of public spaces, especially by individuals with disabilities.

The parks and green spaces in the study area are inadequate in terms of both quality and functionality. Seating lacks green spaces, poor landscape design, and unsupervised areas create security vulnerabilities. Children's playgrounds do not cater to different age groups and lack play elements that foster creativity. The division of parks by roadways, in particular, threatens children's safety. All these deficiencies hinder spatial experiences that support children's social, psychological, and physical development.

The "green corridor" proposal, developed due to the workshop, proposes child-friendly transportation routes by integrating existing open spaces, the school environment, and potential social centers (Figure 5). Multifunctional public amenities for children, such as shaded walkways, playgrounds, climbing trails, and nature experience areas, are designed along this axis. Furthermore, strong connections to areas like Emek Park will increase children's environmental awareness, social interaction, and physical access.

Fig. 5. Design Proposal Developed by Group 2

4.3 Fahrettin Ulusoy Elementary School – Recep Tanrıverdi Middle School and Surroundings

In the third sample area, Group 3 analyzed the Fahrettin Ulusoy Elementary School – Recep Tanrıverdi Middle School area according to the child-friendly public space principles. Site analyses revealed that the school area presents significant transportation challenges due to its high building density and road connections. High-traffic roads, such as Atatürk Boulevard (Sinop-Samsun Highway), create physical barriers that restrict pedestrian access to the Atakum beach. At the same time, the tram line acts as an artificial boundary to the south (Figure 6). This transportation infrastructure hinders children's independent and safe access, and elements such as pedestrian crossings, sidewalk continuity, and overpass design do not align with child-friendly criteria.

Fig. 6. Three-dimensional spatial representation and thresholds of the study area

Despite their public nature, Lozan Street and Lozan Park in the study area present significant challenges, particularly regarding pedestrian mobility and safety (Figure 7). Traffic congestion, uncontrolled parking, and poor lighting threaten both physical safety and the psychological well-being of children. Furthermore, the lack of contemporary design elements appealing to children within parks and green spaces limits play and social interaction opportunities.

Fig. 7. Land use of the Fahrettin Ulusoy Primary School – Recep Tanrıverdi Secondary School area

According to the analysis, while the area presents numerous threats and weaknesses, it also possesses strengths such as its potential as an educational campus, its functionality as a trade center, and its ability to create nature-based learning spaces within a green axis. Design proposals developed in this regard are based on unique spatial configurations such as the "Green Corridor of Parkent Road," the "pedestrianized Lozan Street," a "child-themed play bridge on the overpass," and "open-air classrooms supported by natural learning spaces" (Figure 8). These proposals offer a holistic vision for children and increasing accessibility, sustainability, and social interaction.

Fig. 8. Design proposal developed by Group 3

4.4 Qualitative Criteria-Based Comparative Analysis of the Case Study Areas

A qualitative comparison of the three case study areas based on field observations and spatial analyses conducted by students is presented in Table 1. The evaluation process was carried out by authors based on the presence or absence of specified design elements rather than numerical scoring, in order to reduce subjectivity and increase comparability. After identifying the existing problems using design criteria, the design proposals submitted as a result of the students' work were also evaluated based on these criteria.

Subheadings evaluated under the safety criterion are met at different levels in the work areas within the three sample areas. Safe pedestrian crossings and traffic measures indicate that there is no comprehensive and continuous safety infrastructure in all areas. In particular, school zone warning signs that support the safe movement of children were only identified in the third study area, and it was observed that these were only located at the entrance area and did not cover the entire area. This situation shows that safe pedestrian mobility in school environments is addressed in a fragmented and irregular manner in the three sample areas. Within the scope of the safety criterion, safe pedestrian crossings have been established in all work areas, and a children's safe movement and school zone warning system has been attempted to be established. Traffic-related measures have been addressed. Particularly in school surroundings, school zone designs covering the entire area, not limited to entry points, have been implemented.

Tablo 1: Assessment of three study areas based on child-friendly design criteria

		Current Problem Identification			***Design Recommendations***		
Criteria	**Sub-criteria**	**Case 1**	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Safety	Safe pedestrian crossings	✗	✗	✗	✔	✔	✔
	Children's safe movement and school zone warning	✗	✗	✔	✔	✔	✔
	Traffic issues and measures	✗	✗	✗	–	✔	✔
Accessibility	Continuous sidewalks	✗	✗	✗	✔	✔	✔
	Green space accessibility	✗	✗	✗	✔	✔	✔
Social Interaction	Seating and social interaction areas	✗	✗	✗	–	✔	–
	Sense of belonging in public spaces	✗	✗	✗	–	–	–

Environmental comfort	Presence of green areas	✔	✔	✔	✔	✔	✔
	Age-specific playgrounds	✘	✘	✘	–	✔	–
	Children's play and recreation needs	✘	✘	✘	✔	✔	✔
	Environmental design elements	✘	✘	✘	–	✔	–

Note: "✔" indicates that the criterion is present; "✘" indicates that it is not present; "–" indicates that it is partially present but does not fully meet the expected level.

In terms of accessibility criteria, physical access to green spaces is provided in all three work areas, but it is not continuous or secure. Sidewalk interruptions and discontinuities in pedestrian infrastructure limit pedestrian connections between the school environment and public spaces. Although accessibility issues were identified in all cases, the physical elements associated with these issues varied; local road networks and park applications were effective in the first area, tram lines and overpasses in the second area, and high-speed divided roads in the third area. These findings reveal that, although accessibility is provided quantitatively, it has not reached a sufficient level in terms of spatial continuity. In the design studies, ensuring uninterrupted and barrier-free pedestrian circulation was determined as the primary design priority. To strengthen the connections between the school environment and public open spaces, sidewalk continuity has been ensured, and pedestrian-priority transportation decisions have been made. The reorganization of physical barriers that interrupt access, such as high-speed vehicle roads, tram lines, and irregular parking, is important for increasing spatial continuity.

Within the scope of the social interaction criterion, it was observed that none of the existing public spaces evaluated provided sufficient seating and social interaction areas. The lack of facilities that support children gathering, waiting, or interacting limits the social use potential of these spaces. It was observed that the design concept supporting a sense of belonging in public spaces lacks spatial qualities. Within the scope of the social interaction criterion, public spaces were addressed in a way that meets children's needs for waiting, gathering, and interacting. The creation of seating units, shaded rest areas, and small-scale gathering spaces will increase the potential for social use. The proposed design for Case 2 was considered valuable for creating a route that allows children to be included in the area at every stage.

Within the scope of environmental comfort criteria, green areas exist in all three study areas. However, it has been determined that these areas and their surroundings lack age-specific play areas and arrangements that support children's play and recreation needs, and that facilities catering to different age groups are absent. This situation indicates that play and recreation opportunities are unevenly distributed among the areas and that children's environmental comfort has not been addressed with a holistic design approach. With the proposed design elements, the existing green areas have been qualitatively improved, and efforts have been made to meet the varying play and recreation needs of children according to their age groups. Designing play areas catering to different age groups and addressing environmental design elements within a holistic system will contribute to strengthening the concept of a child-friendly environment.

As a result, the proposed design decisions have been developed considering the unique physical conditions of each sample area. An integrated design approach has been attempted to create safe, accessible, socially supportive, and environmentally comfortable public spaces for children.

4.5 Discussion and Conclusion

This research examines how public spaces around schools respond to children's spatial needs and how spatial arrangements shape these experiences, providing important findings regarding children's rights and spatial justice in urban planning. The field observations from the workshop revealed that deficiencies in the physical environment have a direct impact on children's daily lives. In this study, design alternatives were

developed through an academic studio process with university students, aiming to reinterpret the area from a user-oriented and child-sensitive perspective.

The complexity of children's relationships with space should not be considered solely as a matter of physical safety or access. Chawla (2002) states that the relationships children establish with their environment play a fundamental role in their emotional, social, and cognitive development. In this context, the need to design public spaces that enable children to establish a sense of belonging, move freely, and express themselves arises [7]. However, research results indicate that current practices fail to meet this need. Areas around schools have become prime examples of urban space being ceded to vehicles, resulting in children being either marginalized or endangered. As reported by the European Environment Agency, this situation leads to a loss of children's connection with the environment, a decrease in physical activity, and a significant reduction in the time spent outdoors [8]. Urban planning is often approached from an adult-centered perspective, failing to ensure children's participation as rights-based users [9, 10].

Creating child-friendly environments together with young people signifies a transition towards supportive environments [11], and it should be understood that a child-friendly city will ultimately be a people-friendly city [2]. Therefore, integrating user feedback into design processes is widely recognized as a fundamental principle of inclusive planning. The issues identified in the study suggest that user needs may not have been sufficiently prioritized within the existing spatial configuration.

Public spaces play a crucial role in children's development, contributing to their physical and mental development through play, social interaction, exploration, and recreation [12]. However, because adults' needs often shape these spaces, they are often incompatible with children's daily life practices, difficult to access, risky, or restrictive. According to the "ladder of participation" approach developed by Hart (2013), spaces cannot be sustainable and functional unless children are actively and not merely symbolically involved in planning processes [4]. In the proposals developed in this study, students (Groups) suggested creating connections with nature, safe playgrounds, quiet rest areas, reading corners, and small gardens for pursuing hobbies. These suggestions demonstrate that children need environments that are not only play spaces but also multifunctional, inclusive, calming, and conducive to socialization [13, 14] and that children can be not only users of spaces but also transformers of them [15, 16]. In this context, the factors that hinder children's participation in public spaces are physical and related to social and administrative limitations. The literature frequently emphasizes the concept of "child subjectification" [17], which is a critical consideration for both urban and architectural design practice. Karsten (2003) argues that spatial design and adults' normative control practices determine children's mobility in space. When children's use of space is restricted through surveillance and prohibitions, their visibility in public spaces diminishes, and spaces are erased from their worlds [18].

The workshop results also revealed that most public spaces around schools are perceived as "transitional spaces," yet these spaces hold the potential for children to socialize, play, wait, or rest. This demonstrates that child-friendly spaces are not limited to playgrounds, as discussed in the literature [19, 20], but require a multifunctional, multisensory, and inclusive design approach. Ultimately, the findings of this study emphasize that children should be viewed as rights-bearers in urban planning, not as users. Developing spatial arrangements that guarantee children's rights to physical and social access is essential for their well-being and for more equitable, safe, and livable cities. Therefore, implementing inclusive, participatory, and sustainable approaches to safeguarding children's spatial rights in urban planning is essential.

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MATERIAL MEDIATORS: HOW EVERYDAY FURNITURE AND DOMESTIC OBJECTS SHAPE HUMAN CONTACT WITH SPACE

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Abstract
This paper presents a synthesis of the conceptual, methodological, and empirical work produced within the graduate course *Design and Domestic Culture* at Izmir University of Economics. The course, defined in the official curriculum as an interdisciplinary exploration of domestic objects, interiors, and material culture, encourages students to interpret home life through design theory, ethnographic observation, and socio-cultural analysis. Weekly readings encompass local domestic practices of the middle-class, global variations of home life, and methodological frameworks such as sensory ethnography and participatory mapping. The course familiarizes students with a range of methodologies: auto-ethnography, sensory diaries, participatory mapping, visual analysis, and video reenactment techniques. As part of the final assignment, each student selects a domestic phenomenon—an object, spatial device, or practice—and produces a five-part research study comprising personal impressions, domestic mapping, methodological application, societal interpretation, and academic references. The present paper analyses these course-generated studies collectively in order to examine how everyday furniture and material elements mediate human contact with domestic space. The analysis follows an interpretive comparative approach in which the empirical findings of individual projects are reinterpreted through theoretical perspectives from material culture studies, anthropology of the home, and design research. The first case examines the transparent IKEA Tobias chair through auto-ethnography, a three-day sensory diary, and video reenactments. The student's observations demonstrate how polycarbonate transparency, surface reflectivity, and cantilevered structure heighten bodily exposure, influence posture, and modify cleaning rituals. These findings are interpreted to discuss the disciplinary and performative capacities of contemporary furniture in domestic environments. The second case focuses on the use of separators in multi-purpose domestic interiors. Through participatory floor-plan mapping conducted with four users, the study documents how lightweight dividing elements reorganize privacy, regulate visibility, support shifts between rest and work, and reduce cognitive load. These findings are interpreted within a broader discussion on flexible material skins and the psychological zoning of everyday interiors. The third case investigates domestic heating through a comparative analysis of archival images of Ottoman ember pits and contemporary fireplace practices. Using annotated household flowcharts produced by a participant and verified through a family review session, the study demonstrates how heat determines the "central room," shapes movement patterns, and fosters or disperses family gathering. These observations are contextualized within cultural codes of warmth, sociality, and bodily adaptation in domestic life. By placing these three studies into dialogue, the paper demonstrates that human engagement with domestic space is not shaped by architectural form alone, but by a constellation of material mediators that structure posture, attention, movement, and sociality. Everyday design elements' subtle but persistent influence over domestic rhythms is revealed in transparent chairs that discipline the body, separators that modulate privacy and cognitive load, and heating elements that reorganize spatial centrality. The synthesis presented here shows that even small-scale objects and furniture can operate as active agents in the production of spatial experience, highlighting the value of micro-ethnographic inquiry for understanding the human–object relations through which domestic environments are continuously shaped and reshaped.

Key Words: Domestic Design, Furniture Design, Micro-Ethnography, Everyday Practices, Human–Object Relations

1. Introduction

The ways in which individuals encounter and inhabit domestic space are shaped not only by architectural form but, more intimately, by the material objects that mediate bodily presence, sensory experience, and everyday routines. The first point of contact between the human body and the built environment typically occurs through furniture and small-scale material devices. Chairs, partitions, tables, heating elements, and other domestic artefacts operate as extensions of the body and as regulators of behavior, subtly choreographing how people sit, move, rest, work, gather, or withdraw. Yet despite their centrality to lived experience, these mediating objects often remain analytically backgrounded—treated as functional accessories rather than active participants in the production of space.

Established scholarship in material culture studies and domestic anthropology has highlighted the need to reconsider the home as a dynamic assemblage of practices rather than a static interior. Studies by Cieraad, Miller, Attfield, Shove, and Pink have shown that domestic life is constituted through rhythms of maintenance, sensory interaction, and embodied habits [2–5,7,11]. However, within this growing body of work, there remains a notable gap: the specific mechanisms through which everyday furniture and domestic objects structure human–space contact are still insufficiently theorized. The behavioural, affective, and spatial consequences of material devices—such as transparency, weight, mobility, surface texture, or heat—are rarely foregrounded in discussions of product design or interior architecture, which tend to focus on formal, stylistic, or programmatic dimensions. This article responds to this gap by examining how ordinary objects operate as material mediators that define micro-territories, regulate posture and visibility, organise circulation, and influence affective atmospheres within the home.

The empirical foundation of this study emerges from a semester-long pedagogical environment: the graduate course *Design and Domestic Culture* at Izmir University of Economics, Design Studies Program [13]. The course introduces students to interdisciplinary readings on domesticity, ranging from middle-class suburban practices in Turkiye to Japanese clutter cultures, from the sociology of possessions to the ethnography of everyday design [2,3,9]. Methodologically, the course familiarizes students with auto-ethnography, sensory diaries, participatory mapping, visual analysis, and video reenactment techniques [4,5]. As part of the final assignment, each student selects a domestic phenomenon—an object, spatial device, or practice—and produces a five-part research study comprising personal impressions, domestic mapping, methodological application, societal interpretation, and academic references [13].

This article aims to analyses the conceptual patterns emerging from these works which were examined collectively, rather than presenting them individually or adopting their findings as primary data. The research question is situated to interpret how a diverse set of student inquiries can be brought into dialogue around a unifying theoretical question: How do everyday objects and furniture mediate human contact with the objects within the domestic confinement? The course's pedagogical structure generated a wide range of investigations—including transparent furniture lightweight separators and heating practices—yet among these, recurring themes emerged around materiality, sensory experience, privacy, discipline, and spatial negotiation. It is these thematic convergences that are the major focus of the present analysis.

Furniture and domestic objects, far from being passive supports, actively shape how individuals inhabit space: how they sit or stand, gather or retreat, focus or rest, display or hide. By synthesizing the insights that emerged across student projects, this article proposes that small-scale material elements are indispensable to understanding how the home is lived, sensed, organized, and continuously remade. In doing so, the article emphasizes the analytical value of micro-ethnographic inquiry within design research and domestic space. It argues that a richer and more nuanced understanding of domestic life can be achieved by attention to material mediators—rather than solely to spatial layouts or stylistic features. However, it is important to acknowledge the limitations of the study, that the students had limited research resources, and that, in some cases, interviewees were the members of their own inner circle. They also had time limitations and were required finish their research by the end of the semester. Despite such limitations, this study is able to create an awareness that examining human–object relations at the scale of everyday furniture opens a productive pathway for rethinking the conceptualization teaching and design of domestic interiors and objects.

2. Course Outcomes: Different Narratives on Domestic Life and Objects

The final projects produced within the Design and Domestic Culture course generated a series of distinct yet conceptually intersecting narratives on domestic life. Three clusters of findings, in particular, provide insight into the mechanisms through which domestic objects shape spatial experience. The first concerns the relationship between transparency, visibility, and bodily comportment, as examined through the transparent chair study [14]. Materials such as polycarbonate or acrylic do not simply occupy space; they reshape how users perceive themselves within it, producing new forms of exposure, attentiveness, or discipline [6,7]. A second cluster centers on mobile or lightweight separators, which operate as flexible boundaries that reorganize privacy, cognitive focus, and emotional regulation in multi-purpose rooms common in contemporary homes, as documented in the separator study [15]. The third involves thermal infrastructures—such as fireplaces or historical heating artefacts—that function as spatial directors, determining centrality,

guiding movement patterns, and structuring family cohesion or dispersal across rooms, as explored in the ember pit study [16].

2.1 Transparency and Bodily Discipline: The Case of the Transparent Chair

One of the most conceptually rich projects emerging from the course examined a transparent IKEA Tobias chair through an auto-ethnographical approach in relation with the childhood memories and household everyday life [14]. Rather than treating the chair as a stylistic object within a minimalist interior, the study approached it as a material mediator that reorganizes bodily comportment, visibility, and domestic discipline. The focus was not on the design history or the designer information of Tobias Chair, but on the lived consequences of transparency within everyday home life. In order to dwell on this theme, a multi-modal methodology rooted in design anthropology and sensory ethnography was appropriated, using the longitudinal self-reporting diary and video re-enactment as primary tools [4,5]. The student filled out a structured diary over three days to capture her longitudinal relationship with the object which enabled her to track the correlation between the status of the chair and the emotions evoked in everyday interaction.

The student's initial motivation for choosing the transparent chair stemmed from a desire to reduce visual heaviness and spatial claustrophobia in a small room [14]. Accordingly, her research questions targeted finding out the changing emotions or moods which the transparent chair evoked; for instance, moments of use, avoidance, or casual interaction. Transparency was imagined as lightness, invisibility, and spatial expansion. However, through longitudinal self-observation, a more complex dynamic emerged. The chair did not disappear within the room; instead, it intensified exposure. Its polycarbonate surface refracted light, highlighted dust and disorder, and rendered any object placed upon it visually amplified. Transparency thus became not absence but hyper-visibility, revealing how domestic objects can actively shape perceptual experience within everyday interiors [2,7]. This shift from invisibility to exposure had direct behavioral consequences. The diary entries revealed that when the chair was used as a temporary storage surface—covered with clothes—it generated what the student described as "aesthetic guilt." Unlike opaque furniture that conceals disorder, the transparent surface made clutter appear suspended in space, transforming the chair into what Mary Douglas would term "matter out of place" [1]. Cleanliness shifted from maintenance to erasure; wiping replaced polishing. The object demanded discipline.

Guided by the methodologies of Sarah Pink and Kerstin Leder Mackley, which were discussed throughout the course, the student utilized the "video re-enactment" method to explore the tacit, embodied knowledge of living with transparency [4]. Video re-enactment is a sensory ethnographic method that asks participants to recreate familiar everyday activities while being recorded, allowing researchers to examine bodily movements, spatial negotiations, and tacit forms of knowledge that may not emerge through interviews or conventional observation [5]. Within this methodological framework, re-enactments are intended as reflexive and collaborative research activities that enable participants and researchers to play out and revisit embodied experiences of domestic environments. Reenactments allow participants to reconstruct familiar activities within the research setting and generate insights that might not emerge through conventional interviews or observation [5]. For this project, the reenactment exercise was established through a simple recording protocol. Using a mobile phone camera, the student documented three everyday interactions with the transparent chair as they normally occur in daily life rather than staging or acting out them [14].

The video reenactments further revealed how material properties influence bodily negotiation. When sitting, the slight bounce of the cantilevered structure required subtle muscular adjustment. The cold, smooth surface discouraged lounging and encouraged upright posture. The chair did not simply support the body; it structured it. In this sense, the project resonates with Galen Cranz's argument that chairs embody cultural expectations of posture and productivity [6]. Yet here, transparency added an additional layer: the sitter remained visually exposed, framed rather than enclosed. The chair functioned less as a container and more as a display platform.

A particularly revealing moment occurred in the "blanket scenario" recorded by the student [14]. When using the chair for leisure, the introduction of a textile layer softened the surface and visually obscured the body. The blanket operated as a temporary corrective to the disciplinary regime of transparency. This act illustrates a micro-negotiation between modernist minimalism and embodied comfort. The object's inherent material logic—clarity, cleanliness, structural lightness—was domesticated through textile intervention.

Fig. 1. Workshop Poster by the Student 1

Conceptually, this case demonstrates that furniture materiality actively reorganizes domestic experience. Transparency, often marketed as spatial neutrality, in fact produces heightened self-awareness and behavioral regulation. The chair mediates not only posture but also domestic morality: tidiness, order, readiness for display. It transforms the home into a subtly performative environment in which the body is framed within space rather than sheltered by it. More broadly, the study suggests that contemporary middle-class domestic aesthetics—clean lines, light materials, visible surfaces—may be understood as disciplinary infrastructures rather than purely visual preferences [2,7]. The transparent chair becomes emblematic of a cultural shift toward visibility, exposure, and controlled minimalism. It reveals how even a single piece of furniture can reconfigure human contact with space by intensifying awareness of one's body, movements, and surrounding environment.

2.2 Negotiating Boundaries: Separators and Psychological Zoning

A second project focused on the role of separators within multi-purpose domestic interiors, particularly in rooms where working, resting, and storage coexist within a single spatial field [15]. Rather than approaching separation as a matter of interior walls or permanent partitions, the study examined lightweight, movable, and operable devices—screens, shelving units, textile panels—as mediators of visibility, privacy, and cognitive focus. The research employed a participatory floor-plan technique, which was presented in the context of the methodologies for researching homes within the course. In design ethnography research on domestic environments, the floor plan activity is used as a participatory method to explore how inhabitants perceive and organize their homes through everyday practices [5]. During this activity, participants are invited to draw or annotate the layout of their homes while explaining how particular rooms, objects, and pathways are used in daily routines. This process enables the researcher to visualize spatial relationships, circulation patterns, and the ways domestic environments are structured through lived experience rather than architectural plans alone. By combining drawing with verbal explanation, the activity reveals participants' tacit spatial knowledge and provides insight into how everyday movements and practices shape the meaning and organization of domestic space [5]. The student, for her project, employed four participants who inhabited compact domestic environments characterized by overlapping functions [15]. Participants were asked to draw simplified plans of their living spaces and map daily movement patterns, activity sequences, and zones of visual exposure. Through this process, the separator emerged not merely as a physical divider but as a psychological regulator of spatial experience.

A recurring issue identified across participants was the absence of transition between rest and productivity. In one case, the direct visual alignment between bed and desk generated persistent cognitive

tension. Upon entering the room, the body encountered both obligation and fatigue simultaneously. The spatial configuration offered no hierarchy, no filtering mechanism. The separator—introduced either as a shelving unit, curtain, or folding panel—functioned as an instrument of visual interruption. It reorganized sightlines, reducing simultaneous exposure to competing functions. Importantly, the separator did not produce total enclosure. Unlike architectural walls, these devices created degrees of permeability. Sound travelled; light filtered; shadows marked boundaries without sealing them. This partial division proved central to the study's findings. Participants reported improved focus and psychological clarity not because they were fully isolated, but because spatial signals became differentiated. The separator allowed the room to operate in modes rather than in conflict.

Fig. 2. Workshop Poster by the Student

The project also revealed how visibility relates to social exposure. In shared households, the immediate visibility of one's working posture when someone enters the room intensified self-consciousness and interrupted concentration. The separator introduced a temporal buffer—a brief delay between entry and encounter—that reduced the feeling of being abruptly "on display." In this sense, the separator modulated the performative dimension of domestic space identified in the previous case study. Where transparency amplified exposure, separation redistributed it. Conceptually, this case resonates with theories of territoriality and privacy [10], as well as with Blunt and Dowling's interpretation of the home as a negotiated site of belonging and boundary-making [8]. Yet the study adds a micro-material perspective by demonstrating how small-scale devices can recalibrate domestic dynamics [15]. The separator functions as a tangible skin of space: a movable membrane that reorganizes cognitive load, emotional regulation, and bodily orientation.

Moreover, the participatory mapping revealed that separators shape circulation patterns. When active, certain zones became designated as "work territories," while others reclaimed their association with rest. Without the separator, circulation remained fluid but mentally fragmented; with it, movement gained structure. The floor plan became not only a representation of space but a diagram of lived negotiation. This case expands the article's broader argument by showing that human contact with space is mediated not only by surfaces that discipline posture, but also by boundaries that structure attention and social exposure. If the transparent chair intensified visibility, the separator redistributed it. Both, however, demonstrate that furniture operates as an active regulator of spatial experience. Taken together, the findings suggest that contemporary domestic interiors—particularly in urban contexts characterized by spatial compression—depend increasingly on flexible material interventions rather than fixed architectural hierarchies. The separator becomes emblematic of a broader shift toward adaptive, user-mediated spatial organization. It

reveals that privacy, focus, and well-being are not solely functions of layout, but outcomes of material negotiation enacted through movable objects.

2.3 From Central Hearth to Shadowed Object: Ember Pit and the Reconfiguration of Domestic Centrality

The third project approached domestic life through a historically layered object: the Ottoman ember pit [16]. Unlike the previous cases rooted in contemporary domestic observation, this study began with an encounter in a museum context. The student's attention was drawn not only to the object itself, but to its location—placed under the stairs at Yemişçizade Mansion, partially obscured and detached from its former centrality. This spatial displacement became the conceptual trigger of the project. The ember pit was once a central heating device within Ottoman domestic and palace life. Archival representations and palace interiors show the ember pit positioned prominently in gathering spaces, often aligned with zones of authority and social interaction. As documented in the student's archival analysis, heating objects functioned not merely as technical solutions but as points of attraction around which daily practices unfolded [16]. Rituals such as coffee preparation, conversation, and collective rest were spatially organized around warmth, illustrating how heating devices historically structured patterns of gathering and social interaction within domestic environments [11].

As the ember pit no longer exists as an active object in contemporary domestic life, the student designed the study in two complementary stages [16]. First, the project employed archival and representational analysis in order to investigate how the ember pit functioned in earlier domestic and palace settings. Historical imagery, museum observation, documentary material, and popular culture representations were used to reconstruct the social and spatial role of the object. Through thematic analysis of palace imagery, popular culture representations, and documentary materials, the project identified several intertwined dimensions of the ember pit's significance. It functioned as a center of attention, creating spatial orientation and gathering; it operated as a multifunctional device in which heating intertwined with daily practices; it embodied prestige and craftsmanship within palace contexts; and it carried cultural memory that persisted even after its practical use declined. What is particularly striking in this case is the transformation from central object to marginal artifact. The ember pit's relocation under the stairs in a museum context symbolizes a broader cultural shift: practices that once structured domestic centrality have been overshadowed by new heating technologies and spatial logics. The project insightfully reframed the research question from "What is this object?" to "What happened to the practice it once organized?"—a shift that resonates with broader discussions of how material objects continue to function as carriers of cultural memory even after their practical contexts disappear [12].

In the second stage, in order to examine whether the spatial logic historically associated with the ember pit could still be observed in present-day domestic life, the student introduced the fireplace as a contemporary comparative tool [16]. In this sense, the fireplace was not treated as a direct equivalent of the ember pit, but as a methodological bridge through which the spatial effects of warmth could be examined under current living conditions. For this comparative stage, like in the previous project, the student used a floor plan activity, a participatory mapping method [5], in which the participants are invited to draw and annotate the layout of their homes while explaining how activities unfold across rooms. Following this approach, the student worked with two household members in a summer house in Dikili that is occasionally used during the winter. The first household member initially drew the plan of the house and mapped the daily routes, durations, and room uses under two different scenarios—when the fireplace was active and when it was inactive. The second household member then reviewed the map, confirmed certain sequences, and added corrective notes and details based on her own domestic routine [16]. Although having the sample of a limited number of respondents, the methodological value of this approach lies in its ability to make spatial practice visible [16]. Rather than treating the house as a fixed architectural container, the floor plan activity revealed how heating conditions reorganized everyday life through movement, time allocation, and room occupation. The comparative mapping showed that when the fireplace was active, the living room emerged as the central room of the house and family activities concentrated there. When the fireplace was inactive, domestic life contracted into smaller and warmer zones, certain rooms were avoided because of cold drafts, and bodily adaptation practices such as layering clothing or using electric blankets became more prominent. These observations resonate with studies showing how heating infrastructures organize patterns of domestic gathering and spatial hierarchy within the home [11].

Fig. 3. Workshop Poster by the Student 3

Following this methodological exploration, the findings can be interpreted within a broader framework of how thermal infrastructures organize domestic life. Heating devices, whether historical or contemporary, do not simply regulate temperature; they structure patterns of gathering, attention, and spatial hierarchy within the home. As studies of everyday energy practices have shown, heating technologies often produce zones of attraction around which social interaction and domestic routines are organized [11]. The mapping exercise therefore demonstrates that the logic historically associated with the ember pit—warmth functioning as a spatial center—continues to persist in contemporary domestic environments, even when the original device has disappeared [16]. At the same time, the relocation of the ember pit from a central domestic device to a marginal museum artifact illustrates how domestic objects undergo shifts in both function and symbolic status. Once embedded within everyday social life, the ember pit structured patterns of gathering, hospitality, and authority within Ottoman interiors. In the museum setting, however, the object appears detached from these practices, preserved primarily as a historical reference. In this sense, the ember pit operates as what Pierre Nora describes as a *lieu de mémoire*: an object through which traces of past practices remain visible even when the social conditions that produced them have faded [12].

3. Discussion

When examined together, the three projects—transparent chair, separator, and ember pit—reveal a shared structural dynamic: domestic space is not merely inhabited but actively choreographed through material mediators. Each case isolates a different dimension of this choreography—visibility, boundary, and thermal centrality—yet all demonstrate that furniture and domestic devices regulate how bodies orient themselves, how attention is distributed, and how social proximity is negotiated. What becomes visible through this comparative reading is that furniture is not secondary to architecture; rather, it performs the minute, repetitive labor through which architecture becomes lived [2,7]. The home is experienced less as a fixed container and more as a fluctuating field of micro-adjustments enacted through objects. Transparency disciplines the sitter; separators negotiate proximity; heat centralizes presence. In each case, the object does not merely occupy space—it produces spatial experience. Importantly, these mediations also encode cultural values. Transparency reflects contemporary aesthetics of lightness and display; separators echo long histories of gendered privacy and adaptable spatial hierarchies; the ember pit carries traces of ritualized warmth and social cohesion. Thus, material mediators are not neutral tools but carriers of ideological, historical, and affective meanings. They inscribe cultural codes into everyday spatial practice [7]. By synthesizing the pedagogical outputs of the course, this article demonstrates that micro-ethnographic inquiry can reveal

structural patterns otherwise overlooked in architectural discourse [5]. The cumulative insight is that human contact with space is never direct; it is always filtered through material interfaces that discipline, soften, divide, or gather. Domestic life unfolds within these interfaces.

The broader implication of this research lies in its methodological orientation. By foregrounding micro-ethnographic approaches within design education, the study shows how close observation of everyday objects can generate theoretical insight into spatial experience. The integration of auto-ethnography, participatory mapping, and archival interpretation demonstrates that domestic phenomena—however ordinary—contain layered narratives of cultural memory, social negotiation, and embodied practice [5,11]. Ultimately, the article suggests that to understand interior space, one must attend not only to walls and volumes but to the material mediators that quietly structure daily life. Chairs, screens, and heating devices are not peripheral elements; they are active agents in the choreography of dwelling. Recognizing their agency opens new pathways for rethinking how interiors are analyzed, taught, and designed.

This study also has certain limitations that should be acknowledged. The empirical material derives from a pedagogical setting and is based on a limited number of student-led micro-ethnographic case studies. While this scale allows for detailed observation of everyday spatial practices, the findings cannot be generalized across all domestic contexts. Instead, the value of the study lies in its interpretive and exploratory character, demonstrating how small-scale design ethnography can reveal subtle mechanisms through which domestic objects mediate spatial experience. Future research could expand this approach through larger participant groups and comparative studies across different cultural and socio-economic domestic settings. To understand the home, therefore, is to understand the subtle choreography between bodies, objects, and atmospheres through which space becomes lived.

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SERVICE SPACE ADAPTATION FOR TRADITIONAL TIMBER-FRAME HOUSES: A MODEL FOR SUSTAINABLE CONSERVATION

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Abstract
Advances in construction technologies and evolving domestic lifestyles have rendered historic traditional houses increasingly unable to meet the expectations of contemporary domestic life, resulting in cycles of neglect, abandonment, and demolition in historic neighborhoods. This study develops a service space adaptation model for traditional timber-frame houses, addressing the core deficiency that drives residents away: inadequate kitchens and bathrooms that fail to satisfy contemporary standards of hygiene, comfort and functionality. The inhabited traditional houses have accumulated modifications and ongoing patters of use; therefore, the proposed model begins by mapping each space with its current condition, original function and adaptation potential before identifying suitable locations for service space adaptation / intervention. Through a four-stage analytical procedure (analysis, evaluation, proposal, and application management) applied to three traditional houses of varying sizes, the study produces a decision-making framework, i.e. the Bathroom and Kitchen Adaptation Chart, that cross-references spatial adequacy with the presence of authentic architectural elements to guide intervention. The model employs raised floor systems and infrastructure walls to ensure minimum intervention, reversibility, and material compatibility with historic fabric; all the while integrating new service space installations into existing spatial configuration without harming structural, architectural, or spatial integrity. The proposed approach replaces the prevailing cycle of neglect-abandonment-demolition with a sustainable alternative: upgrade-use/maintain-conserve.
Key Words: *sustainable adaptation; traditional timber-frame houses; service spaces; conservation; heritage*

1. Introduction

Traditional residential neighborhoods embody the daily life of successive generations, yet they are increasingly neglected, particularly in large cities where urban expansion reduces them to obsolete zones caught in recurring cycles of abandonment. As homeowners improve their circumstances, they relocate to newer housing, converting former homes into rental properties. Maintenance, when undertaken, typically prioritizes cost minimization and visual acceptability over heritage values; unprofessional repairs may keep buildings in use but do not ensure long-term survival [1].

Beyond developments in construction technology, shifts in domestic lifestyles, such as changing household structures, evolving standards of hygiene and comfort, and the expectation of individually equipped kitchens and bathrooms, have widened the gap between what traditional houses offer and what contemporary inhabitants require. This study identifies the core deficiency as the lack of properly functioning service spaces, such as kitchens and bathrooms, which fail to meet contemporary demands. The objective is to develop a model that replaces the prevailing cycle of neglect-abandonment-demolition with a sustainable alternative: upgrade-use/maintain-conserve. By enabling targeted intervention in service spaces while preserving structural, architectural, and spatial integrity, the model aims to retain residents and sustain neighborhood living cultures.

The paper is structured as follows: The theoretical framework discusses conservation through adaptation (Section 2.1) and contemporary housing requirements and service space needs, including the lifestyle shifts that have intensified service space deficiencies (Section 2.2). The materials and methods introduce the site and case selection from a traditional neighbourhood in Ankara (Section 3.1), detail the four-stage analytical procedure (Section 3.2), and document existing conditions and damage patterns (Section 3.3). The results present alternative refunctioning charts mapping each space's adaptation potential (Section 4.1), develop service unit proposals for bathroom and kitchen installations (Section 4.2), and describe the raised floor system and application methods that ensure reversibility and material compatibility (Section 4.3). These

findings are synthesized into the Bathroom and Kitchen Adaptation Chart, a decision-making framework cross-referencing spatial adequacy with the presence of authentic architectural elements (Section 5).

2. Theoretical Framework

2.1 Conservation through adaptation

Buildings are constructed for specific purposes, yet over time, historic structures often cease to meet the requirements of their original functions. To extend the lifespan of such buildings, interventions become necessary to sustain their functionality; conservation through adaptation offers long-term solutions [2]. Rather than demolition, sustainable adaptation seeks to prolong the life of historic buildings through retrofitting and modification, thereby keeping them in active use. This approach mitigates the excessive energy and material waste associated with demolition and new construction [3].

Ongoing efforts seek to protect traditional areas and their communities while sustaining the cultural diversity and living cultures of these neighborhoods. Within this framework, the survival of traditional neighborhoods depends substantially on retaining current residents in their homes, thereby ensuring continuity in the neighborhood's living cultures, while embracing necessary change. Successful conservation is ensured by keeping buildings in continued use through daily care and maintenance [4], [2]. Such maintenance, when extended from individual houses to the neighborhood scale, can foster long-term revitalization and, in turn, economic benefits from increased tourism. This improvement in the social and physical condition of the neighborhood may also influence homeowners' decisions to maintain their properties, motivated by a desire to meet prevailing neighborhood standards and housing quality.

Any intervention in historic buildings must be guided by established conservation principles. Pye defines two primary activities in the conservation process: rectifying the effects of existing or past deterioration, and preventing further deterioration [1]. Within this framework, the first principle is to recognize that each case is unique and requires specific measures. These measures should prioritize minimum intervention and respect for the authenticity of architectural elements and materials. The second principle is honesty in application, ensuring that the distinction between new and old remains clearly legible. The third principle concerns the balance and compatibility of old and new, achieved through harmony of proportion, texture, and materials [5]. To conserve the spirit of place, interventions should not compromise historical and architectural characteristics: plan layout, façade organization, and architectural elements. Moreover, any proposed model should aim to keep alterations reversible, so that applications can be easily replaced if necessary [5].

2.2 Contemporary housing requirements and service space needs

In terms of contemporary housing needs, similar requirements exist across diverse contexts and can be addressed through comparable solutions: the provision of sanitary service spaces with contemporary equipment and appropriate technical infrastructure, including water supply, drainage, electricity, heating, ventilation, and service space equipment. The adaptation proposal thus aims to equip underutilized spaces as kitchens, bathrooms, and toilets, together with the pertinent technical infrastructure. The proposed model requires no alteration to exteriors or authentic architectural elements and does not involve mass additions or removals. It simply provides for the conversion of an existing space into a service space. However, the selection of the appropriate space must be carefully conducted and monitored to conserve not only the formal appearance of the structure but also its spatial and structural integrity and authentic interior architectural characteristics.

Timber, as a natural and organic material, is inherently vulnerable to wet and dry rot as well as wood-boring beetles; certain conditions, i.e. particularly moisture and damp, promote rot growth and infestation. Wet rot typically occurs at surfaces and is common in areas prone to wet conditions, whereas dry rot develops in concealed spaces such as beneath floorboards and within roofs, resulting from limited air movement and poor maintenance of leaking gutters, and is consequently more potentially damaging [6]. The best solution is therefore to keep water away from original materials through a simple protective layer. This protective layer can be established using raised floor systems supported by technical shafts housing technical equipment and sanitaryware.

3. Materials and Methods

3.1 Site and case selection

Every remodeling project requires an analytical procedure; namely, the analysis of the requirements of the new function to ensure harmony and compatibility between the historic building and new installations

[7]. In this study, the procedure comprises four stages: analysis (gathering information), evaluation (detecting problems), proposals (providing solutions), and application management (monitoring implementation and anticipating future issues).

The first step in identifying cases for assessment is the site survey, which locates representative traditional residential buildings according to the building typology of the selected neighborhood, since each neighborhood is unique and displays authentic characteristics. The criteria informing case identification are authenticity, representativeness of a particular neighborhood's housing typology, and size variation to provide alternatives for different family types (Figure 1).

For the purposes of this study, three cases from a traditional neighborhood in Ankara (Jewish neighborhood) are used to assess the proposed methodology: a four-stage analytical procedure (analysis, evaluation, proposal, and application management) leading to a decision-making framework for bathroom and kitchen adaptation in traditional timber-frame houses. All three houses employ a timber-frame structural system with brick or mudbrick infill, built upon a stone masonry base [8]. The plan organization is based on rooms surrounding a primary hall (*sofa*) at the center, a common plan typology of traditional Anatolian houses [9-13]. The *sofa* serves as the predominant circulation, gathering, and living space, while the surrounding rooms (*oda*) share similar characteristics in terms of size and spatial qualities [9-13].

Figure 1. The selected cases: (a) Case A, (b) Case B, (c) Case C. Plans [14]. Photographs by the author(s).

3.2 The four-stage analytical procedure

Following the identification of cases according to façade and plan typology, the next step is the analysis of the current state of the selected cases (Figure 1). This analysis includes identification of property ownership, user definition, architectural and structural characteristics, and spatial adequacy of spaces according to their functions. The second step is the evaluation phase, which detects problems in existing service spaces. If current service spaces are spatially inadequate, have been modified through arbitrary alterations involving partial or complete removals or additions, or have suffered hidden or apparent material decay and disintegration due to trapped moisture and resultant damp, then new spaces are sought for service unit installations. For each housing case, alternative refunctioning of spaces is documented, and a suitable space is determined for the new installation.

The initial aim of an efficient 'fit' is physical compatibility; that is, ensuring that the size of the space meets spatial requirements [15]. To understand the limitations and possibilities of individual spaces, it is essential to examine each space's allocation, its relationship with adjacent spaces, its spatial adequacy for the required function, and its ventilation properties. These qualities determine the feasibility of spaces for partial adaptations or complete conversions.

After the alternative functioning of spaces has been analyzed and evaluated, the third step identifies suitable spaces for new installations and proposes a model for each case. For the final stage of application management, i.e. the monitoring step, one bathroom and one kitchen example are developed step-by-step in detail to demonstrate the applicability of the proposed model.

3.3 Documentation of existing conditions and damage patterns

In all cases examined, service unit conversions had been executed as if applied to new construction rather than historic fabric by the users. Dampness is inevitable in such installations and causes material decay while destabilizing structural integrity. Finishing materials such as ceramic tiles, cement-based plaster, or oil-based paint, had been applied directly without a protective layer. The damage resulting from these arbitrary service space applications follows a consistent pattern: spatial inadequacy; loss of original spatial quality; additions or removals of walls that compromise structural integrity; poor execution; incompatible application materials; disintegration of materials and connections; missing elements; and loosening of connections [16]. These findings underscored the urgent necessity for a systematic model for service space applications.

4. Results

4.1 Alternative refunctioning charts

A successful adaptive reuse project ensures that user requirements are harmoniously integrated into the adapted building or space. It is essential to identify basic requirements, understand the usage patterns of the inhabited building, and consequently find solutions that fit service units into the spatial organization of the household [7].

The alternative refunctioning charts (Figures 2-4) map each space against its size, current use, original function, and adaptation potential. A core principle emerges: spaces central to the traditional plan typology, such as *taşlık* (stone-paved inner hall), *sofa*, *baş oda* (main room), and where present, *hamam* (traditional domestic bath), should retain their original functions. These define the spatial hierarchy of the house and have no equivalent in modern layouts. The remaining rooms, typically smaller and more peripheral, offer flexibility.

In Case A, the primary spaces (two *sofa* halls [A-G2/A-G3, A-F2], one *taşlık* [A-B2], one *hamam* [A-B7]) are protected (Figure 2). Later-period partition walls (A-G7, A-F7, A-F9, A-F10) are recommended for removal to restore spatial legibility. Small-sized spaces are prioritized for service adaptation.

Case B presents greater complexity (Figure 3). The *taşlık* (B-G1) and *sofa* (B-F1/B-F10) are protected, but the latter has been subdivided and an ancillary mass added, compromising circulation. Some partitions should be removed; others must remain because they now structure multi-household occupation. The space B-F9, for instance, can function only as a bathroom; not because it is ideal, but because the partition creating it has become an obligatory circulation route to B-F11. That room, by contrast, offers natural light, ventilation, and traditional cupboards, making it suitable for kitchen conversion. The ground-floor rooms (B-G2, B-G3, B-G4, B-G8) and first-floor rooms (B-F2, B-F3, B-F6, B-F11) offer greater flexibility where undivided.

Case C presents the clearest scenario (Figure 4). Beyond the *taşlık* (C-G1) and *sofa* (C-F1), the remaining rooms accommodate varied functions without conflict. The current bathroom (C-G4), divided from the *taşlık*, is spatially inadequate; the area beneath the stairs (C-G4a) serves as a toilet but requires improved ventilation. Rooms C-F2 and C-F3 offer the best possibilities for service space adaptation.

What the charts reveal, across all cases, is that refunctioning decisions are rarely free choices. They are negotiations between spatial potential, accumulated alteration, and present inhabitation patterns. The selected spaces for the implementation models in this study were chosen based on the criteria of being abandoned, devastated, and possessing fewer authentic architectural characteristics, as exemplified in Case A (Figures 5-6). Given the scope and limitations of the paper, the process of documenting and reconstructing the spaces in Case A also serves to illustrate the spatial conditions encountered in the other cases. However, under the same criteria, smaller residences necessitate a negotiation between preserving authenticity and enabling conversion.

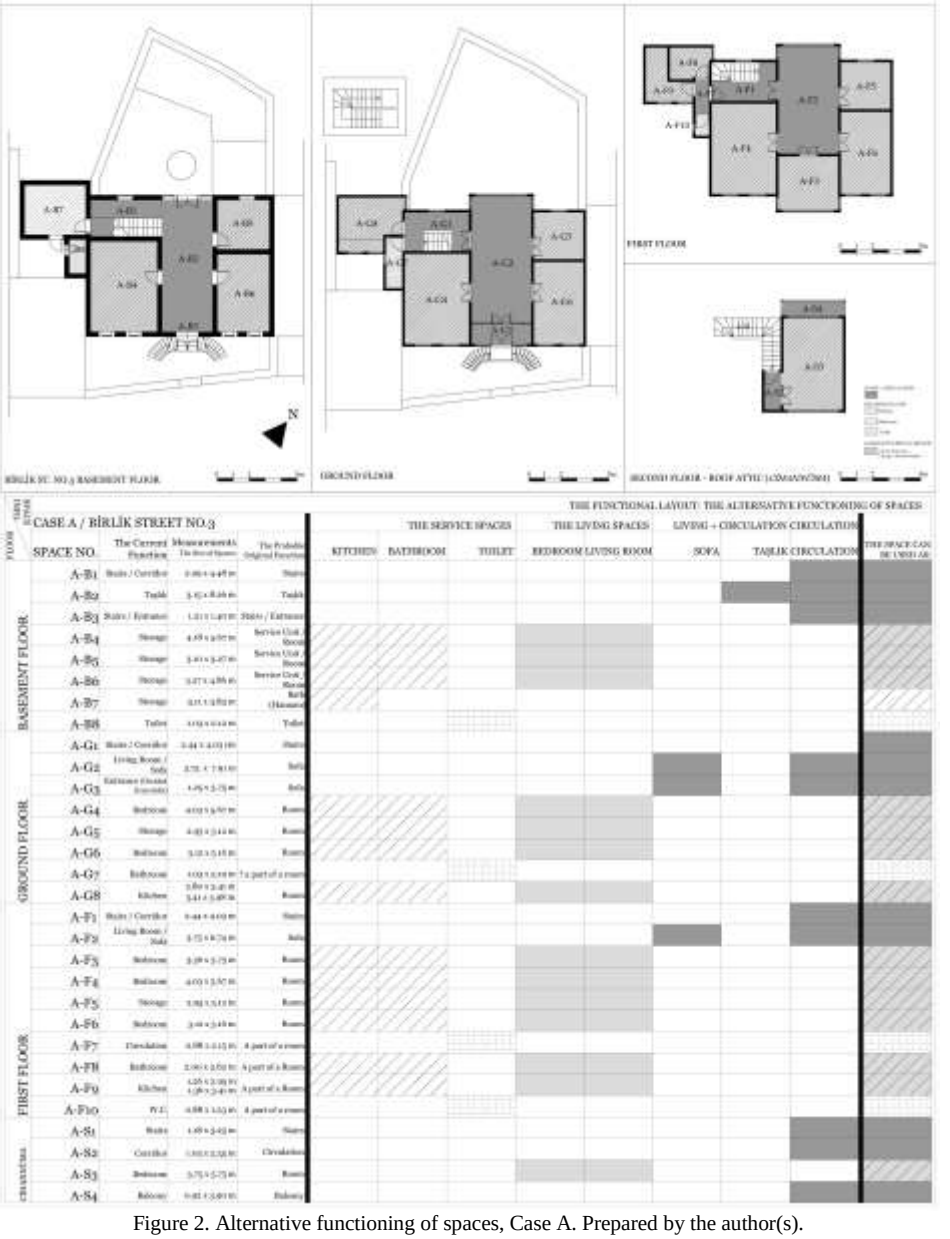

Figure 2. Alternative functioning of spaces, Case A. Prepared by the author(s).

Figure 3. Alternative functioning of spaces, Case B. Prepared by the author(s).

Figure 4. Alternative functioning of spaces, Case C. Prepared by the author(s).

Figure 5. Photographic documentation of spaces selected for service unit conversion in Case A: kitchen space (top row) and bathroom space (bottom row). Photographs by the author.

Figure 6. AI-assisted reconstruction of the selected spaces from fragmentary site photographs. Due to the fragmented nature of the available photographs, and the limited quality of the camera used during fieldwork, the original images alone do not convey the spatial characteristics of the rooms; the reconstructions provide a legible reading of the spaces prior to proposed intervention (generated using ChatGPT 5.3 based on photographs by the author).

4.2 Service unit proposals

Following the identification of suitable spaces from the alternative refunctioning charts (Figures 2-4), one bathroom and one kitchen installation are proposed for each case (Figures 7-9). In Case A, bathroom conversions occupy the smallest spaces on each floor (A-B5, A-G5, A-F5), facing the private courtyard and opening onto the *sofa*. Kitchen conversions occupy adjacent street-facing rooms (A-B6, A-G6, A-F6), consolidating technical infrastructure within a single vertical shaft. Technical equipment remains below kitchen counter height, leaving upper walls untouched. In Case B, the bathroom occupies an already-altered passageway space (B-F8, B-F9), a pragmatic choice that exploits prior compromise rather than introducing new intervention to intact rooms. The installation evokes the traditional *gusülhane* (traditional bathing cubicle in a room): a raised, enclosed cubicle within the larger space. The kitchen occupies the ancillary mass addition (B-G8, B-F11), grouping service functions together and minimizing impact on the principal structure. In Case C, spatial constraints limit the bathroom to a first-floor room (C-F2), inserted as a closed cabin. The kitchen (C-G3), already preferred by users, offers two walls without authentic features, making it the least contentious choice. Across all cases, technical infrastructure is resolved beneath raised platforms and within dedicated shafts, ensuring separation from historic fabric and enabling future reversibility.

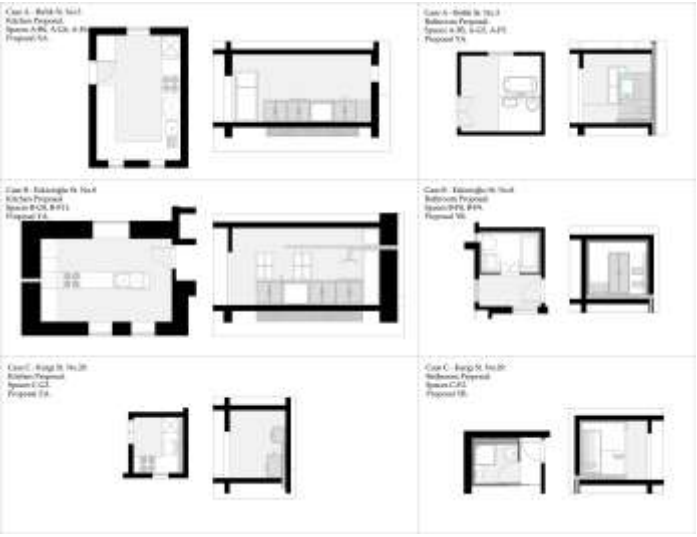

Figure 7. Kitchen and bathroom proposals for the selected cases. First row: Case A; second row: Case B; third row: Case C. Prepared by the author(s).

4.3 The raised floor system and application methods

The raised floor system serves three functions: it protects traditional materials from water contact and consequent decay; it distributes technical loads evenly across original timber girders; and it establishes a legible distinction between historic fabric and new intervention (Figure 8). The platform, constructed of galvanized steel supports and joists beneath removable plywood panels, echoes the traditional *seki*, the raised timber platform marking the hygienic threshold of domestic space [13]. This is not aesthetic quotation but functional continuity: an elevated, dry surface separated from the ground.

Installation follows a straightforward sequence: steel supports align with existing girders (typically 50–70 cm apart), U-profile joists connect them, plastic seals provide sound insulation, and plywood panels complete the surface. Ventilation panels address trapped moisture. The infrastructure wall sits atop the supports, distributing its load to the beams rather than the floor surface. All components are removable, ensuring reversibility, an ethical commitment to the historic fabric.

The bathroom proposal for Case A exploits vertical alignment: spaces A-B5, A-G5, and A-F5 occupy the same position across floors, enabling a single technical shaft to serve all three levels (Figure 9). A freestanding infrastructure wall (180 cm high) anchors the sanitaryware on both sides while a raised platform (219 × 155 cm; 18–24 cm height) conceals drainage below. The design concentrates intervention at the room's center, leaving perimeter walls untouched.

The kitchen proposal for Case B follows similar logic. Spaces B-G8 and B-F11 align vertically, sharing a technical shaft. The platform (510 × 185 cm) occupies one side of the room, and the infrastructure wall rises only to counter height (90 cm), minimizing visual impact and avoiding contact with original wall surfaces or architectural elements (Figure 9).

In these proposals, water supply and drainage pipes are installed within the infrastructure wall or shaft. These operate with pressure systems in which water is pumped to the pipes from the main city services. Pipes may be copper, galvanized steel, or plastic; however, plastic pipes are proposed here as they are mass-produced, lightweight, and easily removable. Water drainage pipes are installed beneath the raised deck where necessary and are kept lower and wider in diameter than water supply pipes in accordance with infrastructural regulations.

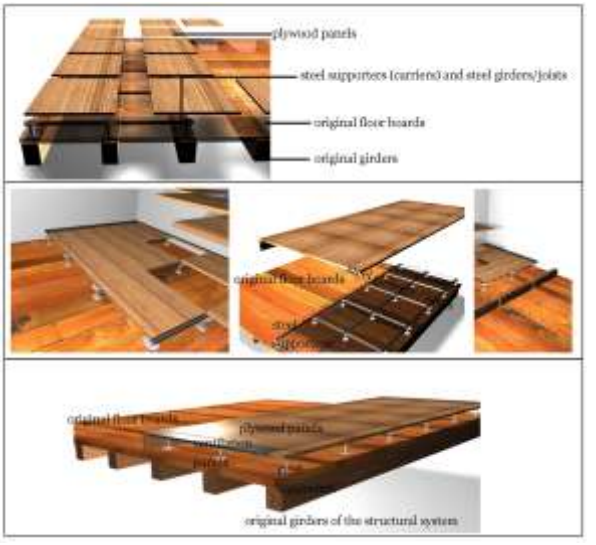

Figure 8. Raised floor systems and application methods. Prepared by the author(s).

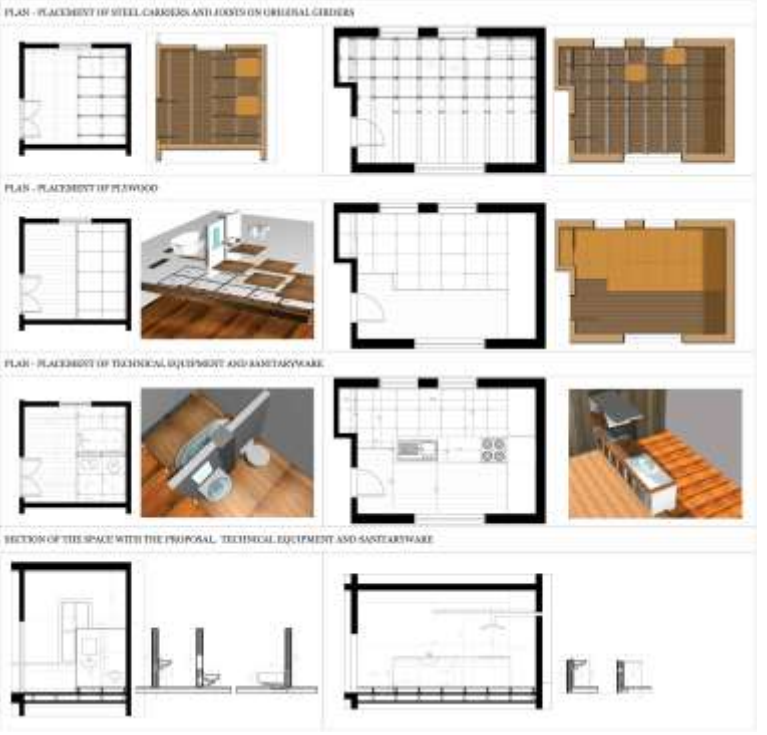

Figure 9. Application methods and steps for bathroom proposal (Case A: spaces A-B5, A-G5, A-F5) and kitchen proposal (Case B: B-G8, B-F11). Prepared by the author(s).

5. The Bathroom and Kitchen Adaptation Chart: A Decision-Making Framework

Drawing from the case analyses and application methods presented above, this study proposes a decision-making framework for service space adaptation in traditional timber-frame houses. The Bathroom and Kitchen Adaptation Chart (Figure 10) synthesizes the findings into a model applicable across diverse contexts.

The model navigates two variables: spatial adequacy and the presence of authentic architectural elements. Where space permits and walls retain decorative or architectural value, installations occupy the room's center

with no wall contact (Figure 10, X). As spatial constraints increase or authentic elements diminish, installations shift toward one wall (Y), then two or more (Z); but never more than two where avoidable, to limit structural load and surface damage. Kitchens allow an exception: counters may line all walls if kept below windowsill height (90 cm), preserving the architectural character above.

The model also distinguishes between full conversion (A) and partial insertion (B). The latter, a self-contained cabin or closet within the room, proves particularly useful for bathrooms, where it reinterprets the *gusülhane* not only as nostalgic reference but as a spatial strategy: an enclosed, raised, hygienic unit that coexists with, rather than replaces, the historic room.

The proposed model addresses established conservation principles in several ways. The emphasis on raised floor systems and infrastructure walls with minimal contact to original fabric ensures minimum intervention, preserving the authenticity of architectural elements and materials. The clear distinction between new installations (steel frames, plywood panels, plasterboard walls) and traditional materials (timber structure, original wall surfaces) maintains honesty in application, ensuring that the difference between new and old remains clearly legible. The removable nature of the raised platform and its components ensures reversibility, allowing applications to be easily replaced if necessary; and finally, the design approaches, whether positioning units at the center of rooms or echoing traditional elements such as the *seki* platform or *gusülhane* cubicle, achieve compatibility and harmony of proportion, texture, and materials.

The model's applicability extends beyond the specific cases examined. The decision-making framework provides a guide for practitioners working with traditional timber-frame houses in diverse contexts. By cross-referencing spatial adequacy with the presence of authentic architectural elements, the chart enables systematic decision-making while respecting the uniqueness of individual cases.

Limitations of the model include its focus on timber-frame construction, which may require adaptation for other structural systems. Additionally, the model assumes access to contemporary technical infrastructure (water supply, drainage, electricity), which may not be available in all contexts. Future studies might extend the model to address these variations.

The implications for future adaptation projects are significant. By demonstrating that service space deficiencies can be addressed through targeted, reversible interventions, the study offers a pathway for retaining residents in traditional neighborhoods.

6. Conclusion

A conservation project should guarantee utility for users with varying needs and expectations, rather than simply conserving buildings for the sake of conservation [17]. The essential responsibility is to ensure continuity of the environment by neither diminishing the value of the past nor the potential of the present [6]. This study accordingly develops a service space adaptation model for traditional timber-frame houses, addressing user demands for adequately equipped service spaces as fundamental components of contemporary housing. The objective is to conserve abandoned houses and maintain their use by preventing residents from abandoning their property.

The study demonstrates that traditional neighborhoods, despite their current condition, can be revitalized through simple upgrading via the introduction of new service spaces. Historic houses can become more functional and appealing to homeowners and residents, thereby averting abandonment and the consequent cycle of neglect and demolition. By ensuring continued occupation, the social and cultural integrity of historic neighborhoods can be preserved, and consequently, the spirit of place will be transmitted to future generations.

The cases examined served as exemplary applications of the further developed service space implementation model [18-19]. The Bathroom and Kitchen Adaptation Chart offers a decision-making framework intended to guide future studies on service space adaptation for historic housing.

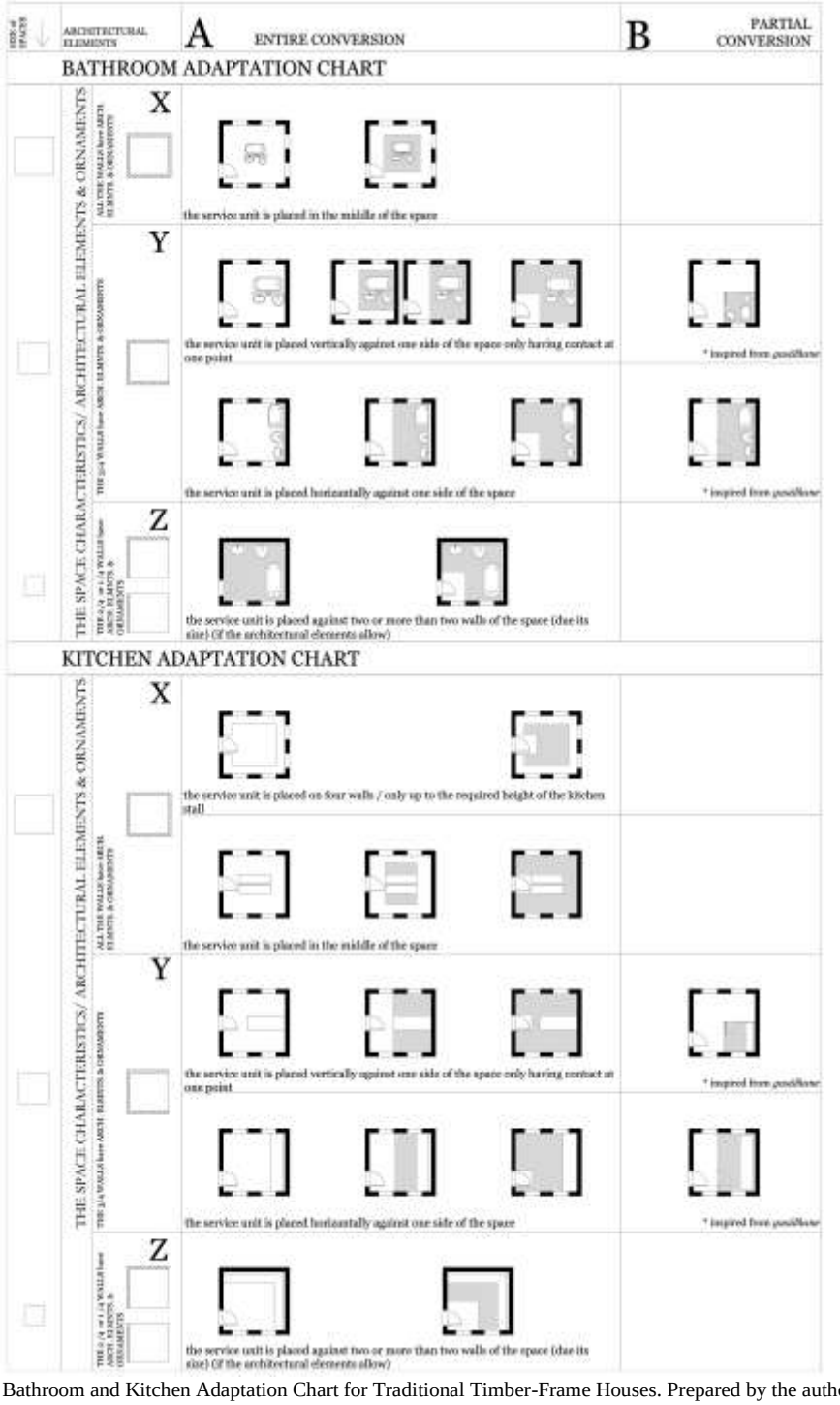

Figure 10. Bathroom and Kitchen Adaptation Chart for Traditional Timber-Frame Houses. Prepared by the author(s).

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A CONCEPTUAL OVERVIEW OF ADAPTIVE REUSE POTENTIAL OF INDUSTRIAL BUILDINGS IN URBAN DEVELOPMENT AREAS

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Abstract
Urban transformation projects carried out in urban development areas that do not possess historical value but include an existing settlement pattern generally emerge due to functional inadequacies and economic pressures. Rapid increases in land values and the resulting changes in planning decisions further contribute to bringing such projects onto the agenda. In these transformation processes, economic efficiency and rent-oriented approaches often come to the forefront, while the reuse potential of the existing building stock—within the framework of newly defined planning functions—is largely overlooked. Demolitions implemented without a holistic evaluation lead to the loss of qualified buildings with potential before they complete their physical life. This situation indicates a critical decision-making problem that needs to be addressed at the early stages of transformation processes in line with sustainability principles.
This study draws attention to the functional transformation potential of large-scale industrial buildings located within urban transformation areas and planned for demolition, and discusses the conceptual framework of an early-stage evaluation approach that addresses their reuse potential. In this context, the study compiles key criteria identified in the literature; such as structural integrity, spatial flexibility, and urban context; and examines how these criteria are addressed, applied, and justified across different studies. Based on these criteria, the study aims to develop a framework that enables a systematic and comparative assessment of whether existing buildings are suitable for reuse.
The proposed approach serves as a reference for urban transformation planning by enabling the early identification of large-scale buildings that have not completed their physical life but are approaching the end of their functional life. By emphasizing adaptive reuse potential at the early stages of the transformation process, the approach aims to prevent unnecessary demolitions and excessive resource use, thereby contributing to physical, economic, and social sustainability goals. The study ultimately provides a discussion framework for the development of sustainability-oriented decisions through the adaptive reuse of industrial buildings exposed to functional obsolescence.

Key Words: Adaptive reuse, Urban transformation, Industrial buildings, Functional obsolescence, Early-stage assessment

1. Introduction

When the academic literature is reviewed, the concept of adaptive reuse is largely addressed within the context of the sustainability of historic environments, the conservation of listed buildings, and restoration practices. These studies undoubtedly make significant contributions in terms of preserving and sustaining listed buildings, creating new discussion frameworks for functional adaptation decisions of historic structures, and ensuring the continuity of cultural heritage [1]. Recent bibliometric studies also indicate that research on the concept of adaptive reuse is predominantly shaped around historic buildings and environments [2]. In particular, industrial buildings that do not possess cultural heritage value or listed status remain largely outside the scope of conservation and reuse discussions.

On the other hand, the need for adaptive reuse of buildings that constitute a large portion of the existing building stock in cities and do not possess cultural heritage value is largely overlooked. However, in contemporary cities, these buildings, especially those forming a significant part of the building stock in urban areas under transformation pressure, become functionally obsolete and face the risk of demolition due to functional obsolescence [3]. Fundamental criteria required for sustainable urban development, such as extending the building physical life, reducing construction waste and therefore carbon emissions, and conserving embodied energy, are directly related to the concept of adaptive reuse [4]. Yudelson's study published in 2010 emphasizes that adaptive reuse and functional adaptation practices will become

increasingly prominent in the building sector in the near future, and states that a large proportion of the existing building stock will consist of adapted buildings [5]. This perspective highlights the extent to which adaptive reuse is important not only for historic environments but for the entire architectural building stock.

When the issue is evaluated from an economic perspective, the optimal use of existing resources is also directly related to the concept of the circular economy. For this reason, the adaptive reuse of existing buildings represents an important criterion that enables the implementation of the circular economy within the built environment. In their study examining the built environment from a circular economy perspective, Pomponi and Moncaster predict that a standard building existing at the time of publication in 2017 will still be standing in 2050, and emphasize that this building stock largely consists of structures constructed between 1960 and 1990 [6]. Based on the same study, the average physical life of a standard building is defined as 60–90 years, while many of these buildings reach the end of their functional life much earlier, making adaptive reuse an indispensable factor for the circular economy. In this context, the concept of adaptive reuse should not be considered solely as an intervention aimed at the conservation of historic buildings; rather, it should be addressed as a strategic sustainability tool for all building types exposed to functional obsolescence in order to achieve a sustainable urban environment.

Therefore, the adaptive reuse of the existing building stock, regardless of historical or heritage value, should be repositioned as a key component of environmental, economic, and social sustainability criteria within contemporary urban transformation policies. In particular, evaluating buildings located within urban development areas whose potential is often overlooked from this perspective at the early stages of transformation will provide significant contributions to holistic decision-making processes.

2. Industrial Buildings in Urban Transformation Processes

Urban transformation processes are shaped particularly in development areas under residential pressure through factors such as increased density, rising land values, and the centralization of peripheral zones. These areas, commonly referred to as urban expansion or development areas, initially served industrial uses due to their location at the urban periphery. With the outward expansion of the urban edge, these areas gradually became part of the urban core. However, in planning decisions prepared for these centrally located areas, demolition- and reconstruction-oriented approaches tend to dominate without sufficiently questioning the adaptive reuse potential of the existing building stock. Previous studies emphasize that while such planning approaches may generate short-term economic gains, they lead to serious environmental, spatial, and social sustainability problems in the long term [3,4].

Industrial buildings that occupy large areas in the urban fabric tend to become functionally obsolete as production activities move away from residential zones. As a result, they are positioned in a vulnerable position within urban transformation planning processes. Such centrally located industrial structures are often regarded in urban transformation projects as a temporary building stock to be eliminated. Since they do not possess cultural heritage value requiring conservation, their existing adaptive reuse potential is largely overlooked [7]. This approach reflects a shallow perspective in which buildings are evaluated solely on the basis of their functional life, without considering their physical life.

However, in his study published in 2006, Douglas states that buildings may be exposed not only to physical obsolescence but also to functional, economic, legal, and social obsolescence. Each of these types of obsolescence affects the adaptive reuse potential of buildings in different ways. The same study also emphasizes that the early-stage assessment of buildings' reuse potential can be a critical step in reversing functional obsolescence [3].

When the issue is considered within the context of Istanbul, it becomes more apparent that industrial buildings are often the first building type to be disregarded in urban transformation processes. Industrial facilities located on large parcels and characterized by single ownership structures are frequently regarded as suitable areas for mass housing and high-density development decisions during transformation processes. The single ownership structure of such parcels allows for faster progress in planning and implementation compared to fragmented ownership patterns. As a result, demolition- and reconstruction-oriented solutions tend to be prioritized rather than critically assessing the adaptive reuse potential of industrial buildings.

A similar transformation dynamic can also be observed following the planning of the Cendere Valley as a residential area. After this decision, it is evident that many industrial buildings in the area were vacated

within a short period, demolished without an assessment of their adaptive reuse potential, and the site was largely opened to residential development. This example reinforces the general tendency to rapidly eliminate industrial buildings in urban transformation processes based on ownership structure and parcel scale.

Examples of the rapid elimination of industrial buildings in urban transformation processes in Istanbul are not limited to Kartal and the Cendere Valley. A similar situation can also be observed in the 4th Levent Fabrikalar district, which represents an earlier and more identity-defining example and derives its name from the industrial facilities that once dominated the area. Although no factory buildings remain in the area today, the continued use of this designation within the settlement pattern and transportation infrastructure, such as bus stops still being named "Fabrikalar" (meaning factories in Turkish), reveals the lasting imprint of industrial buildings on urban memory. The demolition of these structures during the transformation process without considering their adaptive reuse potential creates not only a spatial loss but also a significant gap in terms of the city's historical continuity and social memory. This example demonstrates that even industrial buildings without formally recognized historical value can generate a strong sense of identity and reference within their surroundings; therefore, urban transformation processes should evaluate such structures not only through parcel size and building density but also through dimensions of memory and identity.

In conclusion, within urban transformation areas designated as urban development zones and subjected predominantly to residential-oriented transformation, the urban planning process is defined mainly by land value and parcel size rather than by the existing locations of industrial buildings and the added value and transformation potential they could provide in their current context. As a result, many industrial buildings that do not possess historical status (even when they function as significant elements of urban memory, as in the case of the 4th Levent Fabrikalar district) are categorized as structures that are readily disregarded during transformation processes, subject to rapid demolition decisions, and whose adaptive reuse opportunities are insufficiently considered.

3. Distinction Between Historical Value and Adaptive Reuse Potential

The reason why the cultural heritage value of buildings and their adaptive reuse potential are often perceived together stems from the long-standing treatment of adaptive reuse as a conservation tool within the disciplines of preservation and restoration. A review of the academic literature also shows that the concept of adaptive reuse historically developed in close association with restoration and conservation thinking. Particularly since the second half of the twentieth century, with the growing criticism of the modernist "demolish and rebuild" approach, the idea of reusing existing buildings through preservation has been addressed mainly within the context of cultural heritage continuity. During this period, adaptive reuse was positioned as one of the primary instruments of the conservation discipline, aiming to sustain listed buildings, protect historic environments, and transmit architectural heritage to future generations [8–10].

In *"A History of Architectural Conservation*", Jokilehto refers to the early adaptation of temple buildings for use as churches, while associating modern architecture with the "new building–new construction" paradigm [9]. For this reason, the concept of adaptive reuse during this period was primarily examined through historic buildings. One of the most influential works in the conceptualization of adaptive reuse, Cantacuzino's *"New Uses for Old Buildings"*, addresses use transformation on the basis of restoration and conservation thinking. In this framework, modern architecture is largely excluded from the discussion and, in many respects, is described as conflicting with use transformation through notions such as new construction and new production ideals [8]. More recent studies by Plevoets & Van Cleempoel also support the view that within the architectural discipline, adaptive reuse has been evaluated primarily within the scope of conservation theory rather than modern architectural practice [10]. However, sustainability debates emerging in the 1990s, environmental movements, the concept of the circular economy, and, on the other hand, large-scale functionally obsolete industrial and shopping mall buildings in the United States have transformed the concept of adaptive reuse into a design problem that has also been addressed by modern architecture.

Due to this historical background, the concept of adaptive reuse is often constructed solely around historical value, leading to the misconception that a building's reuse potential is directly proportional to its degree of historic significance. This misconception results in many non-listed buildings that do not possess cultural heritage value, yet remain in good physical condition, not being considered within the scope of use

transformation, thereby causing the loss of their potential. However, the adaptive reuse potential of a building is defined by a complex set of processes and criteria that cannot be evaluated solely on the basis of historical and cultural value. Spatial characteristics, structural capacity, material and load-bearing system data, urban context, and the ability to adapt to changing use requirements constitute only some of these criteria. Evaluating reuse potential exclusively through a building's age and historical value leads to the systematic exclusion of non-historic buildings, which form a significant portion of the existing building stock, from urban transformation processes [11].

In order to prevent this conceptual narrowing, Douglas emphasizes that processes cannot be addressed in isolation and, within this framework, classifies obsolescence into physical, economic, social, functional, and legal forms. Analyses conducted through these types of obsolescence demonstrate that buildings may become functionally obsolete due to exposure to non-physical forms of obsolescence, even when they retain their physical integrity and are capable of performing well in physical terms [3]. In particular, rapid technological development in contemporary society continuously updates spatial requirements. This situation undermines building–function compatibility and accelerates the rate of functional obsolescence in buildings.

A review of the literature indicates that adaptive reuse decisions are mostly made at the stage of design development and function selection, while early-stage preliminary assessments that question the reuse potential of buildings are largely overlooked. This situation introduces a new dilemma, as buildings that are not suitable for adaptive reuse may still be included in reuse processes, leading to unnecessary use of resources. At the same time, the literature clearly states that evaluations of functional transformation potential are often conducted at later stages of the process [4]. This points to the fact that demolition decisions for many buildings with high physical potential but exposed to functional obsolescence are made without a systematic analytical assessment.

Therefore, evaluating adaptive reuse potential independently of historical value, and subsequently attributing qualities such as historic significance and listing status as added values after the assessment of fundamental potential, constitutes a critical threshold in early-stage evaluation. At this stage, assessing which types of obsolescence buildings are exposed to during the initial phases of the transformation process emerges as a highly important factor. This approach reframes adaptive reuse from being merely an intervention considered at the stage of design and function selection into a strategic evaluation framework that guides decision-making mechanisms at the very beginning of urban transformation processes. In this context, distinguishing between historical value and reuse potential represents a critical threshold, particularly in enabling non-listed industrial buildings to be addressed in a more inclusive and sustainable manner.

4. Key Criteria for the Early-Stage Assessment of Adaptive Reuse Potential

The suitability of buildings for adaptive reuse is often discussed only after a functional adaptation decision has already been made. This situation indicates that many adaptive reuse projects are exposed to rapid functional obsolescence in the long term. On the other hand, many buildings that are physically unsuitable for adaptive reuse are also included in adaptation processes, leading to inefficient resource use. The literature indicates that reuse decisions are mostly addressed at the design stage, while early-stage assessment processes that guide transformation decisions remain limited [3,4].

However, particularly in large-scale urban transformation projects that encompass a high number of buildings, the rapid individual evaluation of structures and the identification of those with high adaptive reuse potential at the initial stages of decision-making constitute a critical threshold. At this point, the question of which criteria should guide early-stage assessment is brought into discussion.

4.1. Scope and Purpose of Early-Stage Assessment

Early-stage potential analysis does not aim to answer questions such as which function a building will be converted into or which user group it will serve. Instead, it constitutes a technical form of analysis that examines whether a building meets the minimum conditions required for adaptive reuse. The purpose of this approach is to reposition the concept of use transformation from being an output of the design process to a strategic evaluation tool capable of generating alternatives to demolition and new construction decisions within urban transformation processes. In his study, Douglas emphasizes that adaptive reuse decisions represent a significant intervention capable of reversing functional obsolescence in buildings [3].

Table 1. Key Approaches for Potential Assessment in Reuse and Transformation Processes

Approach / Study	Type	Focus	Main Contribution	Source
Adaptive Reuse Potential (Arp)	Quantitative Model	Physical And Economic Life Cycles	Identifies the optimal time window for adaptive reuse	Langston & Shen, 2007; Langston et al, 2008 [4,11]
Strategic Assessment Of Adaptive Reuse	Assessment Framework	Structural, Spatial, Contextual Criteria	Evaluates reuse opportunities through a multi-dimensional perspective	Langston et al, 2008 [11]
Building Adaptation Framework	Conceptual Framework	Types of Obsolescence And Adaptation Decisions	Grounds transformation decisions by addressing obsolescence in a multi-dimensional manner	Douglas, 2006 [3]
Transformation Potential Meter	Technical Assessment Tool	Physical And Structural Suitability	Examines the technical transformability of buildings	Geraedts, 2002 [12]
Obsolescence Risk Indicator	Risk Assessment Tool	Functional And Economic Obsolescence	Reveals the need for reuse through an early-warning mechanism	Remøy, 2006 [13]
Adaptstar Model	Multi-Criteria Decision Support Model	Environmental, Structural, Economic Criteria	Compares adaptation scenarios in terms of sustainability	Conejos et al, 2014 [14]
Heritage-Based Adaptive Reuse Framework (Hbarf)	Value-Based Framework	Socio-Cultural and Heritage Values	Guides reuse decisions for historic buildings	Yung & Chan, 2012 [15]
Contextual And Functional Fit Approaches	Approach	Functional Fit And Urban Context	Discusses contextual compatibility in reuse decisions	Bullen & Love, 2011; Wilkinson, 2011 [16,17]
Life Cycle Assessment (Lca)-Based Reuse Studies	Analytical Method	Environmental Impact and Carbon Performance	Compares environmental impacts of reuse scenarios	Vilches et al, 2017 [18]
Multi-Criteria Decision Making (E.G., Ahp)	Decision Support Method	Multi-Criteria Evaluation	Compares alternative adaptive reuse scenarios	Yau, 2009 [19]

A review of the literature examining use transformation processes indicates that the fundamental approaches proposed by these studies—ranging from model proposals aiming to directly measure adaptive reuse potential to works that establish conceptual frameworks and highlight the need for early-stage assessment—are summarized in Table 1. In the reviewed studies, it is observed that, due to detailed data requirements, potential assessment processes are generally implemented at advanced stages after a functional adaptation decision has already been made. However, in the context of urban transformation, planning processes are carried out at much earlier stages, and urban-scale studies draw attention to the possibility of conducting transformation potential assessments at earlier phases. This situation reveals the need to incorporate adaptive reuse potential measurements into urban transformation processes as an evaluative dataset that operates with less data, follows a more streamlined structure, and focuses on preliminary screening and elimination.

Studies that support early-stage assessment of adaptive reuse potential demonstrate that existing buildings are subjected to quantitative evaluation based on physical, spatial, and urban criteria, independently of intrinsic values such as historical significance and identity. Such quantitative assessment enables transformation processes to be planned at an early stage and provides a coherent dataset capable of guiding urban transformation decisions in a rational manner. In this context, early-stage assessment in use transformation should be regarded as a decision-support model that operates well before design and function decisions, serving primarily screening and guidance functions.

Accordingly, the key criteria discussed below aim to present an evaluation framework that draws upon these approaches in the literature while remaining applicable at early stages and capable of fulfilling screening and guidance roles.

4.2. Key Criteria for Early-Stage Assessment

The key criteria that stand out within the scope of early-stage assessment of adaptive reuse potential consist of generalizable, technically defined data that are not open to subjective interpretation. Based on previous studies, an evaluation framework composed of criteria that do not require detailed datasets and can be addressed through observation-based assessment increases the applicability of the assessment process [4]. In this regard, the main criteria to be examined can be summarized as the building's physical integrity, spatial flexibility, parcel scale and urban context, environmental impacts, existing legal regulations, and available technologies [7,14]. These criteria should be structured not to determine which function a building should be converted into, but to enable an early-stage inquiry into whether the building is suitable for adaptive reuse. These evaluation dimensions are derived with reference to Langston's Adaptive Reuse Potential (ARP) model, while being restructured to support early-stage, screening-oriented assessment in urban transformation processes [20]. Unlike the ARP model, which primarily focuses on identifying the optimal timing for reuse, this study emphasizes the early-stage evaluation of buildings for screening and guidance purposes at the outset of urban transformation processes.

Under the heading *Physical and Structural Dimension*, the assessment should address the building's physical flexibility and the level of structural adaptability required to accommodate a new function, with plan layout and floor heights evaluated separately [11]. At this stage, the building's construction system and physical robustness also emerge as important factors. In particular, the structural performance of buildings exposed to natural hazards such as earthquakes, floods, and inundation should be examined within their specific risk context. In addition, the need for renewal of technical infrastructure associated with a building's existing function, as well as its level of adaptability, constitutes another criterion that should be evaluated within the scope of physical and structural characteristics [17].

Within the scope of the *Functional and Spatial Dimension***,** the level of adaptability of spaces to different functions, as well as the accessibility of the building and its interior spaces**,** emerge as fundamental criteria [12]. In addition, since the potential of spaces to generate public spaces can provide added value for adaptive reuse, this aspect should not be overlooked, and the potentials of open and semi-open spaces should be carefully evaluated [7].

Assessment conducted within the *Sociocultural and Ontological Dimension* demonstrates strong alignment with social sustainability criteria discussed in the literature [15]. At this point, the relationship between the building and its surroundings, as well as notions of belonging, come to the forefront. The need to sustain existing identity, neighborhood and stakeholder structures, and the potential for conflict between the adapted function and the surrounding context are evaluated within this scope [16]. In this section, the building is assessed not as an isolated entity but through its surrounding environment, and its potential to respond to local social needs should be incorporated into the analysis. At the same time, factors such as traffic exposure, noise pollution, and transformation pressure exerted by the social environment on the building constitute additional criteria within this evaluation.

The *Urban and Environmental Dimension* of early-stage assessment criteria emphasizes that buildings should be evaluated not only through their physical characteristics but also through their surrounding environment and the relationships they establish with this context [4]. Transportation and public transit accessibility, social infrastructure, and the building's relationship with public space and its potential contribution constitute the core aspects of this dimension. These criteria provide important references for assessing the extent to which adaptive reuse decisions can be efficient and sustainable at the urban scale. In addition, environmental gains resulting from transformation, such as the conservation of embodied energy and reduced carbon emissions, can be made visible through early-stage assessment, bringing ecological considerations into the decision-making process [6].

One of the most decisive criteria in the implementation of adaptive reuse projects is undoubtedly the *Legal and Planning Dimension*. The alignment of existing zoning and development plan decisions with adaptation proposals, the support of transformation processes through legal incentives, changes in development regulations, and the resulting advantages and disadvantages directly influence reuse decisions in practice

[17]. In this respect, early-stage assessment does not aim to overcome constraints but rather to make them visible. Particularly in urban-scale transformation decisions, legal regulations that may be required can be identified at this stage, while alternatives that fall outside the legal framework can be systematically excluded from the process [3].

Finally, the most rational criteria for early-stage assessment are compiled in this study under the *Economic and Financial Dimension*. Within this scope, factors such as the land value of the parcel, transformation pressure, maintenance and adaptation costs, and the estimated return periods of investments are evaluated. The assessment conducted at this stage does not aim to perform detailed cost analyses requiring extensive datasets; rather, it seeks to enable comparison among alternatives [4]. This evaluation provides a framework for identifying which alternative offers the optimal solution potential from an economic perspective. Accordingly, this assessment dimension constitutes an important dataset for preventing unnecessary resource use.

Table 2. Dimensions and Sub-Criteria for the Early-Stage Assessment of Adaptive Reuse Potential

Assessment Dimension	**Sub-Criteria**	**Early-Stage Assessment Scope**
Physical and Structural Dimension	Structural integrity	Physical stability and survivability of the building
	Construction system	Adaptability of the load-bearing system
	Floor heights	Compatibility with different use scenarios
	Plan layout	Suitability for spatial transformation
	Physical robustness	Performance against risks such as earthquakes, floods, and inundation
	Technical infrastructure condition	Renewability of existing systems
Functional and Spatial Dimension	Spatial flexibility	Adaptability to different functions
	Accessibility	Physical access to the building and interior spaces
	Open and semi-open spaces	Potential for public use
	Spatial continuity	Indoor–outdoor spatial relationships
Sociocultural and Ontological Dimension	Spatial identity	Perceptual value of the building within its context
	Sense of belonging	Relationship established with users and surroundings
	Memory value	Referential significance formed without historic designation
	Stakeholder structure	User profile and neighborhood relations
	Risk of social conflict	Compatibility of the new function with the surrounding context
Urban and Environmental Dimension	Parcel scale	Urban-scale position of the building
	Transportation accessibility	Public transport and access connections
	Relationship with public space	Interaction with surrounding open spaces
	Environmental gain	Conservation of embodied energy and carbon reduction
Legal and Planning Dimension	Zoning and planning decisions	Existing functions and development conditions
	Legal constraints	Regulation-based limitations
	Incentives and support mechanisms	Regulations facilitating transformation
	Need for plan modification	Feasibility of the process
Economic and Financial Dimension	Land value	Degree of transformation pressure
	Intervention cost	Required level of building adaptation
	Maintenance and improvement costs	Investment required for reuse
	Estimated payback period	Comparison of alternatives

When the physical, spatial, sociocultural, urban, legal, and economic dimensions of adaptive reuse potential are considered together, these assessment approaches constitute a holistic process. By enabling buildings to undergo a rapid early-stage screening process, this approach allows functional preferences to be determined more efficiently at a second stage for structures that genuinely exhibit high transformation potential. In this context, the early-stage assessment of adaptive reuse potential should not be regarded merely as an analysis that feeds into the design process; rather, it represents a strategic approach that facilitates the development of more rational, sustainable, and inclusive decisions within urban transformation processes.

5. Discussion and Conclusion

This study is grounded in the assumption that, within a context where the concept of adaptive reuse has long been addressed primarily within the framework of the conservation of historic environments and listed buildings, non-historic structures can also be evaluated through a comparable analytical perspective. Industrial buildings located in development areas under intense transformation pressure, often facing demolition decisions without adequate consideration of their reuse potential as a result of their scale and land value, constitute the main point of departure for this research.

Within the scope of this study, it is intended to identify the dimensions through which the adaptive reuse potential of buildings should be evaluated independently of historical value, and to define the corresponding sub-criteria for each dimension. By addressing physical, spatial, sociocultural, urban, legal, and economic dimensions together, this approach emphasizes that adaptive reuse decisions should not be considered solely through isolated technical indicators, but rather within a holistic evaluation process. Studies conducted in line with these criteria provide a foundation for the construction of an analytical dataset. Through such a dataset, it becomes possible to identify buildings suitable for transformation at an early stage through a systematic and rapid screening process, to more easily exclude structures with low reuse potential, and to direct both effort and costs toward buildings with higher adaptive reuse potential.

The most significant contribution of this approach lies in enabling the early identification of buildings that are worthy of preservation and reuse at the very outset of urban transformation processes, prior to the widely adopted practice of total demolition followed by new construction. In this way, a rational basis is established for matching buildings with high transformation potential to appropriate functions in subsequent phases of the process. At this point, the study offers a critical perspective on the increasing automatization of demolition and reconstruction decisions in urban transformation processes. This is because urban identity and collective memory are not always shaped solely by historical value; it is also observed that certain non-listed buildings can become important reference points within the urbanization process of a district. The removal of such structures without leaving a trace during transformation processes generates negative impacts not only on the physical environment but also on the social sustainability of the city. Therefore, the early-stage assessment of transformation potential functions as a strategic tool that enables urban transformation processes to adopt a more holistic and inclusive perspective.

On the other hand, the systematic monitoring of the building stock enabled through early-stage assessment will also contribute to the development of several rational strategies, including the prevention of unnecessary resource use, improved waste management, the reduction of environmental and ecological burdens, and the achievement of lower carbon emissions.

Nevertheless, this study clearly acknowledges that the proposed evaluation framework does not replace detailed design processes, engineering analyses, or economic feasibility studies. Rather, the framework is conceived as a preliminary decision-support tool that guides decision-makers at the initial stage of the transformation process by fulfilling screening and guidance functions. Future research is expected to make significant contributions to the adaptive reuse literature by testing this framework in different urban contexts, supporting it with quantitative data, and integrating it with interdisciplinary assessment models.

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DETERMINING EQUIVALENT DIFFICULTY DESIGN TASKS FOR EXPERIMENTAL STUDIES IN ARCHITECTURAL DESIGN EDUCATION

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Abstract
Comparative experimental studies in architectural design education often investigate the effects of different design environments on design processes; however, such comparisons are methodologically constrained by learning effects that arise when the same task is repeated. While varying the design task can reduce learning effects, it introduces the challenge of maintaining equivalent task difficulty across conditions. This study aims to address this problem by proposing a systematic approach for identifying architectural design problems with comparable perceived difficulty levels. A single design task was structured around constant spatial constraints, representational requirements, and evaluation criteria, while the main functional program was varied across five alternatives. The study was conducted with 110 second-year architecture students enrolled in the same design studio during a single academic term. Participants evaluated the relative difficulty of the functional variations using a structured pairwise comparison method based on the Analytic Hierarchy Process, and difficulty weights were calculated after excluding inconsistent responses. The results revealed distinct groupings in perceived task difficulty. Micro-scale cafe and exhibition functions were consistently rated as easier, the wildlife observation function was rated as medium, while meditation and resting area functions were perceived as more difficult. These differences were interpreted in relation to functional familiarity and the degree of programmatic definition within architectural education, with more clearly defined and commonly practiced functions associated with lower perceived difficulty. The findings indicate that the perceived difficulty of architectural design tasks can be systematically assessed and controlled, offering a practical methodological framework for selecting equivalent design problems in experimental studies and supporting more reliable comparisons of design environments in future research.

Key Words: *Architectural Design; Task Difficulty; Analytic Hierarchy Process (AHP); Design Task Difficulty Evaluation; Architectural Design Problems*

1. Introduction

Experimental research in architectural design education has been the subject of extensive research aimed at comparing different design environments in order to understand their effects on design processes [1], cognitive demands [2], and learning outcomes [3]. Such studies commonly examine how variations in representation media [4], working conditions [5], or design tools [6] influence designers' performance and experience. However, conducting controlled experiments in architectural design poses distinct methodological challenges, as design tasks are inherently open-ended and sensitive to prior experience, individual interpretation, and learning effects. One of the central methodological problems in comparative design experiments is the learning effect that emerges when participants are exposed to the same design task under multiple conditions. Repeating an identical task may lead to increased familiarity with the problem, solution strategies, or imposed constraints, thereby contaminating the results and weakening causal interpretations. A common strategy to address this issue is to vary the design task across experimental conditions [3], [6], [7] Yet, this approach introduces a second critical challenge: ensuring that the alternative tasks are equivalent in terms of difficulty. If task difficulty is not adequately controlled, observed differences may reflect variations in task demands rather than the effects of the experimental condition itself.

While this issue has been widely recognized in design research, particularly through studies emphasizing the ill-defined and evolving nature of design problems [8] and the co-evolution of problem and solution spaces [9], architectural design research has given relatively limited attention to the systematic identification or construction of design tasks with comparable difficulty levels. In many studies, task equivalence is assumed rather than empirically tested, or it is justified through expert judgment without validation from the target participant group. This situation may limit the methodological robustness and comparability of findings in

experimental architectural design research. The present study addresses this methodological concern by proposing a structured approach to determining equivalent difficulty design tasks for use in experimental studies. The approach is based on maintaining a consistent overall design task structure while varying the functional program and empirically assessing perceived task difficulty through participant-based evaluation. By focusing on perceived difficulty rather than objective performance outcomes, the study aims to capture how design tasks are experienced by students within an educational context.

Accordingly, the main aim of this study is to identify architectural design task variations with comparable perceived difficulty levels that can be used interchangeably in experimental research. The study is guided by the following research question: How do different functional programs within a controlled architectural design task differ in terms of perceived difficulty, and which task variations can be considered equivalent for experimental use? To answer this question, a sketch-based design task with multiple functional variations was administered, and perceived difficulty was evaluated using a structured pairwise comparison method.

2. Method

The study employed a task-based evaluation approach to identify architectural design problems with comparable perceived difficulty levels. A sketch-based architectural design task was developed with fixed spatial constraints, representational requirements, and evaluation criteria to control the overall task structure. The task (Figure 1) required participants to design a transitional space connecting two points with 6-meter level difference within a limited floor area. To introduce controlled variation while maintaining task consistency, the main functional program was varied across five alternatives, including a resting area, meditation space, wildlife (bird) observation point, small exhibition (video and photography), and small cafe.

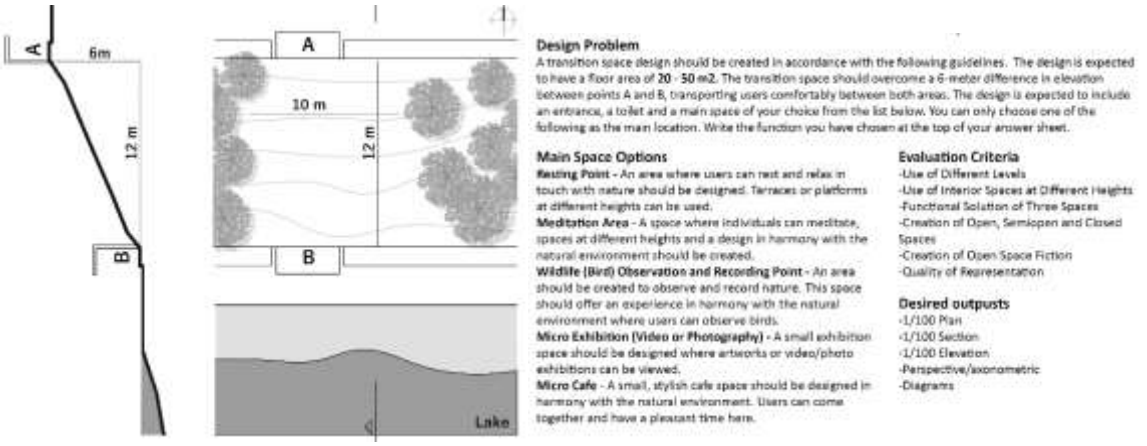

Figure 1: Design task problem

The study was conducted with 270 second-year architecture students enrolled in the same architectural design studio during a single academic term. All participants completed the same design task (Figure 1) under identical conditions as part of an in-class sketch examination. Following the examination, participants were invited to evaluate the relative difficulty of the five functional variations. A structured pairwise comparison questionnaire (Table 1) based on the Analytic Hierarchy Process (AHP) was administered via online survey to assess perceived task difficulty. The post-examination questionnaire was conducted on a voluntary basis, and participants were verbally informed about the purpose of the study and the use of the collected data. No personal or identifiable information was collected.

A total of 110 participants completed the questionnaire, and the AHP-based difficulty assessment and consistency analysis were conducted using these responses. The AHP approach was adopted to reduce the likelihood of random or inattentive responses that may occur in post-examination surveys, as it requires respondents to make consistent relative judgments rather than provide isolated difficulty ratings. In addition, the consistency analysis inherent to AHP allowed the identification and exclusion of responses that did not meet acceptable coherence thresholds. This approach enabled systematic comparison of functional variations by requiring participants to judge relative difficulty rather than assign absolute scores.

Table 1: A structured pairwise comparison questionnaire.

Function	Difficulty									Function
	9	7	5	3	1	3	5	7	9	
Resting Point										Meditation Area
Resting Point										Wild-Life Observation
Resting Point										Exhibition
Resting Point										Cafe
Meditation Area										Wild-Life Observation
Meditation Area										Exhibition
Meditation Area										Cafe
Wild-Life Observation										Exhibition
Wild-Life Observation										Cafe
Exhibition										Cafe

To reduce the influence of random or inattentive responses, consistency ratios were calculated for each questionnaire, and responses exceeding the acceptable consistency threshold of 0.20 were excluded from further analysis. An acceptable consistency threshold of 0.20 was adopted, considering the non-expert participant group and the post-examination data collection context [10]. Following this filtering process, responses from 50 participants were excluded, and difficulty weights were computed based on the remaining 60 participants. These weights enabled the identification of functional variations with similar perceived difficulty levels. The resulting difficulty rankings were used to determine which design task variations could be considered equivalent for use in experimental studies.

3. Results

As part of the study, sketch-based design outputs produced during the examination were collected for all functional variations. Representative examples of these design outputs are presented in Figure 2. However, the primary focus of the present study is not the evaluation or comparison of design quality or performance outcomes. Instead, the collected design outputs serve to document the implementation of the design task and ensure that all functional variations were addressed under comparable conditions. For this reason, detailed analysis of the design outcomes is beyond the scope of this study and is not reported in the results section.

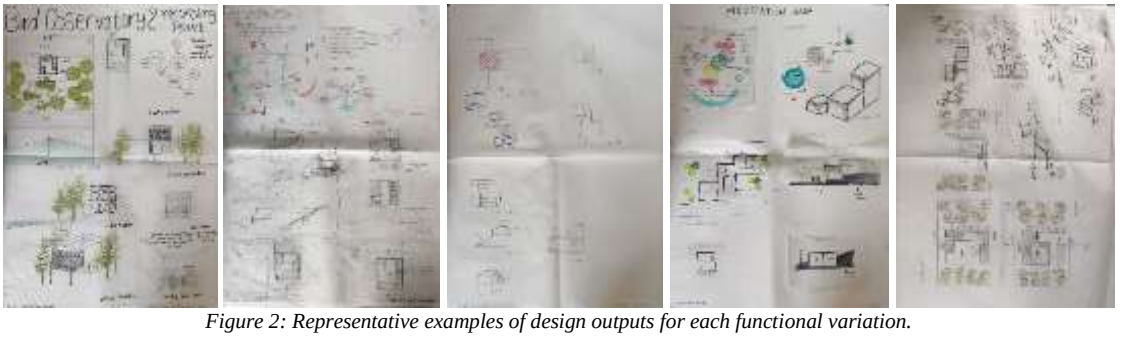

Figure 2: Representative examples of design outputs for each functional variation.

The AHP-based perceived design task difficulty results, calculated using the responses of the 60 participants remaining after the application of the acceptable consistency threshold of 0.20, are presented in Table 2. The results reveal distinguishable differences in perceived task difficulty across the five functional variations. Rather than forming a continuous linear scale, the findings indicate that the functional programs are distributed across distinct difficulty bands based on their relative difficulty levels.

Table 2: AHP-based perceived design task difficulty order (1 indicate hardest, 5 indicate easiest).

Functions	Weight (w_i)	Difficulty order
Resting Point	0.4315	1
Meditation Area	0.2615	2
Wild-Life Observation	0.1462	3

Exhibition	0.1024	4
Cafe	0.0584	5

The resting area function was perceived as the most difficult task variation, followed by the meditation function, which also exhibited a high level of perceived difficulty. Although both functions are positioned at the higher end of the difficulty spectrum, the resting area was rated as substantially more demanding than meditation, indicating that these two functions cannot be considered equivalent in terms of perceived difficulty.

The wildlife observation function occupied an intermediate position within the difficulty distribution. Its difficulty weight was notably lower than those of the resting and meditation functions, yet higher than those associated with the micro-scale exhibition and cafe functions, suggesting a moderate level of perceived difficulty. At the lower end of the difficulty spectrum, the micro-scale exhibition and micro-scale cafe functions were rated as the least difficult task variations. While these two functions exhibited different difficulty weights, they were positioned within the same lower difficulty band when compared to the remaining functional variations. This indicates that, although not identical, these tasks may be considered relatively comparable in terms of perceived difficulty within an experimental context.

Overall, the results suggest that architectural design tasks with varying functional programs do not form a continuous linear scale of difficulty, but instead cluster into broader difficulty bands. Based on the obtained difficulty weights, cafe and exhibition functions were identified as equivalent low-difficulty tasks, meditation and resting area functions as equivalent high-difficulty tasks, and the wildlife observation function as a medium-difficulty task. These groupings provide a practical basis for selecting design task variations with comparable levels of perceived difficulty, rather than assuming strict equivalence, for use in future experimental studies.

4. Discussion

The findings of this study demonstrate the difficulty of achieving strict task equivalence in architectural design experiments and emphasize the importance of empirically assessing perceived task difficulty rather than assuming equivalence. Due to the open-ended and interpretive nature of architectural design tasks, design problems cannot be treated as fixed or stable entities, but are continuously constructed and reframed by designers throughout the design process [9]. As problem and solution spaces co-evolve, the same design brief may be understood, reduced, expanded, or reinterpreted differently by participants, leading to variations in cognitive and experiential demands even when spatial constraints and representational requirements are formally controlled. From this perspective, architectural design tasks differ fundamentally from repeatable problem-solving activities, as design is a constructive activity concerned with how things ought to be rather than how they are and does not aim for reproducibility in outcomes [8]. Consistent with these theoretical accounts, the AHP-based evaluation in this study indicates that variations in functional programs do not produce strictly identical difficulty levels, but instead result in distinct difficulty bands rather than identical difficulty levels.

The observed distribution of perceived difficulty can be interpreted in relation to programmatic definition and familiarity within architectural education. Functions such as micro-scale cafe and exhibition are commonly addressed in studio curricula and are associated with relatively explicit functional requirements and spatial conventions. This familiarity may reduce interpretive ambiguity and intrinsic cognitive load, leading to lower perceived difficulty. In contrast, functions such as resting and meditation spaces require a higher degree of conceptual interpretation, experiential reasoning, and atmospheric decision-making, which are less explicitly defined in conventional functional programs.

These patterns align with design cognition research [11] showing that the level of constraint and definitional clarity in a brief can shape how students distribute cognitive effort between problem framing and solution development. Experimental findings of that study indicate that introducing an external constraint tends to reduce extended exploration of expected behaviours and encourages a more stable, simultaneous focus on

framing and solving, whereas less constrained conditions may involve greater oscillation between these modes over time. From this perspective, more programmatically defined and familiar functions such as a micro-cafe or micro-exhibition may lower perceived difficulty by providing clearer cues for structuring both problem and solution spaces, while more open-ended functions such as resting, and meditation may increase perceived difficulty by requiring greater interpretive work under time-limited sketch conditions.

From a methodological perspective, the findings suggest that architectural design tasks should not be treated as interchangeable without empirical validation of their perceived difficulty. Rather than seeking exact equivalence, the concept of difficulty bands offers a more realistic and applicable framework for experimental design in architectural research. Tasks located within the same difficulty band may be considered comparable for the purpose of minimizing learning effects while maintaining experimental control, acknowledging the inherent variability of design problems.

Several limitations of the study should be noted. Perceived task difficulty was assessed within a single institutional and curricular context, and the findings may reflect characteristics specific to the participants' educational background. In addition, the study intentionally focused on perceived difficulty rather than objective performance or design quality outcomes, as the latter would introduce additional evaluative dimensions beyond the scope of this methodological investigation. Future research may extend this approach by examining the stability of difficulty bands across different educational levels, institutions, or design media, and by exploring relationships between perceived difficulty, cognitive load, and design performance.

5. Conclusion

This study addressed a common methodological challenge in experimental research within architectural design education: the need to vary design tasks to avoid learning effects while maintaining comparable levels of task difficulty. Rather than assuming equivalence between alternative design problems, the study proposed a structured approach for empirically examining perceived task difficulty through controlled functional variation and participant-based evaluation.

Based on the AHP survey assessment, the findings demonstrated that design tasks with different functional programs do not exhibit strictly equivalent difficulty levels, but instead cluster into distinct difficulty bands. The results showed that functions with more clearly defined and familiar programmatic requirements were perceived as less difficult, while more open-ended and experiential functions were associated with higher perceived difficulty. These findings underline the importance of considering functional familiarity and interpretive openness when designing experimental tasks in architectural design research.

From a methodological standpoint, the study contributes a practical framework for identifying design tasks with comparable perceived difficulty, supporting more reliable task selection in experimental studies. By focusing on difficulty banding rather than strict equivalence, the proposed approach acknowledges the inherent variability of architectural design tasks while offering a realistic strategy for minimizing confounding effects related to task difficulty.

Overall, the study demonstrates that perceived task difficulty can be systematically assessed and incorporated into experimental design decisions. This approach has the potential to strengthen the internal validity of experimental studies in architectural design and provides a basis for future research examining the relationships between task difficulty, cognitive load, and design performance.

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INTEGRATION OF GENERATIVE ADVERSARIAL NETWORKS INTO PARTICIPATORY ARCHITECTURAL PRACTICE: A SCOPING REVIEW

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Abstract
This scoping review systematically examines the integration of Generative Adversarial Networks (GANs) into participatory architectural practice through a three-stage bibliometric analysis. Using the Web of Science database and VOSviewer software, the study analyzed 290 publications across three progressively focused searches: (1) artificial intelligence and architectural design (n=44), (2) participatory design and artificial intelligence (n=146), and (3) GANs and architectural design (n=100).
The analysis reveals a critical bifurcation in contemporary research. Stage 1 demonstrated that AI-architecture literature centers on generative tools (Midjourney, Stable Diffusion, GANs) and technical methodologies but completely lacks participatory or user-centered approaches. Stage 2 established a robust participatory design and AI literature emphasizing human-centered frameworks, conversational interfaces, and ethical considerations (algorithmic justice, responsible AI), yet this body of work exhibits zero engagement with architectural or spatial design applications. Stage 3 confirmed that GANs-architecture literature is technically sophisticated but entirely devoid of participatory design concepts, user engagement frameworks, or collaborative methodologies.
Keyword co-occurrence network analyses revealed disciplinary isolation: technical AI-architecture research proceeds independently from human-centered participatory AI research, with minimal cross-pollination. Temporal analysis showed convergent trends, with significant publication increases from 2022 and peaks in 2025 for both AI-architecture and GANs-architecture domains, yet the persistent mutual absence of participatory concepts in architectural AI literature and architectural contexts in participatory AI literature indicates systematic neglect.
The findings definitively validate a critical research gap: despite growing interest in both AI-assisted architectural design and participatory AI systems, the integration of GANs into participatory architectural practice remains unexplored territory. This review establishes the conceptual foundations for reconceptualizing GANs not merely as technical tools but as collaborative design actors in human-centered architectural processes. The emerging research agenda calls for interdisciplinary synthesis bringing together technical AI capabilities, participatory design methodologies, and architectural domain expertise to enable more inclusive, responsive, and democratized AI-assisted architectural practice.

Key Words: Generative Adversarial Networks, Participatory Architectural Design, Bibliometric Analysis, Scoping Review, Artificial Intelligence in Architecture.

1.Introduction

Architecture has historically been a discipline shaped and continuously evolved by technological advancements. With the development of digital design tools, computational design has gained significant prominence in architectural processes, enabling designers to develop data-driven, parametric, and algorithmic approaches. Today, artificial intelligence is being integrated into architectural design processes, particularly through machine learning, deep learning, and generative models, supporting designers' decision-making mechanisms. Artificial intelligence possesses the capacity to analyze large datasets, generate design alternatives, and process user feedback to offer dynamic, interactive, and customizable solutions. In this context, AI-supported design models not only accelerate design processes but also enable the development of innovative, user-centered, and data-driven approaches.

Artificial intelligence, which emulates learning and thinking processes, has acquired significant capabilities in areas such as data analysis, pattern recognition, and generation. AI-based approaches in the architectural discipline have the potential to evaluate design inputs and offer various optimal solutions in a short time. Different branches of artificial intelligence are supported by technological approaches that incorporate computational, iterative, generative, and evolutionary methods (Kudless, 2024). These developments enable artificial intelligence to be positioned not merely as a computation-based tool, but also as a creative design actor.

On the other hand, while artificial intelligence assumes the technical and computational aspects of architectural design, the architect continues to fulfill the role of shaping contextual, cultural, and historical layers. The integration of artificial intelligence with architecture will trigger a significant transformation in architectural design processes in the future through interdisciplinary collaborations.

1.1 Scope of the Study

The proliferation of artificial intelligence applications in architectural design processes is transforming the role of the architect and design methodologies. In this context, while various studies exist in the literature on the integration of artificial intelligence into architectural design, there is a notable absence of systematic mapping of research addressing how user-centered design approaches can be integrated with generative artificial intelligence models.

The research question is thus framed as: "How are Generative Adversarial Networks (GANs) being integrated into participatory architectural design processes, and how does this integration transform the role of the architect?"

Research Objectives

The primary aim of this scoping review is to comprehensively examine the relationship between GANs and participatory architectural design through systematic literature review and bibliometric analysis methods. In this regard, the specific objectives of the study are as follows:

- *Mapping the existing literature: To systematically compile and classify academic studies, application examples, and theoretical discussions concerning the use of GAN technologies in participatory architectural design processes,*
- *Conducting bibliometric analysis: To reveal the overall structure of the literature by visualizing publication trends, leading researchers, institutions, and conceptual networks in the field,*
- *Redefining the role of artificial intelligence in participatory design: To identify how GANs are positioned in the design process (as a tool, co-designer, creative actor, etc.),*
- *Identifying research gaps: To reveal gaps in the literature, methodological limitations, and future research needs.*

This study aims to provide a conceptual and methodological foundation for future research and application projects by offering a systematic overview of research that positions artificial intelligence not merely as a computational tool, but as a creative and dynamic component of the design process. Furthermore, by proposing a research agenda for this field, a roadmap will be drawn for the more effective use of artificial intelligence in user-centered architectural design.

2. Literature Review: Generative Adversarial Networks in Architectural Practice

2.1 Evolution of Generative Adversarial Networks

Generative Adversarial Networks (GANs), introduced by Goodfellow et al. (2014), represent a significant breakthrough in artificial intelligence and machine learning. The framework proposes a novel approach to generative modeling through an adversarial process where two models are simultaneously trained: a generative model (G) that captures the data distribution, and a discriminative model (D) that estimates the probability of whether a sample originated from training data rather than from G (Goodfellow et al., 2014). This adversarial framework corresponds to a minimax two-player game, where the training procedure for G aims to maximize the probability of D making classification errors.

The theoretical foundation of GANs demonstrates that in the space of arbitrary functions G and D, a unique solution exists where G recovers the training data distribution and D equals 1/2 everywhere (Goodfellow et al., 2014). Unlike previous generative models that relied on Markov chains or complex approximate inference networks, GANs can be trained entirely through backpropagation when both models are defined by multilayer perceptrons, making them computationally more efficient and accessible.

2.2 GANs in Architectural Design

The application of GANs in architecture has gained considerable momentum in recent years, particularly in the domain of floor plan generation and spatial design. As Eroğlu and Gül (2022) notes in their comprehensive study, the rapid development of artificial intelligence methods and computational capabilities has enabled significant advances in image processing problems, with GANs emerging as the most successful generative model for producing high-quality visual outputs.

2.2.1 Specialized GAN Architectures for Architecture

Several specialized GAN architectures have been developed specifically for architectural applications:

DCGAN (Deep Convolutional GAN): Radford et al. (2016) established specific architectural criteria for DCGANs, which have been successfully applied to architectural plan generation. Eroğlu and Gül (2022) demonstrated that DCGANs can produce original building designs by learning features from training datasets, though they require substantial data and extended training periods. The model's ability to preserve feature diversity while generating novel outputs makes it suitable for autonomous design applications, though production times remain a limiting factor.

Pix2Pix: Huang and Zheng (2018) pioneered the use of Pix2Pix, a conditional GAN (cGAN), for architectural plan development. This model employs paired, labeled datasets to enable detailed production through matched generation. The U-Net architecture utilized in Pix2Pix allows for effective image-to-image translation, though the requirement for extensively labeled datasets complicates the preparation process (Eroğlu and Gül, 2022).

CycleGAN: This architecture has demonstrated particular effectiveness in style transfer applications. Eroğlu (2021) found that CycleGAN can achieve rapid training and produce clear results even with limited data (approximately 100 images), making it suitable for early design phases and real-time applications. The model's ability to work with two unpaired image clusters distinguishes it from Pix2Pix's requirement for precisely matched datasets.

StyleGAN: Karras et al. (2019) introduced StyleGAN as a style-based generator architecture that has shown exceptional capabilities in architectural form exploration. Eroğlu and Gül (2022) demonstrated StyleGAN's strong capability for image learning and reconstruction simulation, noting its ability to absorb pixel characteristics from input datasets and produce high-quality imitation outputs. Importantly, StyleGAN can generate clear images without style-related noise and exhibits powerful simulation abilities across epoch stages, making it particularly suitable for form-finding problems in three-dimensional architectural design.

2.3 User Interaction and Control Mechanisms

A critical challenge in implementing GANs for architectural practice involves developing effective mechanisms for user control and interaction. Güldilek et al. (2024) address this challenge directly, arguing that user-centered design processes are essential for effective integration of AI technologies in architecture.

2.3.1 Control Methodologies

Research has explored various approaches to enable user control over GAN-generated outputs:

Parametric Control: Bahrehmand et al. (2017) developed rule-based constraint parameters to guide floor plan generation through heuristic optimization. While this work predates GAN-specific applications, it established important principles for user-directed generative design.

Dimensional Control: Güldilek et al. (2024) proposed two distinct approaches for user interaction with GAN-generated plans:

A dimension-based method allowing users to specify room widths and lengths, providing greater freedom in dimensional control but potentially compromising learned spatial relationships

A total area-based method that preserves learned relationships while constraining overall square footage, though requiring more iterations to achieve desired specifications

Graph-Based Input: Nauata et al. (2020) introduced House-GAN, which combines graph-based approaches with GANs, allowing users to model spatial relationships through graphs. This system enables

users to specify desired relationships between spaces, which the model then uses to generate appropriate plans. Nauata et al. (2021) further refined this approach in House-GAN++, incorporating Convolutional Message Passing Neural Networks (Conv-MPN) to better learn inter-room relationships and enhance edge perception.

Multi-Stage Ecosystems: Aalaei et al. (2023) developed a more complex ecosystem incorporating three different GANs, where users provide inputs such as bubble diagrams and area constraints. This approach demonstrates the potential advantages of task division among specialized GAN models, though it increases system complexity.

2.3.2 Scaling and Dimensioning

A fundamental challenge in GAN-based architectural design involves translating pixel-based outputs into real-world dimensions. Güldilek et al. (2024) developed a scaling coefficient method that references standard architectural elements (such as door dimensions) to convert pixel counts into square meters. This approach enables meaningful evaluation of generated plans against user requirements and building regulations.

The scaling methodology revealed important insights about the training data: the RPLAN dataset used in their study contained plans with living rooms ranging from 13-56 m², bedrooms from 8-61 m², and bathrooms from 1.5-25 m² (Güldilek et al., 2024). Understanding these ranges is crucial because GANs cannot reliably generate plans with dimensions far outside their training distribution.

2.3.3 Potentials for Participatory Design

The integration of GANs into participatory architectural practice shows promising potential but remains largely unexplored. Current research suggests several possible directions:

- Design Space Exploration: GANs can rapidly generate numerous design alternatives based on user-specified constraints, enabling broader exploration of design possibilities (Chaillou, 2020; Eroğlu, 2021).
- Iterative Refinement: The ability to adjust inputs and regenerate designs supports iterative design processes common in participatory settings (Güldilek et al., 2024).
- Visualization of Possibilities: GANs can help non-expert stakeholders visualize spatial relationships and design options, potentially facilitating more informed participation (Eroğlu and Gül, 2022).
- Simulation Capabilities: StyleGAN's demonstrated ability to create smooth transitions between design states suggests potential for exploring design evolution and transformation scenarios (Eroğlu and Gül, 2022).

However, significant gaps remain in understanding how these technical capabilities can be effectively integrated into genuinely participatory design processes. As Eroğlu (2021) notes, the development of specialized expertise areas—including data preparation, model customization, and output evaluation—suggests that successful implementation will require multidisciplinary collaboration rather than simple tool adoption.

3. Material and Method

In this study, the relationship between GANs (Generative Adversarial Networks) and participatory architectural design has been examined through literature research, and the bibliometric analysis method, which enables systematic and quantitative results to be obtained within the scope of the research, has been selected. Bibliometric analysis is an analytical method that facilitates the examination of characteristics of information sources in a specific field, such as publication title, language, year, references made, authors, and keywords contained, using mathematical methods (Bozer et al., 2024). This method also offers the opportunity to systematically analyze data in literature research and enables the examination of connections between different disciplines or fields (Thom, 2008). Bibliometric analysis identifies trends in scientific productivity and gaps in the literature by analyzing past and current research, thereby guiding future studies.

For bibliometric analysis, a literature search must first be conducted in online bibliographic databases, and studies appropriate to the research scope must be identified. Researchers frequently prefer the common

data sources Web of Science (WoS), Scopus, and Google Scholar databases for literature searches (Moral-Muñoz et al., 2020). In this study, the relationship between GANs and participatory architectural design was investigated in the Web of Science database. Publications identified within the scope of the study were transferred to VOSviewer 1.6.20 software to conduct bibliometric analysis, and keyword network clouds belonging to the publications were created. There is an obligation to cite in academic publications for reasons such as establishing connections with previous studies, validating scientific knowledge, and preventing plagiarism (Day and Gastel, 2011). Within this framework, highly cited publications in databases were preferred for transfer to VOSviewer software. VOSviewer is a data analysis software that enables the creation of scientific maps used by researchers for data visualization for bibliometric analysis, and to analyze and examine academic citation relationships (Dereli, 2024). The keyword network map, frequently used in the bibliometric analysis method, enables the examination of connections between concepts and the observation of knowledge flow between concepts by creating concept clusters according to the frequency of co-occurrence and co-use of keywords found in the data information of publications (Callon et al., 1991). In the study, the systematic review process followed in the literature search has been presented in the form of a flowchart using a template belonging to the PRISMA statement (Figure 1). The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram ensures the transparency of the process followed in the research by systematically visualizing the criteria according to which sources included in and excluded from the study were incorporated or excluded (Page et al., 2021).

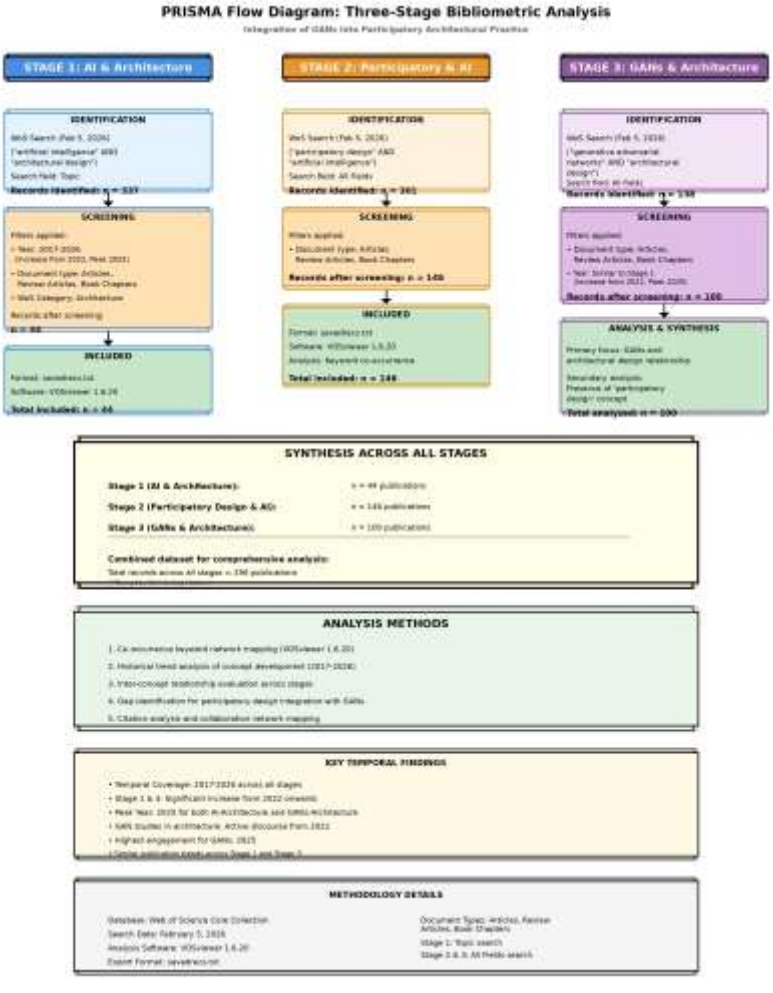


Fig. 1 PRISMA Flow Diagram

4. Findings and Discussion

Three separate bibliometric analyses were conducted during the study process. The bibliometric analyses were performed progressively from general to specific. To access more comprehensive data, the research was limited to English terms, and the first search was conducted in the Web of Science database on February 5, 2026, using the terms ("artificial intelligence" and "architectural design") with the topic search option. The initial search yielded 337 publications. Subsequently, to determine the publications to be evaluated for bibliometric analysis, the distribution of publications by year in the WoS database was examined. As a result of this examination, it was determined that the historical range of publications spanned 2017-2026, showing an increase from 2022 onwards when the topic of artificial intelligence became integrated into interdisciplinary academic discussions, and that the topics of 'architectural design' and 'artificial intelligence' appeared together most frequently in academic studies in 2025 (Figure 2a). Articles, review articles, and book chapters were selected as publication types. Finally, the search section was configured to the Web of Science category of Architecture, and 44 publications were downloaded from the database in 'savedrecs.txt' format and transferred to VOSviewer 1.6.20 software to conduct bibliometric analysis.

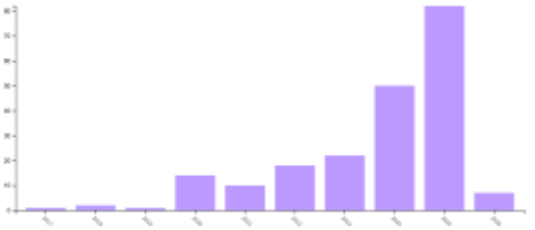


Fig.2a the annual distribution of the first bibliometric analysis

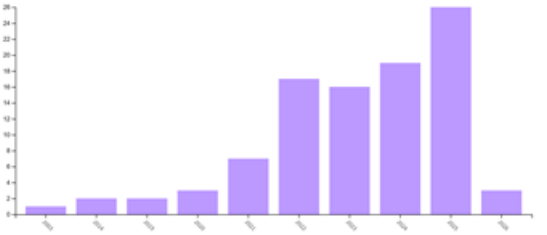


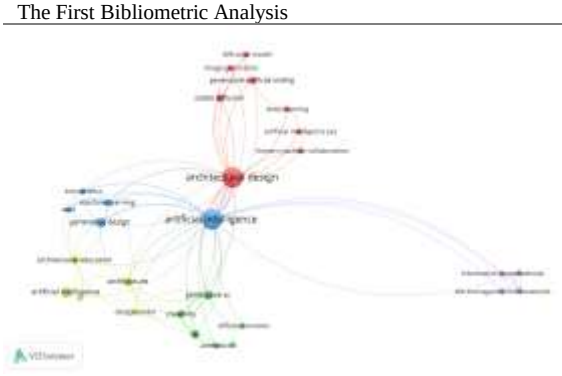
Fig.2b the annual distribution of the second bibliometric analysis

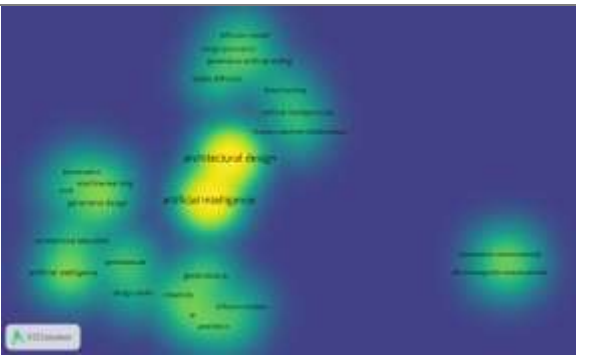
The secondary bibliometric analysis was conducted to examine the dynamics between participatory design and artificial intelligence. For the literature review, the WoS database was searched on February 5, 2026, with the terms ("participatory design" and "artificial intelligence") using the all fields option, identifying 301 publications (Figure 2.b). Articles, review articles, and book chapters were selected as publication types, and 146 publications were downloaded from the WoS database in 'savedrecs.txt' format and transferred to VOSviewer 1.6.20 software. A co-occurrence keyword network map of the publications transferred to VOSviewer software was created to examine which concepts the studies concentrated on, and inter-conceptual relationships were evaluated based on the findings obtained.

Finally, in the third bibliometric analysis, the relationship between 'generative adversarial networks' and 'architectural design' was analyzed in accordance with the fundamental research question, and the presence of the 'participatory design' concept within these studies was discussed. For the literature review, the WoS database was searched on February 5, 2026, with the terms ("generative adversarial networks" and "architectural design") using the all fields option, identifying 138 publications. Articles, review articles, and book chapters were selected as publication types, and 100 publications were downloaded from the WoS database in 'savedrecs.txt' format and transferred to VOSviewer 1.6.20 software. Upon examining the distribution of publications by year, it was observed that a similar graph emerged to the first bibliometric analysis (artificial intelligence and architectural design). However, it was determined that GAN (Generative Adversarial Networks) studies began to be frequently discussed in the architectural design field from 2022 onwards and received the highest engagement in 2025.

Table 1. Findings from bibliometric analysis

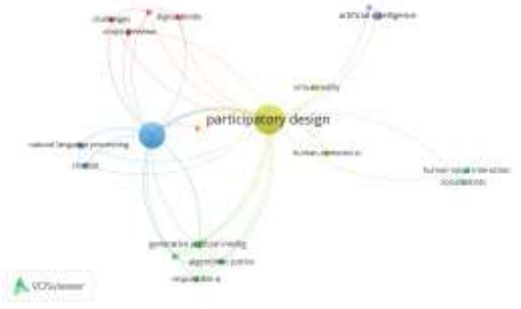
The First Bibliometric Analysis

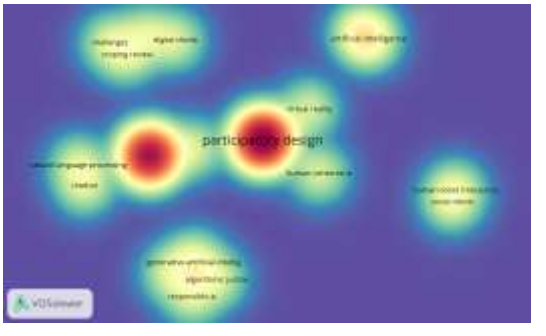




A significant finding noted in the bibliometric analysis is the absence of concepts related to "participatory design" or user participation in this keyword network. This situation reveals that the existing literature examining the relationship between artificial intelligence and architectural design predominantly exhibits a technology-oriented approach and does not adequately focus on user-centered design processes. Furthermore, the concentration of the literature on commercial platforms (Midjourney, Stable Diffusion) indicates that AI use in architecture is still largely addressed from a tool-oriented perspective, and in-depth discussions regarding the positioning of artificial intelligence as a creative design actor remain limited. The Stage 1 bibliometric analysis reveals that the literature on artificial intelligence and architectural design is structured around two main themes: (1) generative AI tools and applications, (2) theoretical and methodological frameworks. However, it has been determined that participatory design, user experience, and social dimensions are not adequately represented in this literature. These findings support the necessity of examining the relationship between participatory design and GANs in the subsequent stages of the research.

The Second Bibliometric Analysis



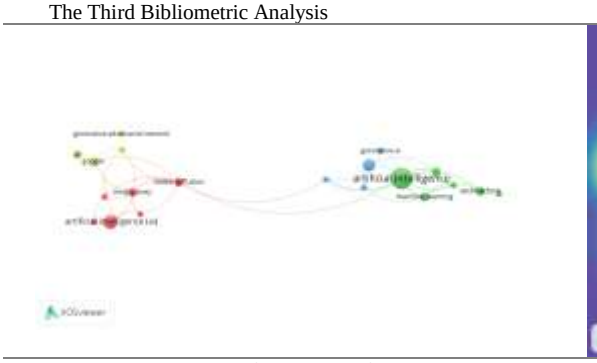


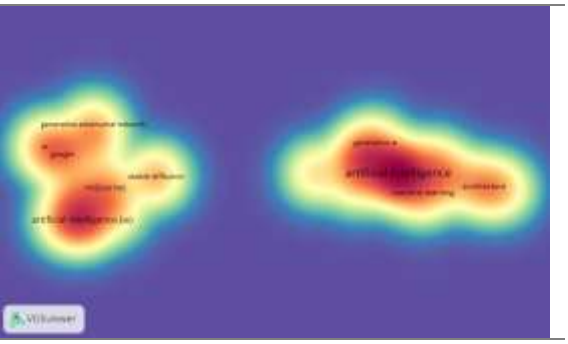
Notably, domain-specific concepts such as "architecture," "architectural design," "urban design," or "spatial design" are entirely absent from this network. This reveals that the participatory design and AI literature remains predominantly focused on product design, service design, and interaction design domains, with minimal engagement with spatial and architectural applications. The Stage 2 bibliometric analysis reveals a participatory design and AI literature characterized by:

Strong human-centered orientation emphasizing user agency and collaborative design,
Methodological diversity ranging from conversational interfaces to social robotics,
Growing ethical consciousness regarding algorithmic justice and responsible,
AI Domain specificity concentrated in interaction design and service design contexts,
Limited engagement with generative AI technologies and spatial/architectural applications

The absence of both architectural contexts and generative AI technologies (particularly GANs) in the participatory design and AI literature confirms a significant gap that this research addresses. The Stage 2 bibliometric analysis establishes that while participatory design and AI constitute an active research area with strong human-centered and ethical orientations, it exhibits limited engagement with generative AI technologies and architectural applications. This gap reinforces the necessity of Stage 3 analysis, which specifically examines GANs and architectural design, and ultimately highlights the novelty of investigating their integration with participatory design approaches.

The Third Bibliometric Analysis





The Stage 3 analysis definitively confirms the research gap motivating this study:

Gap 1: Participatory Design Absent from GANs-Architecture Discourse

Despite 100 publications on GANs and architectural design, zero engage with participatory design concepts. This confirms that integrating participatory approaches with GANs in architecture represents unexplored territory.

Gap 2: Architectural Applications Absent from Participatory-AI Discourse

Stage 2 showed participatory-AI literature (146 publications) with no architectural applications. Stage 3 shows GANs-architecture literature (100 publications) with no participatory methods. The mutual absence confirms a significant interdisciplinary gap.

Gap 3: Human-AI Collaboration Frameworks Underdeveloped

While GANs are discussed extensively as technical tools, frameworks for collaborative human-AI design processes in architectural contexts remain underdeveloped. The minimal presence of NLP and complete absence of co-design concepts indicate this gap.

Gap 4: User Agency and Control Mechanisms

The absence of concepts related to user input, control, or evaluation suggests that GANs in architecture are predominantly researcher/developer-driven rather than user-empowered, representing a significant limitation for democratizing AI-assisted design.

5. Conclusion

This three-stage bibliometric analysis systematically mapped the landscape of AI in architectural design, participatory design with AI, and GANs in architecture, revealing a critical bifurcation in contemporary research. Stage 1 (44 publications) demonstrated that AI-architecture discourse centers on generative tools (Midjourney, Stable Diffusion, GANs) and machine learning methodologies, yet completely lacks engagement with participatory or user-centered approaches. Stage 2 (146 publications) established a robust participatory design and AI literature emphasizing human-centered AI, conversational interfaces, and ethical considerations (algorithmic justice, responsible AI), but this body of work exhibits zero engagement with architectural applications or spatial design contexts. Stage 3 (100 publications) confirmed that GANs-architecture literature is technically sophisticated, focusing on deep learning methodologies and generative processes, but entirely devoid of participatory design concepts, user engagement frameworks, or collaborative design methodologies.

The keyword co-occurrence network analyses across all three stages reveal disciplinary isolation: technical AI-architecture research proceeds independently from human-centered participatory AI research, with minimal cross-pollination. This mutual absence confirms a significant research gap: despite growing interest in both AI-assisted architectural design and participatory AI systems, the integration of GANs into participatory architectural practice remains unexplored territory.

The temporal analysis across stages revealed convergent trends: significant increases in publications from 2022 onwards, with peak activity in 2025 for both AI-architecture and GANs-architecture domains. This suggests growing scholarly attention to AI in design contexts, yet the persistent absence of participatory concepts in architectural AI literature (Stages 1 and 3) and architectural contexts in participatory AI literature (Stage 2) indicates that this growth has not bridged disciplinary divides.

This scoping review makes several contributions:

Empirical Contribution: First comprehensive bibliometric mapping of the intersection (and notably, non-intersection) of GANs, participatory design, and architecture across 290 publications.

Methodological Contribution: Three-stage progressive analysis strategy (general to specific) effectively identified research gaps by revealing what exists separately but not in combination.

Theoretical Contribution: Establishes the conceptual foundations for reconceptualizing GANs not merely as technical tools but as potential collaborative design actors in participatory architectural processes—a framing absent from current literature.

Practical Contribution: Identifies specific gaps that practicing architects, AI developers, and participatory design facilitators must address to realize democratized, AI-assisted architectural design.

Concluding Remarks

This bibliometric analysis definitively confirms that while AI technologies (especially GANs) are increasingly discussed in architectural discourse, and while participatory approaches to AI are robustly theorized in design research, their integration in architectural contexts remains a critical research gap. The literature reveals a field at a crossroads: will AI in architecture develop as an expert tool reinforcing existing professional hierarchies, or can it be reimagined as a democratizing technology enabling broader participation in design decisions? Answering this question requires the kind of interdisciplinary synthesis this review calls for—bringing together technical AI capabilities, participatory design methodologies, and architectural domain expertise into novel frameworks that position GANs as collaborative actors in human-centered design processes. The research agenda emerging from this review offers pathways toward more inclusive, responsive, and democratized AI-assisted architectural practice.

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PROCEEDINGS BOOK

THE TRANSFORMATION OF EVERYDAY PRACTICES INTO SPATIAL NARRATIVES THROUGH SENSORY PARAMETERS: THE MACRO MUSEUM

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Abstract
This study aims to reveal the sensory, narrative, and participatory qualities of architecture. The research focuses on the design created by Odile Decq for the MACRO Museum of Contemporary Art in Rome. In particular, the interactive handwashing unit in the museum's restroom is examined to explore how architectural experience can transform into a multisensory narrative. The experience produced through color, light and sound is considered not only as a functional space but also as an emotional and aesthetic event.
The red light activated during handwashing, icy surfaces and sound effects demonstrate architecture's capacity to transform everyday actions into unexpected theatrical scenes. This experience is analyzed through Juhani Pallasmaa's sensory-based understanding of architecture, Bernard Tschumi's concepts of shock and interruption and Brian Massumi's theory of affect. In addition, Gaston Bachelard's concept of poetic space is used to discuss how an ordinary interior can be enriched through imagination. Based on a qualitative methodology employing visual–formal analysis, the study examines the impact of multisensory interactions in interior architecture on user experience within a theoretical framework. Ultimately, it argues that architecture produces not only space but also a narrative realm that generates experience and leaves lasting impressions in the user's memory.
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Key Words: Sensory Architecture, Narrative Space, Odile Decq, MACRO, Interactive Design

1. Introduction

Space is not merely a geometric order, a set of physical boundaries or a functional shell; rather, it is an experience of sensations that gains meaning through the senses and is continuously reconstructed through its relationship with the subject. In this context, space occupies a central position in phenomenological philosophy and architectural theory. This perspective interprets space as an intense sensory entity and as a field of relations with other entities.

Phenomenology, established by Edmund Husserl as a philosophical approach, seeks to understand the essence of consciousness and perception; that is to say, what is experienced. For Husserl, this is achieved by returning to what is directly experienced (epoché) and analysing the structures of essence. As Aşer's study [1] states, interpreting the act of spatial design through Husserl's concept of epoché enables the designer to transcend conventional thought patterns and establish a more authentic relationship with space. However, spatial experience is not limited to mental reflection or abstract representation. Phenomenologists such as Merleau-Ponty emphasise the fundamental relationship between the body and the world, arguing that the senses -vision, hearing, touch, smell, and taste- constitute the basic pillars of existence. In this sense, space becomes an embodied field of experience in which human beings and their environment are mutually shaped through the senses.

When multisensory perception in space and contemporary issues are considered, sensory analyses of space today do not remain solely at a theoretical level; they are also expanding through technological and interdisciplinary research. For example, in the study by Şimşek, Balkan, and Koca [2], the concept of synesthesia (multisensory perception) is examined within the context of spatial experience, exploring how architecture can be designed as an experience enriched by sensory elements such as sound, light, touch, and smell. Similarly, Yılmaz and Akbulut's study [3], titled "The Correspondence of Sensuality and Performativity in Spatial Production," discusses the visually oriented discourse of modern architecture and its tendency to neglect other sensory dimensions, such as touch and sound. The study also considers the

necessity of addressing this deficiency in architectural practice and explores the active role of the senses in architectural production.

This study aims to examine how spatial experience in architecture is produced through the senses and how the effect of interior space on the user transforms into a meaningful and transformative narrative within the framework of phenomenological approaches and theories of multisensory perception.

2. Meaning and Experience

Heidegger argues that we have forgotten the essence of art and artistic production, and that this forgetting has also occurred in architecture. In this point space and the architectural arts are analysed in terms of design, as well as poetically, ontologically and etymologically. According to Heidegger, buildings bear witness to human endeavour in the material world, and on a large scale, they reflect the distinctive character of both the builder and the inhabitant. In this way, architecture can help to place human beings at the centre of the world, offering spaces in which individuals can embark on a journey of self-discovery [4]. This theoretical framework requires space to be understood not merely as a represented object, but as a field of sensory and embodied experience; this approach provides a fundamental basis for reading the architectural composition through which Odile Decq's MACRO Museum transforms everyday practices.

Nevertheless, when such an experience-oriented perspective is adopted, it becomes necessary to acknowledge the variability of perception. This study has certain limitations, particularly due to the subjective nature of sensory experience. Architectural perception may vary according to users' age, cultural background, physical abilities, sensory sensitivity, and spatial memory. For example, while red light may evoke vitality and energy for some, it may create feelings of pressure or disorientation for others. Similarly, large volumes may feel liberating to some users and alienating to others. Therefore, the phenomenological reading presented here does not claim universality, but rather adopts an interpretive approach situated within a specific theoretical framework.

Thinking about modern architecture involves moving between questions of space and representation. Although buildings can be interpreted as layered representational systems, architecture also establishes a sensory and experiential field of encounter. Analyses limited to visual representation may therefore overlook the multilayered experience of space. While this study discusses such complexity through a phenomenological perspective, it acknowledges the diversity of subjective experience and the contextual nature of interpretation as an inherent limitation. In this sense, architecture is approached not as a fixed meaning, but as a domain continuously reconstituted through different users and experiences.

3. Odile Decq's Design Language: Senses, Body and Theatrical Space

The act of design, as a transformative movement that transcends itself, requires questioning not only the produced object but also the position of the subject who performs this act, particularly in relation to its engagement with the new. Building on Jean-Paul Sartre's distinction between "being-in-itself" and "being-for-itself", Aşer challenges the conventional perception that design operates solely through existing concrete objects and instead brings the freshness of the designing subject into the field of inquiry. In Sartre's understanding of being-for-itself, the subject is constantly recreating freedom and responsibility through a mode of existence that is defined by not being what it is and being what it is not. In this context, design emerges as an expression of the human process of developing one's identity through action. As Aşer states, design is a discipline that enables the emergence of the "new" through the actions of the acting subject. Therefore, innovation is not grounded in the object itself, but in the active mode of existence of the subject [5]. This philosophical ground, which is aligned with inquiries into the search for the essence of truth, finds concrete expression in Odile Decq's architectural approach. Decq's transformation of a restroom -designed for a functional, everyday act- into an experiential space that functions almost as an artistic installation, can be seen as an expression of the desire to transcend existing boundaries and disrupt familiar layers of meaning. In this sense, Decq's design practice can be associated with Sartre's concept of "being-for-itself", placing the freedom and originality of the designer at the core. Here, design is not merely the production of space, but a redefinition of the designer's existential relationship with the world through a new experience.

Odile Decq's architectural approach is based on body-centred, experience-oriented spatial construction, shaped by sensory stimuli. Distinguishing features of her designs include the use of vivid colors that create

striking contrasts against dark backgrounds and the transformation of space into a theatrical stage through light and sound. In Decq's architecture, concepts such as surprise, play and interactivity function as both formal and experiential strategies. This approach resonates with Juhani Pallasmaa's concept of the architecture of the senses, which defines architecture as a multisensory field of perception. Decq transcends the physical boundaries of space to create interactive environments in which users' bodies are transformed on emotional and cognitive levels. Here, color, light and sound are not merely aesthetic elements, but components of a perceptual dramaturgy.

In particular, the transformation of everyday spaces, such as a restroom, beyond their conventional functions into theatrical and surprising experiential fields demonstrates that architecture can move beyond being an object designed solely to meet functional needs. This approach recalls Bernard Tschumi's concept of event architecture, which emphasizes the relationship between space, event, and movement. In this context, architecture is defined and produced together with the experiential events that take place within space. By constructing events within spaces, it disrupts everyday routines and transforms the user from a passive observer into an active participant. Similarly, Steven Holl's phenomenological understanding of architecture prioritizes the sensory and embodied experience of space. In his designs, the movement of the body within space and the dialogues established with light, texture, and the specific conditions of place enable architecture to be reconfigured as a multisensory experiential field [6]. This approach represents an effort to move beyond perception alone and to foreground the sensory and temporal dimensions of the human–space relationship; architecture thus redefines the relationship between space and body, positioning the user as an active presence within space. Studies on Holl's phenomenological and tectonic sensitivity emphasize that architectural design is interpreted through the body's multidimensional sensory relationships with space, and that this interpretation enriches the sense of spatial belonging [7]. Ultimately, Decq's architecture can be read as a narrative constructed through the senses. Space moves beyond function to become an experienced event, a remembered moment, and a stage written by the body.

3.1. Sensory Architectural Approaches Between Silence and Noise

Juhani Pallasmaa's The Eyes of the Skin [12] critiques the dominance of vision in architectural discourse and the consequent neglect of other senses such as touch, hearing, smell, and taste. Pallasmaa emphasizes that space should be perceived through the totality of the senses; architecture is a multisensory, existential experience grounded in the body's sensory memory. From this perspective, architecture is not experienced solely through sight but through an integrated sensory field in which silence, shadows, light, and the body's physical contact with space must be interpreted together.

Pallasmaa frequently refers to everyday architectural elements such as door handles, stair treads, and material textures, to highlight the importance of touch and movement in spatial experience. He describes architecture as a profound form of embodied communication, felt within silence, pointing to what he terms the "silent experience of architecture." In contrast, Odile Decq's architectural approach stands in strong opposition to Pallasmaa's quiet, body-centered sensibility. Decq dramatizes space, offering an aesthetic of "noisy architecture" through sharp contrasts created by color, light, sound, and spatial tension. Within her architectural narrative, space is no longer a silent witness but an active force that strikes, unsettles, and stages experience. In this context, a conceptual opposition can be drawn between Pallasmaa's inward-oriented, introspective architecture of shadows, silence, and tactility, and Decq's ceremonial, pluralistic, and multisensory architecture, in which the body becomes expressive and performative. Although both architects advocate for sensory architecture, Pallasmaa proposes a mode of perception that turns inward, while Decq produces spaces that open outward, foregrounding bodily exposure and performative engagement.

3.2. The Transformation of Everyday Space: Decq's Architectural Narrative

The MACRO complex is the result of an expansion project launched through an international architectural competition organized by the Municipality of Rome in 2001, which nearly tripled the museum's original footprint. The former Peroni brewery, designed by architect Gustavo Giovannoni and constructed between 1912 and 1932, holds significant historical value. For this reason, the competition revealed two contrasting approaches: while several proposals, such as Nicola Di Battista's second-prize

project, adopted a neutral strategy toward the existing structure, others -most notably the winning design by Odile Decq- introduced a bold and radically contemporary architectural insertion into the historic fabric [8]. Through this approach, the idea of a new experiential space began to take shape.

In Gaston Bachelard's understanding of space, the image is not merely a mental representation but a mode of existence shaped through the body and the senses. A true image precedes thought, resonates internally and deepens through imagination. Architecture, in this sense, creates poetically constructed experiential spaces. Bachelard's concept of *poetic space* suggests that places are experienced not only physically but also imaginatively and emotionally. In Decq's design for the MACRO Museum, this notion finds a concrete architectural expression. She identifies and dramatizes the imaginative potential embedded in everyday situations. The museum's restroom space is a striking example of this approach. Rather than remaining an anonymous functional area, it is transformed into a stage-like experience through dramatic lighting, abrupt color shifts, and unexpected spatial angles. The mirror functions like a spotlight, red lighting dominates the space, and the user is positioned as a performer. In this scenographic setting, the body becomes both subject and object, and everyday action turns into ritual. The image that emerges is not imagined but directly experienced through the bodily encounter with space.

Within MACRO's interior, asymmetrical circulation axes, vivid color contrasts against dark voids, and deliberately fragmented perspectives prevent space from being perceived as a fixed image. Instead, it becomes fluid, experiential and variable. The user engages with the space through movement, surprise, and bodily response, allowing Bachelard's idea of space as a lived and imagined entity to be reconsidered within Decq's contemporary public architecture.

3.3. Fragmentation and Spatial Tension

In *Architecture and Disjunction*, Bernard Tschumi invites us to think of architecture beyond traditional concepts such as representation, form, and function, and instead as a series of disjunctions. According to Tschumi, architecture is not only the physical organization of space but also a system in which contradictions between senses, actions and expectations are staged. Within this framework, shock becomes a central architectural strategy: the user is unsettled, loses orientation, and begins to question the meaning of the experienced space [9].

Tschumi's concept of *disjunction* introduces interruptions between form, program and use, transforming architectural experience into a fragmented, plural, and multi-layered condition. Function is no longer the primary determinant; rather, it becomes part of a fragmented, often disorienting, theatrical and body-centered spatial scenario. This theoretical approach finds a direct counterpart in Odile Decq's design for the MACRO Museum. Sudden changes in color palettes, dramatic lighting contrasts, sharp breaks in perspective, and unexpected sound effects in the interior spaces operate as a contemporary manifestation of Tschumi's "aesthetics of shock." As the user moves through the museum, transitions from dark voids to vivid red volumes occur abruptly, followed by angled surfaces that disrupt conventional spatial orientation. In this way, space is fragmented not only physically, but also at a cognitive level, and continuously reconstructed through experience. Especially within the museum's circulation design, functional continuity is deliberately interrupted. The positioning of elevators, the angles of ramps, and the geometry of wall surfaces do not simply guide movement; instead, they confront it, interrupt it and provoke reflection. In line with Tschumi's notion of the "spatial scenario," the user is transformed from a passive observer into an active participant in the architectural event.

Through fragmentation and shock, Tschumi's architectural language materializes in Decq's sensory and theatrical architecture. At this point, MACRO emerges as a contemporary embodiment of Tschumi's theoretical propositions, where architecture operates not through visual continuity, but through event, tension, and interruption rather than form and stability.

3.4. Architecture as Message: The Environment as Meaning

Although the concepts of space, time, and place are often used interchangeably in architectural theory, they are in fact distinct yet mutually reinforcing phenomena. Approaches shaped by phenomenology in the twentieth century emphasized architecture as an experiential construct that reveals the meaning and spirit of place. According to the perspective developed by Norberg-Schulz, inspired by Heidegger, place is a

holistic and lived phenomenon. In this context, the task of the architect is to make this spirit visible by creating meaningful places and offering a transformative understanding [10]. This theoretical framework allows architectural space to be understood as a medium that produces meaning and conveys messages. In Odile Decq's design for the MACRO Museum, the intense use of red tones, a carefully controlled lighting scheme, and a distinct auditory atmosphere are transformed into an experiential narrative. This approach enables visitors to perceive space in a multi-sensory way and demonstrates that architecture can function as an environment that generates meaning and emotion. The meaning of a message in space lies both in its content and in the structure or nature of the environment through which it is conveyed. From this perspective, technologies such as light, sound, and digital systems become carriers of the message itself. The light used by Decq is not merely a visual element, but an active medium that gives meaning to space, structures spatial experience, and directs the body. Dramatic lighting, the psychological impact of red illumination, and sudden sound effects emerging from silence transform the user's relationship with space at both cognitive and perceptual levels.

The handwashing unit within the museum provides a particularly striking example. This routine action, typically defined as a hygienic practice, is transformed into a staged experience through Decq's intervention. Hands washed in red light collide with their reflection in the mirror, while echoing sounds alter the rhythm of the act. In this context, handwashing becomes a communicative gesture. The message here is not the act of cleaning hands, but the transformation of space itself into a message. In Decq's architecture, technology constitutes a fundamental component of the space's discursive power. In this sense, it evolves into a form of spatial epistemology. The user is positioned as part of a message, immersed within light and sound.

3.5. The Architecture of Feeling: Affect Theory

Brian Massumi's *Parables for the Virtual* provides an important conceptual framework for experience-oriented disciplines such as architecture by centering the relationships between the senses, the body, and affect. According to Massumi, thinking through feeling requires surrendering to its flow and daring to be immersed in conceptual layers, because affect can only be understood through lived experience [11]. For Massumi, affect refers to an intensity of feeling that is bodily, cognitive, and temporal, yet not fully defined something directly experienced before it is named or conceptualized. This perspective challenges the notion of the user as a passive observer in architecture. In this regard, Decq's architecture produces experience directly and guides it in a deliberate manner. For instance, a corridor becomes a space where changes in movement speed, challenges to orientation, and heightened spatial awareness emerge. As Massumi suggests, such situations can be described as affects that are felt before they are interpreted, existing independently of cognition yet guiding it. Decq's architectural approach prioritizes effect over form and felt flow over structural order. The relationship between the user and space transforms into a series of micro-events that resist verbalization but are inscribed in the body. In this context, MACRO is shaped as a construct in which architecture exists through sensory intervention.

4. The Space of the Senses: Meaning Production through Color, Light, and Sound

Pallasmaa argues that architecture is constructed through experiences of touch, sound, and movement. According to him, a successful architectural experience activates the body as a whole [12]. In addition to its functional solution, the handwashing unit at MACRO offers users a multisensory interaction through elements such as sound, sudden red light, and icy surfaces. This can be read as an example of architecture evolving from passive use toward active participation. In space, perception is not limited to data alone; it is a comprehensive and layered concept that includes sensations, memory, knowledge, judgment, and the position of matter within the world of objects [13].

In Tschumi's architectural theory, shock and disjunction -namely the separation of function and form- occupy a central position. A simple space such as a restroom can thus be transformed into a dramatic stage within this theoretical framework. At MACRO, the restroom turns the act of handwashing into a visual and auditory performance, inserting a shock effect into everyday life. This interruption elevates the user's relationship with architecture to a deeper level of awareness. Such an approach can be considered a form of architectural poetics in line with Bachelard's notion of the relationships space establishes with the

imagination. According to him, even the most ordinary spaces can gain a poetic dimension if they stimulate the imagination. The handwashing unit's initial resemblance to a block of ice, followed by the transformation of the entire space through red light, constitutes the experiential counterpart of this poetic dimension.

4.1. The Physical and Perceptual Dimensions of Sound in Architectural Space

From a physical perspective, sound is a form of energy that travels as vibrations through air, water, or solid materials and is perceived by the human ear as sound. Beyond its physical properties, contemporary architectural and environmental psychology studies emphasize sound as an atmospheric element that shapes spatial perception. Factors such as sound type, intensity, and reverberation time play a significant role in influencing perceptions of spatial openness and transparency [14]. The basic physical properties of sound are frequency and amplitude, which determine pitch and loudness. Within architectural space, sound behaves through processes such as reflection, absorption, diffusion, and transmission. These acoustic behaviors play a key role in shaping sound distribution and directly influence acoustic comfort [15]. Reverberation time, a key parameter in spatial acoustics, varies according to spatial function. In this context, installations such as *Shalekhet (Fallen Leaves)* intentionally intensify reverberation and noise, using sound as a sensory and emotional medium rather than a purely functional element (Fig. 1).

Menashe Kadishman, Shalekhet (Fallen Leaves), 1997-2001

Feature	Impact and Purpose
VOICE usage	The "rattling" sound created by the iron plates reinforces the metaphor of a silent scream, evoking feelings of guilt, anxiety, and loss in the visitor.
Spatial design	It directs the visitor into a void with no end or exit. The architectural simulation of disorientation within the structure is provided.
Emotion and thought production	Architectural elements—light, concrete, space—create a multi-sensory poetic narrative, allowing the visitor to gradually integrate with the atmosphere and embark on a meaningful inner journey..

Fig. 1: The effect of sound on spatial design and sensory production in the installation Shalekhet (Fallen Leaves).

Along the experiential route of the MACRO Museum, the transition from the muted silence of the garden to the large enclosed interior creates a clear sense of spatial openness, allowing even subtle movements to become perceptible. This acoustic condition extends into the restroom areas. As architectural acoustics research indicates, sound behavior is shaped by material, form, and geometry: hard and reflective surfaces increase reverberation, while parallel planes and metal-coated finishes intensify noise levels and affect spatial perception at psychological and phenomenological scales [16]. In the MACRO restrooms, these conditions reinforce a sense of distance and uncanniness, heightening attention and awareness. In this context, sound functions as a decisive design parameter in shaping spatial atmosphere, comparable to light, materiality, and spatial organization.

4.2. The Physical and Perceptual Dimension of Color and Light in Architectural Space

Space is a multilayered field of experience shaped by the interaction of form, surface, material, and volume. Within this framework, light and color function as key perceptual tools that shape spatial experience. Color, in interaction with light, can emphasize form, recede into the background, or transform spatial perception, often being perceived before form itself due to its strong sensory and psychological impact. As a compositional strategy, color–light design is closely related to function, use, and intended atmosphere, influencing perceived boundaries, height, and focal points. In this sense, color and light

operate as meaning-producing elements that construct spatial identity, narrative, and emotional atmosphere.

Odile Decq's use of vermilion red in the Opera Garnier Restaurant (Figure 2) represents a strong semantic and perceptual intervention. The visual prominence of red, linked to optical and physiological processes, results from its long wavelength (approximately 620–750 nm) and its strong stimulation of the eye's L-cones, which enhances its perceptual salience.

Odile Decq, The Opera Garnier Restaurant, 2011

Feature	Effect and Purpose
Use of Red Color	The intense red tones establish a relationship with the historical and dramatic identity of the opera building while generating a contemporary dynamism. They reinforce feelings of passion, movement, and theatrical tension.
Fluid Spatial Form	Curvilinear surfaces and a sense of spatial continuity enhance the visitor's movement experience, creating a spatial counterpart to the rhythmic flow of opera performance
Contrast with the Historic Structure	The bold contemporary design language deliberately contrasts with Garnier's baroque-classical ornamentation, enabling a dialogue between past and contemporary architecture.
Use of Light and Reflection	Glossy surfaces and controlled lighting strengthen the theatrical atmosphere; light reflections add depth to spatial perception.
Production of a Sensory Atmosphere	The integration of color, material, and form creates an experiential environment beyond mere function, fostering a psychological transition space before or after the performance

Fig. 2: The effect of color on spatial design and sensory production at the Opera Garnier Restaurant.

The Opera Garnier restaurant stages a striking encounter between contemporary architecture and a historic context, where the dramatic use of red, central to Decq's architectural language, creates a strong contrast with the existing fabric. This vivid, organic red interior introduces a theatrical and emotionally charged experience, guiding movement and intensifying spatial dynamism. Read through Pallasmaa's principle of thinking through the senses, color here operates not as a sign but as an event that initiates experience and produces meaning within space.

In a text published by the French CNAP, the MACRO Museum's auditorium is described as *sang rouge* (blood red), positioned as a dynamic focal point suspended between ground and sky. In a 2017 *Artribune* interview, Decq emphasizes her preference for saturated, vivid colors over pastel tones, indicating that red was deliberately chosen to give the space a strong and expressive presence [17].

Color perception plays a key role in psycho-spatial experience by generating both conscious and subconscious stimuli. Closely linked to psychology, symbolism, and cultural context, color functions in architecture not merely as a surface quality but as an active design tool that shapes volume, orientation, and atmosphere. Psychological and experimental studies show that color influences perceptions of distance, height, and depth, producing both physiological and emotional effects; however, architectural color cannot exist independently of light and emerges as a dynamic phenomenon through illumination [18].

In this context, the Bruder Klaus Field Chapel exemplifies how light operates as a primary agent of spatial design and sensory production (Fig. 3). The direct light entering from the upper opening directs perception upward, while its changing intensity transforms the interior atmosphere. Reflected on rough concrete surfaces, light becomes an architectural element, shaping spatial depth, material perception, and emotional response, and reinforcing the contemplative character of the space.

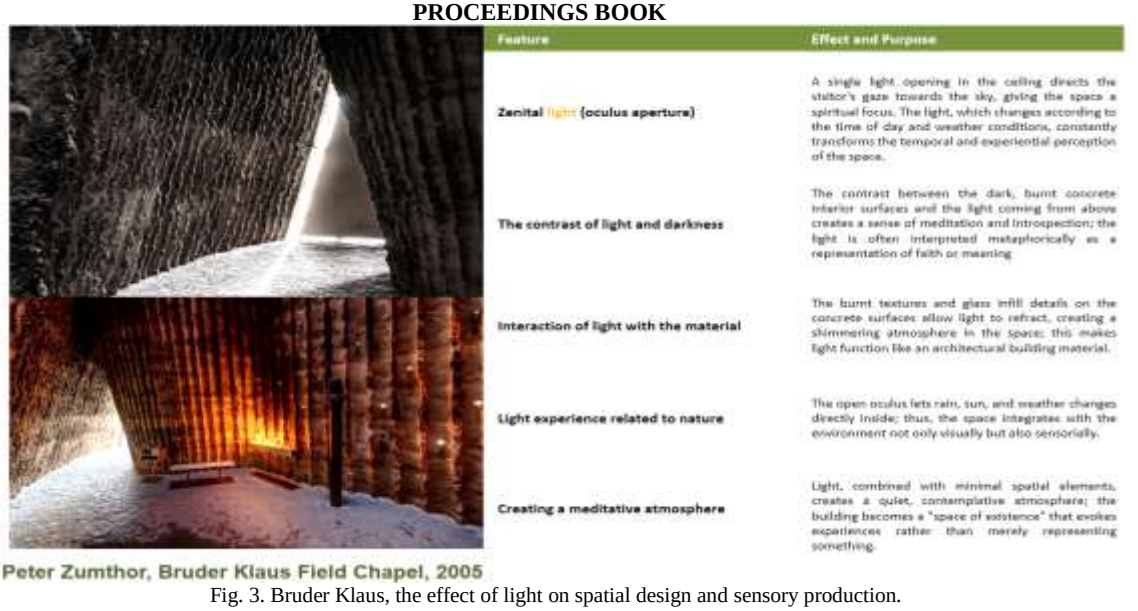

Fig. 3. Bruder Klaus, the effect of light on spatial design and sensory production.

5. MACRO - Museum of Contemporary Art in Rome

The MACRO Museum is located in the Via Nomentana area near Porta Pia, to the east of Rome, an area shaped by nineteenth-century industrial and residential development. Created through the transformation of the former Peroni Brewery built in 1912, the museum mediates between its industrial past and contemporary artistic expression. Following its conversion into an art gallery in 1999 and its expansion through the competition project won by Odile Decq and Benoît Cornette in 2001, the building gained a strong spatial identity defined by the contrast between preserved industrial fabric and a contemporary architectural language. This contrast produces a perceptible tension in the visitor's experience [19], while the new additions establish a dynamic dialogue with the urban context (Fig. 4a).

From a phenomenological perspective, the museum's steel structures, glazed roofs, bridges, and irregular geometries encourage continuous movement and embodied engagement with space (Fig. 4b). The circulation system formed by transparent bridges beneath a glass enclosure creates multiple viewpoints and perceptual layers, aligning with Merleau-Ponty's emphasis on space as something understood through movement and lived experience.

Fig. 4(a): Exterior view of the MACRO Rome Museum of Contemporary Art, (b) MACRO Entrance Courtyard-Garden.

At the center of the museum, the bright red, irregularly shaped auditorium volume functions as a strong perceptual focal point (Fig. 5a). Within an atmosphere dominated by black and gray surfaces, this red mass initially appears as an art installation, yet it is experienced as a functional space. As an architectural insertion, the auditorium makes a significant contribution to the museum's spatial narrative. Described by Decq as the beating heart of the museum, this volume enhances the emotional impact of the space from a phenomenological standpoint. Color, material, and light are deliberately orchestrated to leave lasting impressions in the visitor's sensory memory (Fig. 5b).

Fig. 5: (a) MACRO Museum restaurant exit stairs, (b) MACRO Museum café counter and red floor area.

Lighting strategies further support this experience. Natural light entering through the roof opening in the entrance hall, together with dynamic artificial lighting in the galleries, continuously reshapes spatial perception. The neutrality of black surfaces intensifies the presence of both artworks and architectural form, a condition that can be associated with Husserl's concept of *epoché*, as it encourages attention to pure perception beyond preconceived judgments.

Bridges, terraces, and viewing platforms at different levels enable visitors to experience artworks from multiple perspectives, transforming space into a kinesthetic rather than purely visual field. In galleries displaying large-scale sculptures, bridges positioned near the ceiling alter viewing distance and generate varying perceptual conditions.

Within contemporary phenomenological discussions, multisensory perception (synaesthesia) has become increasingly significant. As noted by Şimşek, Balkan, and Koca [2], spatial experience is inseparable from sound, touch, light, smell, and atmosphere. At MACRO, glass transparency, the tactile presence of metal structures, reverberant acoustics, and shifting light effects collectively support this multisensory experience (Fig. 6a–6b).

Fig. 6. (a) Washbasin unit at the MACRO Museum; (b) Restroom cabin at the MACRO Museum.

In particular, the design of washbasin elements using semi-transparent materials illuminated from within and capable of changing color transforms the everyday act of handwashing into a memorable spatial experience. This design strategy extends architecture's narrative capacity beyond exhibition halls by intensifying an ordinary function into a sensorially charged space. The lighting scheme defines the spatial atmosphere and enhances bodily awareness. The activation of washbasin lighting through user interaction such as red light effects linked to motion or water-flow sensors, establishes a reciprocal relationship between user and space, transforming architecture from a passive backdrop into an experiential agent (Fig.7a).

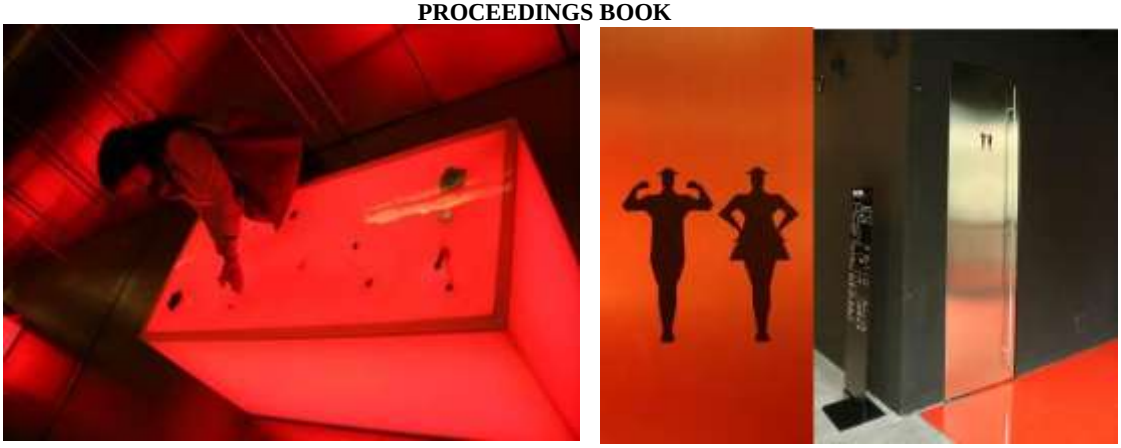

Fig. 7. (a) Change in Light Color at The Washbasin Unit, (b) Restroom Doors and Applied Graphics.

Through user movement, shifts in sound and light are activated, allowing individuals to become aware of their presence within the space. This condition represents a small-scale reflection of the museum's broader dynamic and experience-oriented architectural approach. Color further reinforces this sensory intensity.

The recurring combination of red and black in Decq's architecture creates an atmosphere that is both dramatic and directional. While the pulsating effect of red light injects energy into the space, dark surfaces generate a sense of depth. Even briefly, this returns the visitor to the theatrical atmosphere of the exhibition experience, transforming the restroom into an intermediate stage that sustains the continuity of the museum's architectural narrative.

Conclusion

The MACRO Museum of Contemporary Art stands as an example that questions architecture's sensory capacity and transforms the user from a passive observer moving through space into an active participant. The interactive handwashing unit located in the museum's restroom clearly demonstrates how architectural narrative can evolve into an experiential scene through sound, light and color. This design approach is significant in showing that even everyday functional spaces can be transformed into multisensory and memorable spatial experiences.

Throughout the study, the concept of sensory architecture is employed to emphasize the innovative and experience-oriented nature of Decq's design approach. Moving beyond conventional interpretations of sensory architecture, this concept refers to interactive and experiential design strategies that expand the disciplinary boundaries of architecture. The simultaneous use of color, light and sound, turning an ordinary space such as a restroom into an intense experiential environment, illustrates architecture's capacity to reframe and reinterpret everyday spatial practices.

Odile Decq's architectural practice is grounded in a distinctive aesthetic that treats color as a primary design tool for intensifying spatial experience. The powerful contrast between red and black, frequently observed in projects such as the MACRO Museum, generates dynamism, energy, and dramatic effect, reinforcing both visual and emotional impact. Decq has often emphasized that this chromatic duality constitutes a strong architectural language that deepens spatial narration.

In the museum, particularly within the restroom space, sudden shifts in lighting and unexpected sound installations generate a sensory experience that provokes immediate physical responses from users. This condition demonstrates architecture's potential to construct affective and experiential environments. Such an approach reveals the capacity of architectural space to produce meaning through perceptual and experiential engagement.

Yet, acknowledging this experiential potential also requires recognising its inherent variability. However, the primary limitation of the study stems from the subjective and variable nature of sensory experience. The evaluation presented here is grounded in a phenomenological and interpretive framework and therefore does not claim to define spatial experience through a universal or singular perceptual model. While light intensity, sudden sound installations, and the red–black contrast may

produce stimulation and dynamism for some users, these same elements may evoke disorientation, anxiety, or feelings of alienation for others, particularly when differences in age, cultural background, neuro-sensory sensitivity, or physical ability are considered. This condition suggests that the concept of sensory architecture should also be approached critically. The study does not empirically examine diverse user experiences; rather, it discusses the potential of the spatial configuration at a theoretical level. While it demonstrates architecture's capacity to construct powerful narratives through sensory means, it simultaneously acknowledges that such experiences are plural, contextual, and user dependent. In this sense, architecture does not produce fixed meaning but emerges as an open-ended field of experience continuously reconstituted through different bodies and consciousnesses.

Future research could extend this discussion by conducting comparative field studies that examine diverse user profiles, considering variables such as age, cultural context, disability, and sensory sensitivity. Such an approach would contribute to situating sensory architecture within a more inclusive and pluralistic framework, while also supporting its consideration as an ethical dimension of experience-oriented design.

In conclusion, the use of dark surfaces, intense color, and dramatic lighting in Odile Decq's work represents an experience-oriented architectural approach that departs from modernist rationality. Shaped around concepts such as surprise, play, and shock, this approach transforms everyday spaces into environments that invite emotional and bodily engagement. The sound installation and sudden lighting changes in the lower-level restroom of the MACRO Museum concretely demonstrate how architecture can construct powerful spatial narratives through sensory means.

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THE EFFECT OF LIGHTING DESIGN ON THE SPATIAL ATMOSPHERE AND USER EXPERIENCE IN RESTAURANTS

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Abstract
Lighting design in architectural interiors goes beyond physical functionality, profoundly influencing the atmosphere of the space and the user experience. Especially in experience-oriented spaces such as restaurants, the quantity and quality of lighting play a critical role in shaping how users perceive the space. This article evaluates the effects of lighting design on the spatial atmosphere and its relationship with user experience in luxury restaurants.
The research covers the lighting designs implemented in the functional areas of three distinguished restaurants (Restaurant A, Restaurant B, and Restaurant C) located in the Suadiye district of Istanbul, including the dining area, private areas, beverage service area, circulation area, and wet areas. Lighting arrangements were examined in detail in terms of quantity (illuminance) and quality (color characteristics of light, light directionality, shadow quality, illuminance distribution) within the context of visual space analysis parameters such as visibility, spatiality, and atmosphere. In this study, which combined quantitative and qualitative methods, users' perceptions and satisfaction levels regarding lighting were also measured; these data were correlated with spatial design elements.
The findings show that well-designed lighting not only enhances the aesthetic harmony and conceptual integrity of spaces but also supports visual comfort and functionality. The vast majority of participants stated that high-quality and carefully designed lighting arrangements increased visual comfort and enhanced the overall dining experience.
Key Words: *Lighting Design; Restaurant Lighting; User Experience; Restaurant Atmosphere; Spatial Atmosphere*

1. Introduction

The impact of architectural spaces on users is not only physical but also manifests itself on psychological and emotional levels. The perception of space is shaped by sound, smell, materials, color, and most significantly, light. Lighting does not merely provide visual functionality to a space; it plays a key role in establishing the atmosphere and guiding the user experience. Especially in experience-oriented public interiors such as dining spaces, lighting design becomes a strategic design tool in terms of guiding user behavior, altering spatial perception, and strengthening brand identity. In this context, studies conducted specifically on luxury restaurants aim to understand the effects of lighting on the spatial atmosphere and its relationship with the user experience.

There are many studies in the literature on the effect of lighting on the restaurant experience. For example, it has been found that dim and warm-toned lighting arrangements induce a sense of relaxation and privacy in customers, thereby increasing their tendency to spend more time in the space [1]. Conversely, it has been observed that excessively bright and harsh lighting causes glare, leading to discomfort and prompting customers to leave the environment quickly [2]. Ideal lighting strategies may also vary depending on the type of restaurant: For example, in a fine-dining restaurant, keeping the general illuminance low in the evening and highlighting each table with separate spotlights creates an intimate and exclusive atmosphere, while in fast-service restaurants, higher and more evenly distributed lighting can promote a fast turnover by providing an energetic and lively environment [3,4].

The psychological and physiological effects of lighting on users are also highlighted in studies. The color and intensity of light can alter people's moods and arousal levels [5,6]. For example, warm (low correlated color temperature (low CCT)) soft light creates a relaxing effect, while cool (high correlated color temperature (high CCT)) and intense light can increase attention and provide energy. Similarly, the brightness of ambient light also shapes emotional responses: Bright light makes emotions feel more intense, while dim light provides a more peaceful experience [6,7]. Therefore, the concept of human-centered lighting

has developed today; the goal is for lighting to support rhythms that are compatible with human biology beyond visual comfort [8,9]. For example, adjusting the correlated color temperature (CCT) of light according to the time of day in closed environments that do not receive natural light can help keep people's circadian rhythms in balance [10].

This theoretical framework highlights the need to carefully consider both quantitative (illuminance, adequate lighting, energy efficiency) and qualitative (illuminance distribution, color tone, shadow and accent arrangement, luminaire aesthetics) elements in restaurant lighting design [11,12]. A successful lighting design provides adequate visual comfort for functions such as eating, serving, and circulation (visibility) while also directing the spatial experience (spatiality) and creating the desired emotional atmosphere (atmosphere) by shaping the perceived volume and focal points of the space through the distribution of light within it. Thus, lighting can optimize users' comfort and emotional experience while telling a story consistent with the concept of the space [13,14].

In this context, this study aims to evaluate lighting design principles and their effects through examples from three selected restaurant spaces. Studies conducted in three restaurants in the Suadiye neighborhood of Kadıköy, Istanbul, which have similar socio-cultural environments and fine-dining concepts, examined how different design approaches shape the atmosphere of the space. The Visual Space Analysis (VSA) model was used in the space analyses, and the perceived results of the design were measured quantitatively through a user survey. Below, the research method and analysis model are first explained, followed by an evaluation of the lighting design features of Restaurant A, Restaurant B, and Restaurant C, respectively. Finally, a general discussion and conclusion are presented based on the survey findings.

2. Methodology

This study used the Visual Space Analysis (VSA) model to evaluate the lighting designs of restaurants. The VSA model examines the lighting quality of an interior space in terms of user experience across three main dimensions: Visibility, Spatiality, and Atmosphere [15,16]

(i) Visibility: Refers to the visual functionality and comfort of lighting; it should ensure that users can see objects, surfaces, and details in the space sufficiently and comfortably. Criteria such as the overall illuminance of the environment and glare control are considered to evaluate this [17].

(ii) Spatiality: This is the effect of the distribution and use of light within a space on the perceived volume and spatial organization. The composition of light and dark areas can cause a space to be perceived as spacious, airy, cramped, or compartmentalized [18,19]. For example, illuminating the ceiling and upper walls makes the space feel taller and wider, while illuminating only the table surfaces and floor creates more intimate and divided sub-areas.

(iii) Atmosphere: The emotional response that lighting creates in the user and the character of the space. The color tone of the light (warm/cool light), shadow quality, and accent elements play a decisive role in the romantic, lively, relaxing, or formal perception of the space [20].

Within the scope of this study, lighting design analysis was performed for each space section in the three selected restaurants based on the above dimensions. Each restaurant is functionally divided into the following sections: (1) Dining area – main dining rooms (two sub-sections in Restaurant A and C: indoor and outdoor spaces), (2) Private areas – entrance reception, lounge/waiting or VIP rooms, (3) Beverage service area – bar or beverage preparation-serving sections, (4) Circulation areas – entrance, corridor, staircase, and passage areas, (5) Wet areas – toilet and sink areas. In-situ inspections of each section evaluated the existing lighting arrangement based on the following criteria: illuminance (lx), light color and color rendering index (CRI), fixture type and placement, and illuminance distribution and shadow quality.

The analysis findings obtained were interpreted for each restaurant in terms of the three dimensions of the VSA model. In addition to spatial analyses, user perceptions were quantitatively evaluated through a visitor survey. The survey form included questions aimed at measuring the lighting experience during restaurant visits. Participants were asked for their demographic information, as well as the restaurant(s) they visited and the time of their visit; they were then asked to evaluate the impact of lighting in terms of concept compatibility, ambient atmosphere, visual comfort, appearance of food, and attractiveness of the space. The questions were prepared in the form of statements on a 5-point Likert scale (1: Strongly disagree, 5: Strongly agree). Sample statements: "The lighting was consistent with the overall concept of the restaurant," "The

lighting made the food and table setting look aesthetically pleasing," "The restaurant lighting bothered my eyes" (reverse coded). In addition, open-ended questions asked participants to specify what they liked or disliked about the lighting. The survey was completed by a total of 150 participants who had visited at least one of the three restaurants. The data was examined using descriptive statistics (mean, standard deviation) and comparisons were made between restaurants. This allowed us to understand the extent to which the conclusions drawn from the spatial design analysis corresponded with the user experience.

3. Analysis of Lighting Design Through Example Restaurant Spaces

This section examines the interior lighting designs of three luxury restaurants (Restaurant A, B, and C) located in Suadiye, Istanbul, focusing on five spatial components: the dining area (indoor-outdoor space), special areas (reception, relaxation, and waiting areas), beverage service area, circulation area, and wet area. The study was conducted by considering both quantitative (illuminance) and qualitative (correlated color temperature (CCT), color rendering index (CRI), light directionality, shadow quality, and illuminance distribution) characteristics of the lighting. Evaluations were made in terms of visibility, spatiality, and atmosphere within the scope of the Visual Space Analysis (VSA) model.

3.1. Restaurant A Lighting Design Analysis.

3.1.1. Lighting for Dining Areas (Indoor-Outdoor)

The dining area was examined in two sections, interior and exterior, in terms of functionality and customer experience; the atmosphere-creating role of the interior and the effects of lighting on visual comfort and mood were analyzed, while the exterior was evaluated in terms of its relationship with the natural environment and its use of daylight. Restaurant A's general lighting design is based on accent lighting supported by low-to-medium level general lighting, see Fig. 1 (a, b, c). This approach creates a warm and inviting atmosphere throughout the space while maintaining the visual comfort of users.

3.1.2. Lighting of Private Areas (Reception, Rest, Waiting Areas)

Lower illuminance was preferred in rest areas, aiming for a calming atmosphere with indirect and soft illuminance distribution, see Fig. 2 (a, b). In these areas, lighting plays a supportive role rather than a directive one.

3.1.3. Beverage Service Area Lighting

Accent lighting is prominent in beverage service areas, see Fig. 3 (a, b). In these areas, a higher-contrast lighting scheme creates spatial focus, visually defining the service area.

3.1.4. Circulation Area Lighting

Homogeneous and adequate illuminance have been provided in circulation areas to facilitate orientation, see Fig. 4 (a, b). Visual comfort has been prioritized in these areas.

3.1.5. Wet Area Lighting

A higher and more evenly distributed illuminance has been preferred in wet areas, see Fig. 5 (a). This enhances the perception of hygiene and aligns with functional requirements.

Fig. 1. (a, b, c) Lighting of indoor and outdoor dining areas Fig. 2. (a, b) Lighting of special use areas

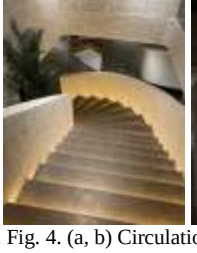
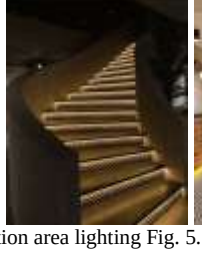

Fig. 3. (a, b) Beverage service area lighting. Fig. 4. (a, b) Circulation area lighting Fig. 5. (a) Wet area lighting

3.2. Restaurant B Lighting Design Analysis

3.2.1. Lighting for Dining Areas

The dining area lighting in Restaurant B showcases a character that highlights the architectural surfaces and spatial depth by applying the widest and most varied lighting scenarios, see Fig. 6 (a, b). The use of indirect lighting in the ceiling system allows light to reflect off the ceiling and disperse, resulting in a uniform and visually comfortable illuminance that is easy on the eyes. Wall washing and accent lighting enhance the sense of spatiality.

3.2.2. Lighting of Private Areas (Reception, Rest, Waiting Areas)

Privacy is prioritized by reducing the illuminance in private areas. The use of warm-colored lighting in these areas creates an intimate atmosphere, see Fig. 7 (a, b).

3.2.3. Beverage Service Area Lighting

The beverage service area is highlighted with focused and contrasting lighting, see Fig. 8 (a, b). This approach contributes to the perceptual separation of the area.

3.2.4. Circulation Area Lighting

Illuminance in circulation areas have been kept controlled, aiming to keep the main visual focus on dining areas.

3.2.5. Wet Area Lighting

In wet area lighting, it has been evaluated as an effective solution that supports the aesthetic integrity of the space and user comfort while meeting functional requirements.

Fig. 6. (a, b) Lighting of dining areas Fig. 7. (a, b) Lighting of special use areas Fig. 8. (a, b) Lighting of beverage service area

3.3. Restaurant C Lighting Design Analysis.

3.3.1. Lighting for Dining Areas (Indoor-Outdoor)

The dining area was examined in two sections, interior and exterior, in terms of functionality and customer experience; the effects of lighting design on spatial perception, user satisfaction, and atmosphere were addressed with a holistic approach. In Restaurant C, the dining area lighting shows a more balanced and homogeneous distribution. General lighting and table lighting are used together to balance both visibility and atmosphere, see Fig. 9 (a, b, c).

3.3.2. Lighting of Private Areas (Reception, Rest, Waiting Areas)

At Restaurant C, private areas have been designed as a more intimate "relaxation corner" connected to the dining room; the furniture arrangement evokes home comfort and is complemented by soft, layered lighting. Thanks to the dim ambient light provided by lampshades and floor lamps and local lighting, a relaxing and private atmosphere has been created at a lower illuminance compared to the dining area, see Fig. 10 (a, b, c).

3.3.3. Beverage Service Area Lighting

The beverage service area at Restaurant C has been designed with an approach to lighting that provides functional visibility conditions consistent with the overall atmosphere and makes the space perceptually legible; the service function is supported through the choice of fixtures and the way the light is directed, see Fig. 11 (a, b).

3.3.4. Area Lighting

In the circulation area, lighting is arranged in a way that softens transitions and supports orientation while maintaining continuity throughout the space, and the illuminance distribution is balanced so as not to compromise user comfort, see Fig. 12 (a, b, c).

3.3.5. Wet Area Lighting

It can be assessed that Restaurant C's wet area lighting is designed at an illuminance level that supports

visibility and the perception of hygiene; at the same time, attention has been paid to maintaining aesthetic integrity with the restaurant's overall concept.

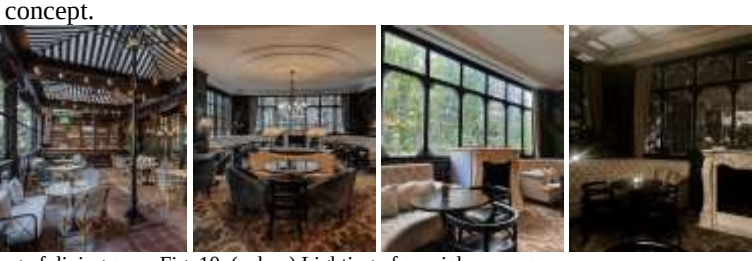

Fig. 9. (a, b, c) Lighting of dining areas Fig. 10. (a, b, c) Lighting of special use areas

Fig. 11. (a, b) Beverage service area lighting Fig. 12. (a, b, c) Circulation area lighting

4. User Survey and Data Analysis

4.1. General Information

A total of 150 participants were included in the study. All participants visited the three restaurants under review, and the effects of lighting design were analyzed comparatively in the context of different spatial atmospheres and concepts. The survey questions and findings are presented below.

Question 1 was "What is the name of the restaurant you visited?" When the responses were examined, it was seen that the participants were evenly distributed among the three restaurants, with approximately the same number of participants for each restaurant. This shows that the sample group was homogeneously distributed among the restaurants and that no restaurant was dominant.

Question 2 was "At what time of day did you visit the restaurant?" The majority of participants visited the restaurant during dinner hours; a significant portion indicated that they visited late at night. The visit rate during other time slots (such as lunch) is quite low. This result shows that most of the evaluations are related to the evening/night atmosphere, where artificial lighting is most prominent.

Question 3 is "For what purpose did you visit this restaurant?" The vast majority of participants stated that they visited the restaurant for social purposes (e.g., dining with family or friends, celebrations, meetings, etc.). In contrast, the percentage of those who visited for business or official purposes was quite low. This distribution shows that the majority of the survey participants preferred restaurants for entertainment, socializing, and special experiences, while business or official purposes were limited.

Question 4 was "Have you been to this restaurant before?" Approximately half of the participants stated that it was their first visit to the establishment, while the other half stated that they had been there before. The balanced ratio of new visitors and repeat visitors indicates that the survey participants included both those experiencing the establishment for the first time and repeat customers. This suggests that the data reflects both fresh impressions and comparative experiences of the restaurant atmosphere.

Overall, the demographic data and visit characteristics indicate that the survey participants were able to consciously experience the restaurant atmosphere. Spread across different restaurants, mostly based on evening experiences and driven by social motivation, participants have a profile that allows them to make careful observations about the venue's atmosphere and notice elements such as lighting. This provides confidence that the feedback obtained from the survey accurately reflects the effects of the restaurant atmosphere and lighting design.

4.2. Ambience and Comfort

This section discusses the results of survey questions regarding the overall atmosphere and user comfort in restaurants. Participants were asked to what extent they agreed with various statements about the atmosphere and environmental conditions of the restaurant they were in. Evaluations were made using a 5-

point Likert scale (1 = strongly disagree, 5 = strongly agree). The results show that the atmosphere created in restaurants is generally perceived positively in terms of hospitality, aesthetics, comfort, and behavioral effects.

The vast majority of participants stated that they found the overall atmosphere of the restaurants inviting and impressive. For example, the average response to the statement "The overall atmosphere of the restaurant was inviting and impressive" was ≈4.23 out of 5, which is a high value. Similarly, responses to the statement "The decoration and interior design were aesthetically satisfying" (see Table 2) were even higher, with an average rating of ≈4.39. These findings show that the interior atmosphere and decoration of the restaurants examined were generally appreciated by users and found to be aesthetically satisfying. Interior spaces designed in line with the concept of the restaurants positively influenced the user experience; the spaces were able to offer an inviting ambiance.

Table 1. *Responses to "The restaurant's overall atmosphere was inviting and impressive"*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	16.7	25
Agree (4)	43.3	65
Strongly Agree (5)	40	60

Table 2. *Responses to "The decoration and interior design were aesthetically satisfying"*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	8	12
Agree (4)	4.7	67
Strongly Agree (5)	47.3	71

The harmony of auditory and visual elements in the restaurant environment was positively evaluated by participants. The average response to the statement "The restaurant's sound (music and ambient noise) and lighting were balanced and harmonious" was ≈4.30 out of 5, indicating a high value.

Table 3. *Responses to "The restaurant's sound (music and ambient noise) and lighting were balanced and harmonious."*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	2	3
Neutral (3)	14	21
Agree (4)	36	54
Strongly Agree (5)	48	72

The contribution of lighting design to the quality and aesthetic perception of the restaurant atmosphere is clearly evident in the survey results, with a high value of ≈4.51. For example, participants' responses to the statement "The lighting gave the restaurant a luxurious feel," as shown in Table 4, revealed that lighting design enhanced the perception of the space's quality and prestige. Similarly, the statement "Lighting made the food and table setting look aesthetically pleasing" also received a high approval rating of approximately 4.5 from participants. Most users agreed with these statements, with very few disagreeing, see Table 5. These results show that properly designed lighting not only enhances the overall atmosphere but also increases the visual appeal of the food, table arrangement, and details.

Table 4. *Responses to "The lighting gave the restaurant a luxurious feel."*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0.7	1
Neutral (3)	6	9
Agree (4)	34.7	52
Strongly Agree (5)	58.7	88

Table 5. Responses to "*The lighting ensured that the food and table setting looked aesthetically pleasing."*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	7.3	11
Agree (4)	35.3	53

Strongly Agree (5)	57.3	86

The harmony of the lighting design with the restaurant's overall concept has also been strongly confirmed, as seen in the responses in Table 6. The average response to the statement "The lighting was in harmony with the restaurant's overall concept" received a high approval rating of ≈4.55.

Table 6. Responses to "*The lighting was in harmony with the restaurant's overall concept.*"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	10	10
Agree (4)	32	48
Strongly Agree (5)	61.3	92

The restaurant atmosphere's ability to feel special, intimate, and comfortable was also measured in the survey responses in Table 7. Participants' level of agreement with the statement "The venue gave the feeling of a special and intimate space" was around ≈4.3. This average indicates that the restaurant atmosphere evoked a sense of privacy and intimacy for many users. Similarly, responses to the statement "The atmosphere of the place made me want to spend more time here" were generally positive, as can be seen in the responses in Table 8. Most participants stated that the atmosphere in the restaurant encouraged them to stay longer. Although the average for this statement is slightly lower than the others, it is still around ≈4.45. In conclusion, a welcoming ambiance and appropriate lighting make users more willing to spend more time in the space. This finding demonstrates the effect of atmosphere on user behavior: pleasant lighting and ambiance ensure that customers enjoy spending more time in the restaurant.

Table 7. Responses to *"The space gave off a special and intimate feeling."*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0.7	1
Disagree (2)	3.3	5
Neutral (3)	10.7	16
Agree (4)	36	54
Strongly Agree (5)	49.3	74

Table 8. Responses *to "The atmosphere of the place made me want to spend more time here."*

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	2	3
Neutral (3)	9.3	14
Agree (4)	30	45
Strongly Agree (5)	58.7	88

These findings regarding the overall atmosphere and comfort level indicate that lighting and other spatial elements in restaurants have been successfully designed. Participants believe that the spaces offer an atmosphere that is both aesthetically appealing (inviting, satisfying, luxurious) and comfortable (warm, balanced, conducive to spending time). This highlights that lighting design, together with decoration and environmental elements, is a critical component that enriches the user experience.

4.3 Lighting Design and Perceived Quality

Another dimension of the survey concerns the characteristics and perceived quality of lighting design in restaurants. In this section, participants were asked more technical and direct questions about the restaurant's lighting. Statements regarding the adequacy of illuminance, color characteristics of light, glare, and the use of different lighting in different areas were again evaluated on a 5-point Likert scale. Overall, the average scores for all questions in this section were concentrated between 4 and 5. This indicates that the lighting design in restaurants created a high level of satisfaction and perceived quality among participants.

The overall illuminance in the restaurants was found to be ideal by the participants. The statement "The illuminance was ideal" received strong approval; the average of the responses was calculated as ≈4.49. According to the survey results in Table 9, an optimal lighting intensity was achieved in the restaurants examined. In particular, multi-layered lighting schemes were used to combine general lighting from the ceiling, accent lighting on the tables, and decorative lighting; thus, every corner of the space was made sufficiently visible while avoiding an overly bright or flat environment.

Table 9. Responses to "The illuminance was ideal"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0.7	1
Neutral (3)	8	12
Agree (4)	32.7	49
Strongly Agree (5)	58.7	88

The color characteristics of the light used for illumination (e.g., correlated color temperature (CCT), color rendering index (CRI)) were also found to be suitable for the space by participants, as seen in the survey results in Table 10. The statement "The color characteristics of the light creating the illumination were suitable for the space" received one of the highest ratings in the survey, with an average score of ≈4.56. Participants believe that a light tone suitable for the restaurant's ambiance was used. This result shows that designers determined the color of the light in a way that was appropriate for the concept and atmosphere goals of the space.

Table 10. Responses to "The color characteristics of the light were suitable for the space"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	4.7	7
Agree (4)	34.7	52
Strongly Agree (5)	60.7	91

Lighting design for tables in venues has also positively impacted the user experience, as seen in the survey results in Table 11. Participants largely agreed with the statement "Lighting at tables positively affected the dining experience" (average ≈4.37). Accent lighting for tables enhances visual and psychological comfort, while insufficient lighting can negatively affect communication and taste experience even if the ambiance is positive. In this context, it has been determined that participant satisfaction highlights the importance of using the correct intensity and focused lighting in restaurants.

Table 11. Responses to "The lighting at the tables positively affected the dining experience"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	2	3
Neutral (3)	10.7	16
Agree (4)	35.3	53
Strongly Agree (5)	52	78

The absence of annoying glare and dazzle in lighting design is an important aspect of quality perception. The statement "The lighting from the ceiling did not cause annoying glare" was also rated very positively by participants, as can be seen in the survey results in Table 12 (average ≈4.44). Preventing glare in lighting design is a critical requirement for users' visual comfort and perception of space; the results obtained indicate that the restaurants examined successfully met this requirement.

Table 12. Responses to "The overhead lighting did not cause uncomfortable glare"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	1.3	2
Disagree (2)	0.7	1
Neutral (3)	7.3	11
Agree (4)	34	51
Strongly Agree (5)	56.7	85

Another important finding regarding the lighting atmosphere is that dim and focused lighting techniques create a more comfortable environment in the space. As can be seen in the survey results in Table 13, participants largely agreed with the statement "Dim and focused lighting techniques created a more comfortable environment" (average ≈4.51). This result shows that deliberately keeping the restaurant ambiance dim has a positive impact on the user experience. Most participants stated that the dim lighting increased their sense of relaxation and comfort in the restaurant.

Table 13. Responses to "Dim and focused lighting techniques created a more comfortable environment."

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0.7	1
Neutral (3)	8	12
Agree (4)	31.3	47
Strongly Agree (5)	60	90

Creating different lighting atmospheres for different areas within the restaurant is also among the topics being evaluated. The statement "Different lighting changes were observed in different space groups (entrance, dining area, beverage area, etc.)" received a slightly lower participation level compared to other statements, but was generally positive overall (average ≈4.39), see Table 14.

Table 14. Responses to "Different area groups (entrance, dining area, etc.) had different lighting changes"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0.7	1
Disagree (2)	0.7	1
Neutral (3)	16	24
Agree (4)	24	36
Strongly Agree (5)	58.7	88

The scale compatibility of the lighting design with the space was also reflected in the participants' opinions. Participants strongly agreed with the statement "The lighting design was proportional to the size of the restaurant" (average ≈4.49), see Table 15. The survey findings reveal that designers used lighting elements appropriate to the scale of the space in the restaurants examined. Participants stated that no area in the spaces they were in was left in darkness, and at the same time, no area was over-illuminated.

Table 15. Responses to "The lighting design was proportional to the restaurant's size"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	0	0
Neutral (3)	8.7	13
Agree (4)	34	51
Strongly Agree (5)	57.3	86

The final technical statement in the survey concerns the dynamism of the lighting. Responses to the statement "The lighting in the space could be adjusted according to different times of day" had the lowest average score compared to other questions (≈4.35), see Table 16.

Table 16. Responses to "The lighting of the space could be adjusted according to different times of day"

Responses	Percentage (%)	Participants
Strongly Disagree (1)	0	0
Disagree (2)	1.3	2
Neutral (3)	14	21
Agree (4)	32.7	49
Strongly Agree (5)	52	78

Overall, participants expressed high levels of satisfaction with all aspects of lighting design and quality. Restaurants met user expectations in terms of technical criteria such as light quantity, color, direction, and distribution. This demonstrates that lighting in the spaces examined not only creates atmosphere but also provides functional quality. Participants' feedback confirms that successful lighting design adds value to the space in terms of both comfort and aesthetics.

4.4 Evaluation of Lighting Design in Case Study Restaurants

The comparison shows that each restaurant adopts a distinct lighting approach in relation to its spatial concept and user experience goals. Restaurant A emphasizes a warm and inviting atmosphere through accent-oriented lighting, Restaurant B demonstrates a layered and spatially expressive lighting composition, and Restaurant C presents a balanced and homogeneous lighting strategy focusing on comfort and intimacy. This comparative evaluation clarifies how different lighting approaches influence spatial perception and atmosphere in similar restaurant contexts.

Table 17. Responses to "Comparative Evaluation of Lighting Design in Case Study Restaurants"

Lighting aspect	Restaurant A	Restaurant B	Restaurant C
General lighting strategy	Accent-oriented lighting supported by low–medium ambient lighting	Layered lighting including indirect ceiling lighting and wall washing	Balanced combination of ambient and table lighting
Dining area lighting	Warm and inviting atmosphere	Spatial depth emphasized	Homogeneous and balanced distribution
Private areas	Lower illuminance and soft lighting	Reduced illuminance and warm tones	Dim layered lighting
Beverage service area	Strong accent lighting	Focused and contrasting lighting	Functional directional lighting
Circulation areas	Homogeneous and adequate illuminance	Controlled illuminance	Balanced distribution
Wet areas	Higher and evenly distributed illuminance	Functional lighting	Adequate illuminance
Dominant atmosphere effect	Warm and inviting	Dramatic and luxurious	Warm and intimate

5 Result and Discussion

In this study, the effects of lighting design in restaurant interiors on the atmosphere of the space and the user experience were comprehensively evaluated through three different examples. The case studies show that each restaurant has succeeded in creating the desired atmosphere by using unique lighting strategies tailored to its own concept and target audience. Restaurant A offered a spacious and comfortable environment with its balanced approach combining natural and artificial light; Restaurant B created a luxurious and energetic ambiance with dramatic and layered lighting compositions; Restaurant C created a warm and intimate atmosphere with its warm and dim lighting.

The Visual Space Analysis (VSA) model used in the analyses allowed for the separate examination of the effects of lighting design on visibility, spatiality, and atmosphere. Accordingly, it was observed that successful restaurant lighting must first provide adequate and comfortable viewing conditions (visibility) for users, while also shaping the spatial experience by managing the perceived volume and focal points of the space through illuminance distribution, and finally determining users' emotional responses and perception of the environment through the color, intensity, and direction of the light (atmosphere). In the spaces examined, it was determined that achieving a balanced combination of these three dimensions had the most positive effect on overall satisfaction. For example, the fact that Restaurant B maintained visual comfort in the general area despite its eye-catching bar lighting, or that Restaurant C provided a dim, romantic atmosphere while also meeting basic visibility needs, points to the importance of this balance.

The user survey yielded results that confirmed the impact of design decisions on the guest experience. Participants greatly appreciated the consistency of the lighting with the restaurant concept, its contribution to the aesthetic presentation of the food, and the overall ambiance of the environment. These findings reveal that supporting the restaurant atmosphere with conscious lighting design increases customer satisfaction and the desire to spend more time in the space. Moreover, thanks to well-designed lighting, the space's image of quality has improved, and customers perceive the space as more high-end and attractive. Decorative details and focal points highlighted by lighting were interpreted as elements that made the venue memorable for guests. On the other hand, a few critical comments from the survey serve as a reminder that functionality should not be completely overshadowed in lighting design—for example, an overly dim environment can make it difficult to read the menu. Therefore, it is recommended that restaurant designers do not neglect user

needs for the sake of atmosphere and respond to different scenarios with adjustable and flexible lighting solutions (e.g., dimmer systems that can increase brightness when needed, additional reading lights, etc.).

In conclusion, the lighting design in the three luxury restaurant examples in Suadiye has been seen to be an integral and defining part of the space's atmosphere. All three restaurants have used light in their own styles to give their spaces identity, producing solutions that combine function and aesthetics. This study demonstrates once again, from the perspective of interior architecture and lighting design disciplines, that light is not merely a technical requirement in social spaces such as restaurants, but also a powerful experience design tool. Properly designed lighting can have tangible effects on how users perceive, feel, and behave in a space. The most important lesson for designers is to integrate lighting planning with the space concept from the early design stage and to think about the user experience in a multidimensional way [21,12]. Ultimately, designs that can create memorable spatial experiences through an integrated lighting strategy will create unforgettable spaces in users' minds and directly contribute to the success of businesses.

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CHILDREN AS URBAN CO-DESIGNERS: KADİFEKALE

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Abstract
This project aims to develop a child-centered, community-based public space identity design for Kadifekale through participatory placemaking practices grounded in children's participation and place-making literature. Drawing on the conceptualization of children as active social actors with the right to influence decisions affecting their lives, the project positions children not merely as users of public space but as legitimate contributors to its design and meaning. Kadifekale is a historically layered hillside neighborhood in İzmir, shaped by the presence of the ancient Pagos (Kadifekale) Castle and characterized by strong local identity alongside socio-spatial challenges and vulnerabilities. Within this context, the project seeks to strengthen the neighborhood's sense of place by integrating children's lived experiences, spatial perceptions, and aspirations into the design of a neighborhood square. In line with placemaking literature, public space is understood not only as a physical setting but as a socially produced environment shaped through collective practices, meanings, and attachments. Beyond physical design outcomes, the project aims to contribute to social cohesion, intergenerational dialogue, and local ownership by embedding meaningful participation into the design process. Within this framework, child-centered participatory workshops were made with 25 children who was born and have lived in Kadifekale to elicit children's spatial experiences, needs, and interpretations of Kadifekale's public spaces. Guided neighborhood walks and observation-based activities were done to document how children use, perceive, and navigate public and semi-public spaces, with particular attention to play, safety, social interaction, and belonging. Such place-based methods align with placemaking approaches prioritize everyday practices and lived experience. Parallel engagement processes with adult residents were made to situate children's inputs within broader community narratives, historical memory, and local priorities, supporting intergenerational dialogue and negotiated meanings of place. Qualitative analysis and synthesis of participatory data were translated children's and residents' contributions into design principles, spatial strategies, and identity elements for the neighborhood square. This stage operationalizes participatory placemaking by linking social process to tangible spatial outcomes. As designers and researchers, we believe that children are capable of contributing meaningful spatial knowledge when appropriate methods are used. Participation influences outcomes only when children's inputs are taken seriously and translated into design decisions. Place-based identity is strengthened through collective meaning-making rather than top-down design.
Key Words: Child-Centered Placemaking; Community Engagement, Social Impact, Paricipotary Design, Sense of Place

1. Introduction

Individuals encounter complex challenges in daily life and are frequently required to make decisions with long-term consequences that extend beyond personal outcomes to affect broader social and environmental contexts. In spatial and environmental design, decisions made without considering the diverse needs, expectations, and lived experiences of those who inhabit, use, and share a space risk producing environments that are socially detached, inequitable, and functionally ineffective. Design practices that disregard participatory input therefore undermine their own relevance, particularly in community-based interventions (Sanoff, 2000; Silberberg et al., 2013). Co-design, also referred to as collaborative design, is grounded in participatory and user-centered traditions and emphasizes the active engagement of users and stakeholders throughout the design process (Manzini, 2017; Antonini, 2021). By embedding local knowledge, lived experience, and contextual insight into decision-making, co-design contributes to long-term social value, sustainable outcomes, and a sense of collective ownership (Kang, Choo, & Watters, 2015). This approach recognizes citizens-including children-as co-producers of space, ensuring that design interventions are responsive to community needs and aspirations. Place-making literature reinforces the idea that space is not merely a physical container but a socially constructed and continuously negotiated entity, shaped through everyday practices, collective memory, and interpersonal interactions (Relph, 1976; Project for Public Spaces, 2007; Whyte, 1980). Participatory placemaking aligns closely with co-design principles by foregrounding local agency, co-created place identity, and community cohesion. In this sense, placemaking

functions both as a design methodology and as a social process capable of generating positive social impact by strengthening local bonds, social inclusion, and community resilience (Silberberg et al., 2013).

In this project, children's involvement is examined through both co-design and rights-based perspectives, emphasizing their participation and creativity as integral to ethical and inclusive design processes. Children are positioned not as passive beneficiaries but as co-designers whose perspectives actively shape spatial and social outcomes. This approach aligns with social work principles promoting empowerment, participation, and social responsibility within community-based interventions (Gray, 2012; Dominelli, 2012). Empirical evidence highlights that co-design and participatory innovation contribute to social justice, collective agency, and inclusive practices in community development (Martin et al., 2023; Villanueva-Paredes et al., 2024). Children, as a sensitive group, require ethically grounded, age-appropriate, and supportive frameworks to participate effectively (Lansdown, 2001). Their distinct cognitive and creative capacities allow them to perceive environments from novel perspectives, providing insights that enrich design processes and enhance social impact (Hansen, 2017).

Therefore, the project's central design question is: "How can child-centered participatory placemaking effectively integrate children's spatial experiences, perceptions, and aspirations to strengthen the sense of place and social cohesion in historically layered urban neighborhoods like Kadifekale?". To answer this question, participatory engagement included child-centered co-design workshops, neighborhood exploration walks, and play-based interactions, eliciting children's ideas, concerns, and aspirations regarding Kadifekale's public spaces. Adult community members were simultaneously engaged to situate children's input within broader historical, cultural, and social narratives, supporting intergenerational dialogue and collectively negotiated meanings of place. Qualitative analysis of these participatory data informed design principles, spatial strategies, and identity elements for the neighborhood square, operationalizing placemaking as a process linking social participation to tangible spatial outcomes.

The findings from this project demonstrate that child-centered participatory placemaking can meaningfully enhance both the social and spatial dimensions of historically layered urban neighborhoods such as Kadifekale. By actively involving children in workshops, neighborhood explorations, and play-based activities, the project elicited rich insights into their spatial experiences, needs, and aspirations. Integrating these perspectives with adult community input allowed for the co-creation of design principles, spatial strategies, and identity elements that reflect both local memory and contemporary lived experience. The process not only generated a physically responsive and contextually grounded neighborhood square but also strengthened social cohesion, intergenerational dialogue, and a sense of community ownership. These outcomes highlight the potential of participatory placemaking to produce sustainable, inclusive, and socially impactful urban environments, demonstrating that children's active engagement is a critical driver of meaningful, community-centered design.

A Placemaking Approach in Kadifekale

Kadifekale, as one of İzmir's oldest settlement areas, presents a unique urban context shaped by historical, cultural, and spatial layers formed around the ancient Pagos (Kadifekale) Castle. Despite this strong historical identity, the neighborhood today faces challenges such as social exclusion, declining spatial quality, and the limited use of public spaces (Figure 1). This situation necessitates approaching any spatial intervention in Kadifekale not merely as a physical design problem, but as a placemaking process centered on local identity, a sense of belonging, and community participation.

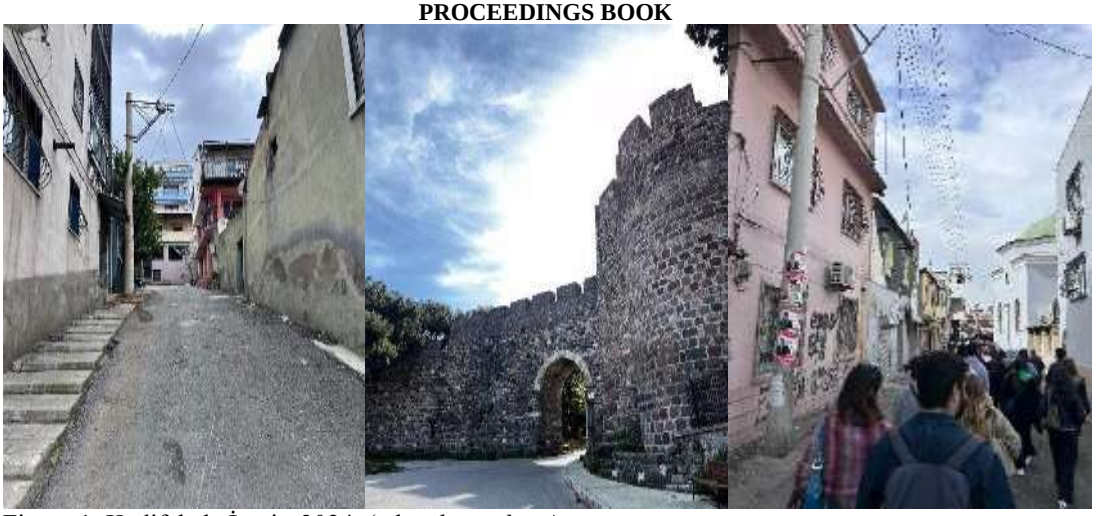

Figure 1. Kadifekale İzmir, 2024 (taken by authors)

In placemaking literature, space is defined not only as a built physical environment but as a "place" that is continuously reproduced through users' everyday practices, collective memory, and social relationships (Relph, 1976; Project for Public Spaces, 2007). Within the context of Kadifekale, this perspective requires a bottom-up production of public space that brings together the neighborhood's historical narratives with contemporary everyday life practices. In this project, the co-design (collaborative design) approach is adopted as a core method for rethinking Kadifekale's public spaces. Drawing on participatory and user-centered design traditions, co-design positions local residents and users as active actors in the design process (Manzini, 2017; Antonini, 2021). In socio-spatially sensitive contexts such as Kadifekale, this approach not only generates more functional design outcomes but also strengthens local attachment and contributes to the long-term sustainability of public spaces. The distinctive feature of the project lies in placing children living in Kadifekale at the center of the placemaking process. Children are considered not merely as future users of space, but as active components of the neighborhood's present social fabric. The literature on children's participation demonstrates that involving children in decisions that affect them is both an ethical obligation and a factor that enhances design quality (Hart, 1992; Lundy, 2007). In line with Article 12 of the United Nations Convention on the Rights of the Child, children's right to express their views and to have those views taken into account constitutes a fundamental principle of this project (Lansdown, 2001).

In Kadifekale, children's everyday life practices are shaped around streets, stairways, vacant plots, and a limited number of public spaces. For this reason, children possess a unique capacity to generate local and experiential knowledge about how public spaces are perceived, where they play, and where they feel safe or excluded. As emphasized by Hansen (2017), children's unrestricted and creative ways of perceiving objects and spaces constitute an important source of learning for design processes.

Within the scope of this project, children's participation is facilitated through creative workshops, neighborhood exploration walks, and play-based interactions. These methods aim to make visible children's perceptions, needs, and imaginations regarding Kadifekale's public spaces. The local and experiential knowledge produced through these processes directly informs the design of the neighborhood square and public space identity, enabling the placemaking process to translate into concrete spatial outcomes. In the context of Kadifekale, placemaking is understood not only as a child-oriented design process but also as an intergenerational space of negotiation. Accordingly, the project seeks to develop a shared spatial language by considering children's contributions alongside the historical narratives and local values of neighborhood residents. This approach positions public space as a site of social learning and collective empowerment.

In the context of Kadifekale, placemaking is understood not only as a child-oriented design process but also as an intergenerational space of negotiation. Accordingly, the project seeks to develop a shared spatial language by considering children's contributions alongside the historical narratives and local values of neighborhood residents. This approach positions public space as a site of social learning and collective empowerment. At the same time, the project proposes an action-oriented placemaking model that aims to bring together multiple stakeholders-such as local authorities, academia, and neighborhood residents-within

conditions of limited resources and time constraints. Children's imagination and curiosity are regarded not merely as pedagogical elements, but as design resources that reveal new possibilities for Kadifekale's public spaces.

In conclusion, this project constitutes a place-based placemaking initiative aimed at re-producing public space in Kadifekale by integrating child participation, the co-design approach, and an ecological-social perspective. By conceptualizing public space design as a process that goes beyond physical intervention-one that strengthens social relations, local identity, and children's visibility in public life-the project offers a more inclusive and sustainable spatial future for Kadifekale.

2. METHODOLOGY

The conceptual framework of the project was shaped through a workshop conducted with 25 children who were born and raised in Kadifekale and who continue to live in this neighbourhood, possessing direct experience of disadvantaged urban conditions. This approach is grounded in an empowerment-based participatory design perspective that regards children not as passive beneficiaries, but as actors with situated knowledge and lived experience of their own environments (Martin et al., 2023).

The workshop process aimed to make visible the everyday spatial experiences, needs, and expectations of children living in a disadvantaged neighbourhood with regard to public spaces. To support children in expressing themselves more comfortably, visually oriented methods-such as drawing, collage, spatial representation, and storytelling- were employed. Within this framework, spatial solutions that could enable spending quality time, collective production, and learning in public spaces were discussed from the children's perspectives. The workshop sought to identify the spatial deficiencies children experience in their living environment and to understand what kinds of public space configurations they find meaningful.

The outputs of the workshop were used as key inputs in the conceptual design phase of the public urban space to be implemented in Kadifekale. In this context, collaboration was established with the İzmir Metropolitan Municipality Department of Social Services, and it was planned to transform a public space allocated by the municipality in line with the needs and demands articulated by the children. Following the necessary sponsorship negotiations, the design was finalized based on the workshop outcomes, and the project proceeded to the implementation phase.

Throughout the different stages of the project, the level of stakeholder participation varied depending on responsibilities related to design, knowledge production, and implementation. The project was approached not as a one-directional intervention by designers, but as a public learning tool that evolved through a multi-stakeholder collaboration process informed by the lived experiences of children.

2.1. PROJECT

Actors

A multidisciplinary design team composed of 20 designers from İzmir University of Economics (IUE), Faculty of Fine Arts and Design 4th year students representing interior architecture and environmental design, product and service system design, architecture, and visual communication design, designed and facilitated the co-design workshop conducted in Kadifekale. Prior to the workshop, the design team participated in a preparatory training session led by a child psychologist and consultant. This training focused on workshop facilitation techniques, ethical considerations, and effective communication strategies for working with children living in disadvantaged urban contexts, with the aim of ensuring a sensitive, ethical, and supportive approach throughout the process.

In line with established best practices in co-design with children, the training emphasized empathetic and non-directive communication, the minimization of adult authority within creative processes, and the creation of an atmosphere of trust and psychological safety (Bergmark & Westman, 2016; Druin, 2002). The primary participants of the workshop were 25 children who were born and raised in Kadifekale and who continue to live in the neighbourhood, thereby constituting the main focus group of the study. Participation was voluntary and limited to children whose parents or legal guardians provided informed consent.

Additional stakeholders involved in the project included the İzmir Metropolitan Municipality's Department of Social Services, which collaborated in the planning and implementation of the public space addressed by the project. Following the completion of the design and implementation phases, the project outcomes were presented to a broader group of İzmir residents during a public design event. This event

served as a platform to collect public feedback and to support reflection and learning beyond the immediate project context.

Procedure

The project process consists of developing the design concept based on the analysis of data collected from the workshop, followed by the preparation of technical drawings for implementation and the implementation phase itself.

Workshop Phase

As part of the project, a participatory workshop was carried out with 25 children who were born and raised in Kadifekale and who continue to reside in the neighbourhood, forming the core participant group of the study. Participation in the workshop was voluntary and consents were provided by the children's parents or legal guardians. The workshop sessions were designed to actively engage children through interactive and creative activities (Figure 2).

Figure 2. Co-design workshop (prepared by designers)

During the workshop, children were invited to visually represent and narrate their ideal urban living environments and activities they wished to experience within them. This process aimed to integrate children's aspirations, perspectives, and lived experiences into the overall design of the project. To support these activities, the design team supplied all required two-dimensional and three-dimensional materials, enabling children to freely explore and communicate their ideas. In addition, video and audio recordings were taken during the workshop for data analysis.

When all visual materials, tables, color analyses, collages, summaries of audio recordings, and interior–exterior spatial representations are examined together, a coherent and convergent pattern emerges regarding children's spatial, social, and emotional expectations. The findings indicate that children are not merely oriented toward isolated activities, but rather express a strong preference for multi-functional, flexible, and experience-based environments.

Findings of Activity Preferences

Analyses of activity preferences (including pie charts, collage contents, and symbolic drawings) show that children most frequently favor cinema/theater, ground-based games, and dance–music activities. A common characteristic of these activities is their openness to collective participation rather than individual engagement. The density of figures in collages and the spatial clustering of stickers suggest that children predominantly conceptualize space as a shared environment-one that supports playing, watching, and interacting together.This finding indicates that children require spatial configurations that prioritize social interaction and that blur rigid boundaries between "playing," "watching," and "producing." Hybrid spaces that allow these activities to coexist appear to be more meaningful from the children's perspective.

Findings of Color Preferences

The color analyses (pie and funnel charts) reveal a clear prominence of red, blue, green, and pink. The frequent use of warm colors such as red and orange may be associated with emotions of joy, energy, and movement, while blue and green function as balancing and calming elements. A noteworthy finding is that children do not use bright colors in isolation; instead, they consistently combine them with nature-related representations (e.g., trees, sky, clouds). This suggests that children's visual preferences are not chaotic or random, but rather reflect an intuitive attempt to establish emotional balance through color and imagery.

Findings of Nature, Outdoor Space and Open-air Emphasis

The external environment analyses-featuring trees, insects, clouds, gardening activities, and playground elements-demonstrate a strong expectation for outdoor spaces that facilitate contact with nature. The repeated presence of gardening activities, green areas, and open-air cinema representations suggests that nature is perceived not merely as a background element, but as an active component of learning and play.

The integrated findings of this workshop demonstrate that children's spatial expectations are multi-layered, socially oriented, nature-connected, and emotionally balanced. For children, an ideal space is not limited to a single function such as playing or watching; rather, it is a flexible environment that simultaneously supports production, sharing, imagination, and rest. When color preferences, activity distributions, collage themes, and verbal expressions are considered together, it becomes evident that children prioritize community-based and collective activities, exhibit a strong need for outdoor spaces that facilitate contact with nature, seek a balance between joy and energy (expressed through vibrant colors) and calmness (supported by natural and neutral elements) and conceptualize space not as a fixed functional container, but as an experience-oriented process (Figure 3).

Accordingly, spatial design and program development for children should move beyond single-function, adult-centered, and rigidly defined environments. Instead, design approaches that are flexible, participatory, and centered on children's expressive capacities and imagination should be adopted. The workshop demonstrates that involving children directly in spatial thinking and design processes yields outcomes that are not only pedagogically valuable but also conceptually and architecturally robust. Moreover, according to these findings, the concept of project and first ideas were discussed among the designers.

Figure 3. Findings from the co-design workshop (prepared by designers)

<u>*Conceptual Phase*</u>

The verbal feedback and graphic outputs obtained from the workshop conducted with 25 children informed the conceptual design of the living urban environment. Designers systematically analyzed both the verbal descriptions and the drawings produced by the participants. The resulting data guided the identification of key concepts and the development of the project's design identity, including children's activity preferences-both individually and in interaction with adults-as well as their choices regarding patterns and colors. The drawings produced during the workshop revealed a strong preference for vibrant, rainbow, and multicolored palettes. In terms of patterns, stripes and organic forms emerged as dominant visual elements. The analysis further indicated that theatre and film screenings were the most preferred activities among all participating children (Figure 4).

Based on the data collection and analysis, the main concept of the living urban environment evolved into a performance-oriented stage emphasizing color and pattern. Accordingly, all required design elements were

developed using recycled materials obtained through sponsorships. After finalizing the conceptual phase, designers began to work on the technical issues for the implementation phase.

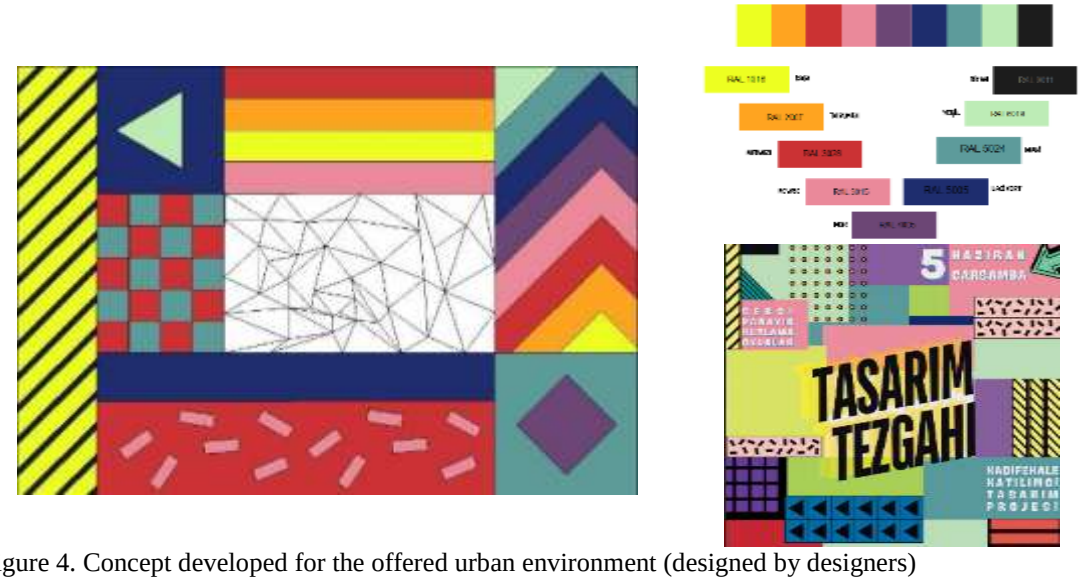

Figure 4. Concept developed for the offered urban environment (designed by designers)

Technical Phase

A comprehensive list of required materials was prepared and formally approved by the Department of Social Services of İzmir Metropolitan Municipality. Upon completion of the technical drawings, subsequent implementation phases -including furniture installation, electrical works, and equipment installation- were carried out (Figure 5).

Following these stages, graphic applications were developed in accordance with the total square meterage of the urban environment. All technical documentation and designed product project files were subsequently finalized and compiled for the implementation process and for submission to sponsoring companies.

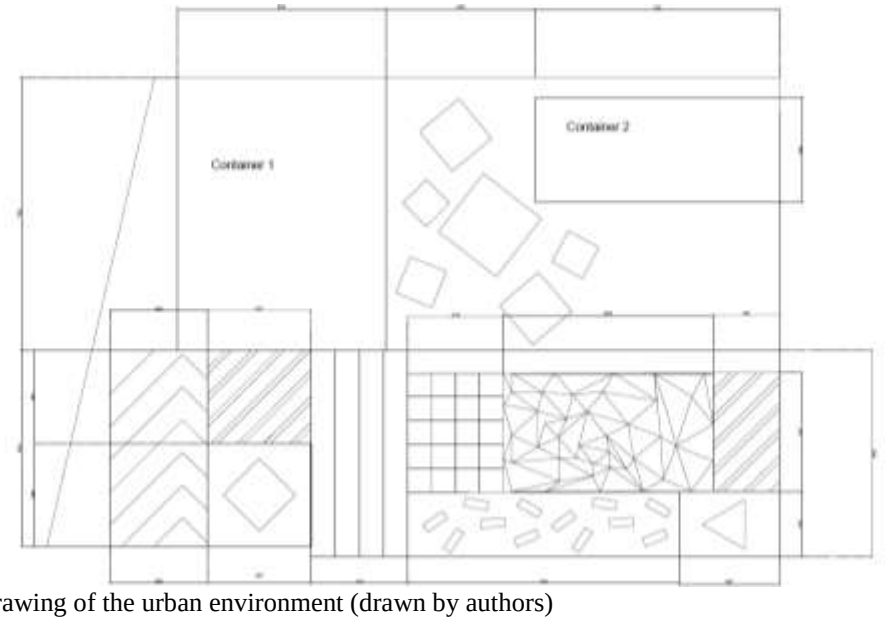

Figure 5.
Technical drawing of the urban environment (drawn by authors)

Application Phase

The application drawings were submitted to the İzmir Metropolitan Municipality's Department of Social Services and sponsorship companies to provide necessary materials. In the meantime, regular meetings were held with companies, and discussions were made based on requests and needs and they have provided all the necessary materials and workmanship. The implementation process is being monitored by the designers. The visual sequence shows the full project journey, from the initial design phase through construction to the final realization. Each stage demonstrates the collaborative process, where design ideas developed and applied with children and stakeholders were translated into a built, functional space. The completed living urban environement stands as a tangible outcome of participatory design in action (Figure 6).

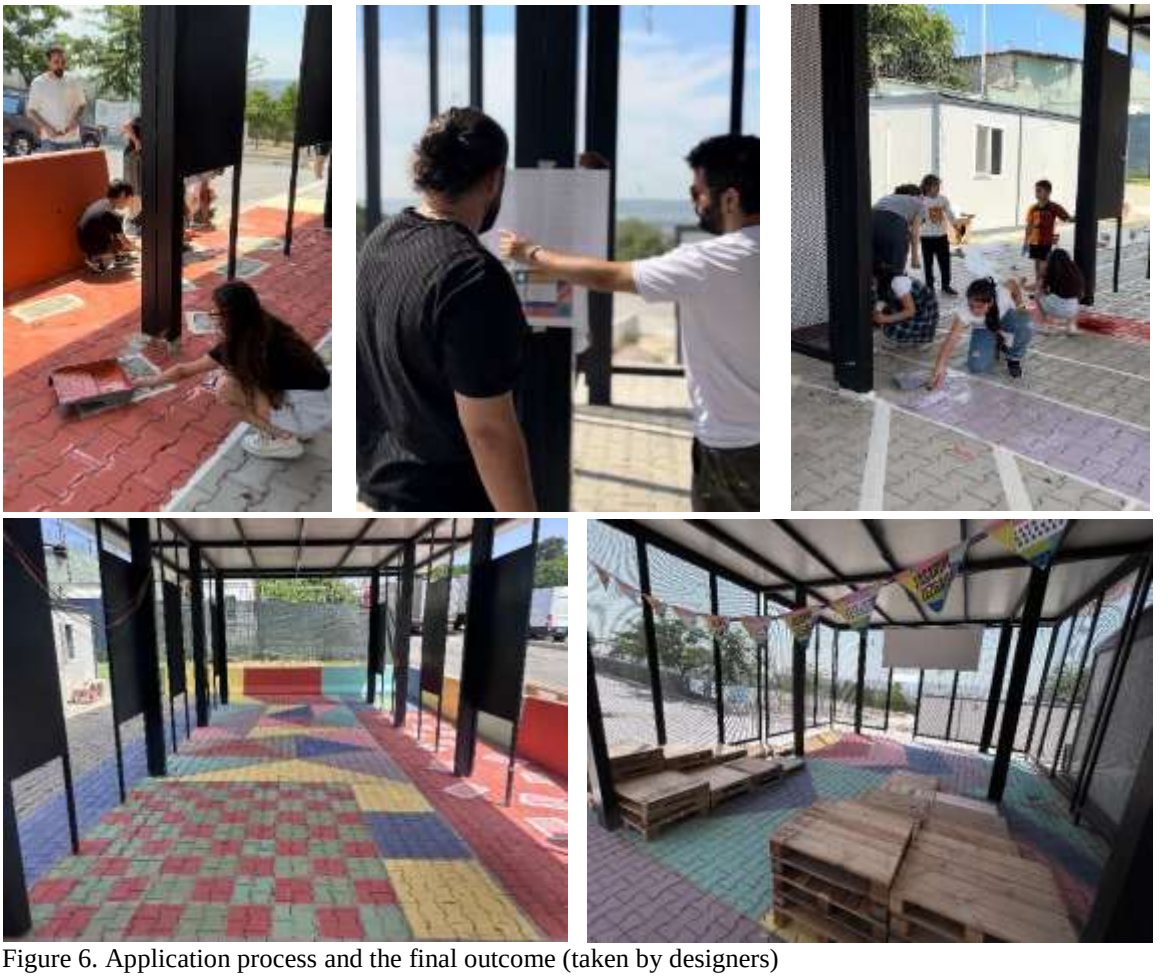

Figure 6. Application process and the final outcome (taken by designers)

3. DISCUSSION

Participation in placemaking within the social and cultural scope has become one of the central agendas of contemporary urban discourse. In modern cities increasingly shaped by top-down planning logics, market-driven redevelopment, and rapid transformation, public space often risks losing its role as a shared social infrastructure. Instead of functioning as arenas for collective meaning-making, many public spaces are reduced to standardized, consumption-oriented environments. Within this context, participatory design practices offer a critical counterbalance by reintroducing local knowledge, lived experience, and social negotiation into spatial production processes**.** The Kadifekale workshop experience demonstrates how child-centered participatory placemaking can operate not merely as a design method but as a socio-cultural intervention in the production of public space. Rather than treating children as passive beneficiaries of adult-designed environments, the project positioned them as legitimate urban actors capable of articulating spatial

memory, safety perceptions, play patterns, and symbolic attachments. This repositioning challenges dominant urban paradigms that marginalize children's agency in decision-making processes.

Public space in the modern city is not only a physical setting but a contested terrain where identities, power relations, and social hierarchies are negotiated. In neighborhoods such as Kadifekale—characterized by historical layering, socio-spatial vulnerability, and strong community ties—participatory processes become particularly significant. Here, placemaking cannot be reduced to aesthetic upgrading or spatial beautification; it must engage with questions of belonging, recognition, and collective ownership. The workshops revealed that children's narratives often intersected with broader community concerns such as safety, accessibility, and cultural continuity. This indicates that children's perspectives are not isolated or naïve; rather, they are embedded within the social fabric of the neighborhood.

Moreover, the intergenerational dialogue component expanded the scope of participation beyond a single demographic group. The negotiation between children's aspirations and adult residents' memories and concerns reflects the multi-layered character of urban public space. Modern public spaces must accommodate diverse temporalities—past heritage, present needs, and future aspirations. Participatory placemaking offers a mechanism for articulating these temporal layers within a shared spatial framework. Importantly, this workshop experience suggests that child-centered participatory placemaking can serve as a transferable methodological model for other urban contexts. The structured yet flexible design of the workshops—combining guided walks, observation-based activities, and creative mapping—provides a replicable toolkit adaptable to different neighborhoods. However, replication requires sensitivity to local socio-cultural dynamics and an explicit commitment to translating participatory knowledge into tangible spatial outcomes.

Thus, the project contributes to contemporary debates on the democratization of urban design by demonstrating that children's participation can enhance both spatial quality and social cohesion. Rather than being an auxiliary educational exercise, child-inclusive placemaking should be understood as a strategic approach to strengthening the public realm in the modern city.

4. CONCLUSION

This study demonstrates that child-centered participatory placemaking can play a significant role in redefining public space within the contemporary urban context. In modern cities facing increasing socio-spatial fragmentation, involving children in co-design processes not only enriches spatial proposals but also reinforces democratic urban culture. The Kadifekale case illustrates that children possess meaningful spatial knowledge grounded in daily practice, embodied experience, and emotional attachment. The project further confirms that participation must move beyond consultation toward co-production. When children's inputs are systematically analyzed and translated into design principles, participation becomes structurally embedded in the planning process. This shift enhances local ownership and strengthens the legitimacy of spatial interventions. In neighborhoods with strong identity yet socio-economic vulnerability, such an approach can contribute to social cohesion and collective resilience.

From a broader perspective, the workshop model developed in this project offers an adaptable framework for other participatory design processes. Its integration of place-based exploration, creative expression, and intergenerational dialogue demonstrates how participatory methodologies can connect social research with spatial design. However, the effectiveness of this model depends on sustained institutional commitment and the willingness of designers and local authorities to genuinely share decision-making power. Ultimately, the project suggests that public space in the modern city should be conceived not as a finished product but as an evolving social process. Children's participation reveals alternative readings of urban space and expands the range of voices included in its production. By foregrounding children as urban co-designers, this research contributes to ongoing discussions about inclusive urban governance and participatory democracy.

Future research may explore the long-term impacts of such participatory interventions on spatial use patterns, community relations, and children's sense of civic agency. Nevertheless, the Kadifekale experience indicates that child-centered participatory placemaking has the potential to function not only as a localized design strategy but also as a model for rethinking public space production in contemporary cities.

Acknowledgements

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UPCYCLING-BASED REPRODUCTION PRACTICES OF JANE PERKINS WITHIN THE FRAMEWORK OF SUSTAINABLE ART

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Abstract
Sustainability in artistic production is a multifaceted concept associated with environmental sensitivity, material use, and critical production practices. Sustainable art places themes such as the conservation of natural resources, waste management, and questioning consumption habits at the center of artistic production. The use of waste materials in art is not merely a search for alternative materials driven by aesthetic concerns, but also an approach that allows for the production of conceptual and critical meaning. In this context, upcycling refers to the re-evaluation of materials that have lost their function or are considered waste while preserving their structural and aesthetic properties, while artistic reproduction establishes a critical relationship between the past and the present through the reinterpretation of images and forms from art history within a contemporary context. This study examines both concepts together, allowing for the investigation of both the material and conceptual dimensions of sustainable art practice. The aim of the research is to reveal how waste materials are transformed into a critical and meaningful means of expression through the reproduction of images from art history. In this regard, Jane Perkins' Plastic Classics series, which stands out with its upcycling-based artistic productions, has been selected as an example for this study.

This study, conducted using a qualitative research method, was carried out in three stages. The first stage involved a literature review to establish a conceptual framework. The second stage involved examining Perkins' works, which recreate iconic art pieces from the past using plastic waste materials, through a three-stage analysis process employing visual and conceptual analysis methods. The types of materials used, formal characteristics, and relationships with the original works were evaluated. The third stage involved evaluating and discussing the works within the context of sustainability, upcycling, and artistic reproduction. In this context, the study offers a conceptual contribution to the sustainable art literature and provides a theoretical foundation for future research on upcycling-based contemporary art practices.
Key Words: *Sustainable art, upcycling, artistic reproduction, Jane Perkins, art.*

1. Introduction

Throughout history, humanity has aimed for development and progress; driven by technological advancements and increasing needs, it has sought to improve the quality of life. This process has led to individual and spatial transformations, and materials that enhance living comfort have become indispensable in human life. However, the short lifespan of these materials and limited raw material cycles have led to problems such as environmental pollution, depletion of natural resources, and disruption of ecological balance. The unsustainability of raw material and energy resources, along with concerns about human-induced climate change, has brought the concept of sustainability to the forefront, aiming to protect natural resources and pass them on to future generations.

The concept of sustainability [1] means paying attention to the recycling and environmental compatibility of used objects, rather than simply consuming and discarding them. Approaches such as recycling, zero waste, minimalism, and upcycling have been developed to reduce negative impacts on the environment and nature and to transfer existing resources to future generations. Among these approaches, which aim to reduce the amount of waste increasing due to excessive consumption, upcycling stands out as an important tool in replacing the linear economy concept with a circular economy that focuses on the longer-term use and re-evaluation of resources [2]. Upcycling means the transformation and reuse of used and waste objects.

Upcycling is the process of reusing a product that has become waste by giving it value through a new process and design [3]. With the upcycling method, the material is kept in the cycle, and attempts are made to prevent it from becoming waste. Keeping the material in its most valuable form for as long as possible in its life cycle, which is the main aim of waste management strategies [4], can be achieved with upcycling. This approach offers a two-way gain, as it aims to both bring waste materials back into use and to preserve or increase their original value.

Unlike recycling, which is based on breaking down waste and turning it back into raw materials, upcycling aims to re-evaluate existing items and add value through design [5]. While in recycling the material usually suffers a loss of quality, in upcycling the aim is to preserve the quality of the material or to achieve a higher value through design.

Upcycling is defined as the process of giving value to a product or material by preventing its lifespan from ending and transforming it into a more qualified state [6]. Through this method, the material can be transformed beyond its current form into a more qualified and therefore more valuable structure [7]. However, upcycling not only contributes to the conservation of resources used in production; it also has the characteristic of being a process that includes materials in a new life cycle by re-examining them through knowledge and interpretation [8]. The use of the upcycling approach in art offers the possibility of re-examining the real values of waste materials and interpreting works from a creative perspective. In this context, the continuity of the life cycle and value of products and materials is ensured, and wastes gain new meaning [9, 10].

Artistic reproduction is the process of transforming an existing work of art by reinterpreting its formal, conceptual, or historical characteristics in accordance with the artist's subjective interpretation. In this approach, the original work is reproduced in a new context with a different layer of meaning. Benjamin [11], when discussing technical and artistic reproduction, draws attention to the fact that what has been done in the past can be reinterpreted in the future, and that a continuous relationship is established between the present and the past through this method. This production aims to reposition the past in a way that is consistent with history; it is a process of moving beyond understanding the past as "what it once was".

The method of reproduction entails the removal of the reproduced object from the domain of tradition. In this way, the reproduced object is multiplied and, instead of its singular existence, is endowed with a mass-based mode of existence. Moreover, by allowing the reproduced object to address the viewer from its current position, reproduction serves to actualize the produced work [12]. On the other hand, this condition can be interpreted as the capacity of a contemporary artwork to generate exchange value becoming the ultimate indicator of its aesthetic validity [13].

Upcycling and artistic reproduction can be considered two fundamental approaches in contemporary art that intersect through material, meaning, and context. Both practices are based on the idea of re-evaluating, transforming, and re-presenting what already exists within a new context. Upcycling refers to the transformation of materials that have lost their function or are considered waste into new products with higher aesthetic and conceptual value. Artistic reproduction, on the other hand, is the process of re-examining images, forms, or compositions from art history from a contemporary perspective and reinterpreting them with different materials or techniques. In this context, both approaches share the principle of "reuse" at both the material and intellectual levels.

Artistic reproduction provides a conceptual foundation for upcycling. The use of waste materials is not only an environmentally friendly choice; it also gains critical meaning through the conscious reproduction of iconic images from art history. Thus, material that is physically waste is transformed into a new aesthetic and conceptual plane by associating it with enduring and valuable images. On the other hand, upcycling ensures that artistic reproduction becomes a contemporary and sustainable form of expression. The reproduction of classic works of art using plastic, metal, or synthetic waste generates a critical discourse against both consumer culture and environmental destruction. This transforms reproduction from a mere formal repetition into a field of social and environmental inquiry.

This study examines the concepts of upcycling and artistic reproduction together, exploring both the material-based and conceptual dimensions of sustainable art practice. The main aim of the study is to demonstrate how waste materials are transformed not only as an environmentally friendly choice but also as a critical and meaningful means of expression through the reproduction of images from art history.In

this context, Jane Perkins' works are considered as contemporary and original examples showing how upcycling is integrated with artistic reproduction.

Jane Perkins, a prominent figure in contemporary upcycling art, combines traditional art with the influences of modern environmental awareness through the methods she employs in her work. Carefully selecting each material she uses, Perkins creates an aesthetic process while simultaneously prompting the viewer to question the harm that consumption habits inflict on nature [14, 15]. Using various recycled materials—such as plastic buttons, beads, wires, old toys, and other waste materials—that are often overlooked or discarded, the artist interprets contemporary classic iconic paintings within the framework of upcycling and artistic reproduction. Therefore, the artist's approach to producing artistic reproductions based on upcycling was a decisive factor in the selection of Jane Perkins and her works for this study.

In the literature, the concept of upcycling is generally addressed within the context of environmental issues. The originality of this study lies in its interpretation of upcycling not merely as a technical or environmental application, but in conjunction with the concept of artistic reproduction. Accordingly, the use of waste materials is positioned as a critical practice that goes beyond aesthetic transformation, referencing art history and questioning consumer culture and environmental problems. This approach aims to provide a conceptual contribution to the sustainable art literature and to broaden the theoretical framework of upcycling-based art production.

2. Method

This study adopts a qualitative research method to examine the concepts of upcycling and artistic reproduction within the context of sustainable art. The research focuses on works by artist Jane Perkins created using recycled plastic materials; these works are analyzed in the context of sustainability, upcycling, and the reproduction of images from art history. The study consists of three stages: a literature review, an analysis, and an evaluation (Figure 1).

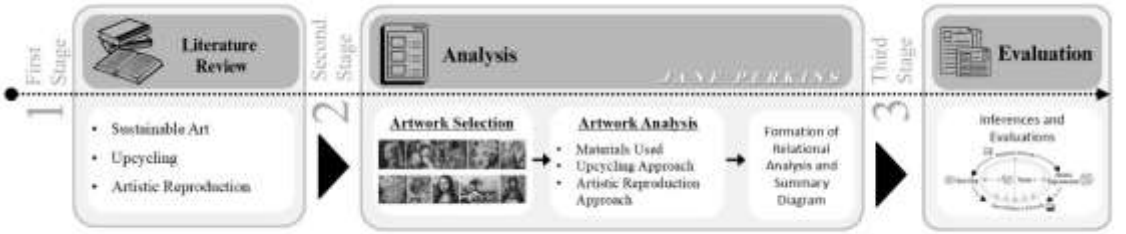


Figure 1. Stages of the study.

- **First Stage: Literature Review**

In the first stage of the research, the existing literature on sustainable art, upcycling, the use of waste materials in art, and artistic reproduction was reviewed. This stage examined the place of sustainability in art practice, the aesthetic and conceptual potential of waste materials, and theoretical approaches to the reproduction of works from art history. The literature review was conducted to establish the conceptual framework of the study and to strengthen the theoretical foundation upon which the research is based.

- **Second Stage: Analysis**

The second stage encompasses the analysis process of the research and consists of a three-stage structure in which the selected works are systematically examined according to the defined criteria.

The first step is the artwork selection phase. In this phase, works from Jane Perkins' Plastic Classics series, in which iconic works of art history are recreated using waste materials, were identified. The artist describes the Plastic Classics series with the expression "In Plastic Classics, Old Masters are given a contemporary twist," emphasizing that classic works are reinterpreted with a contemporary approach [16]. Perkins uses many plastic waste materials, such as toys, seashells, buttons, beads, broken jewelry, and the like, as long as

they have the right size, shape, and color. The Plastic Classics series consists of a total of 16 works. Within the scope of the research, the area of study was limited to 10 works. In the selection of the works, the variety of waste materials used, the fact that they were reproductions of original paintings by different artists, and their clear reflection of Perkins' upcycling approach were determined as the main criteria. Works that are similar to each other in terms of formal and material characteristics were excluded from the scope. Accordingly, a sample was created that represents the practice of upcycling and artistic reproduction, has high diversity, and allows for comparative analysis.

The second step involves the analytical phase aimed at explicating the selected artworks. In this stage, each of the ten identified works was examined within the framework of the artist's upcycling approach and artistic re-production practice. During the analysis process, the types of waste materials used in the artworks, their processes of creation, formal characteristics, and the conceptual messages they convey were evaluated. Using the visual analysis method, the works were examined in relation to the waste materials employed, the upcycling approach, and the relationship established with the original artwork. In order to conduct the analysis process in a more systematic and transparent manner, a visual analysis matrix presented in Table 1 was developed. This matrix enables an evaluation based on four fundamental parameters to examine the relationship between each of Perkins's works and the referenced original artwork. These parameters were determined as material–form relationship, color accuracy, textural contrast, and conceptual interpretation.

Table 1. Visual Analysis Matrix

Analysis Criterion	Description	Evaluation Question
Material–Form Relationship	The extent to which the waste materials used support the original artwork.	Does the work preserve the original composition or transform it? Are there any differences in the composition?
Color Accuracy	The degree to which the colors of the waste materials correspond to those of the original artwork.	To what extent are the colors and tonal values similar to those of the original work?
Textural Contrast	The extent to which the surface texture of the waste materials differs from that of the original artwork.	Does the texture create visual or physical differences? Does it add originality to the work?
Conceptual Interpretation	The intellectual and critical message conveyed by the artwork.	How does the upcycling approach strengthen the conceptual meaning of the artwork?

In the third step, a summarizing graphic was created that presented the original work, the waste materials used in the reproduction, and Jane Perkins' reproduction work together. Through this graphic, the relationship between the original work and the artistic reproduction was made visually comparable; the transformation process of the materials used and the way the work was reinterpreted were presented holistically. Thus, the aim was to present the findings of the analysis process in a clearer and more understandable way.

- **Third Stage: Evaluation**

In the final stage, based on the data obtained, Jane Perkins' works were evaluated in the context of sustainability, upcycling, and artistic reproduction. The potential of the works to transform waste materials into art objects with aesthetic and conceptual value was revealed, and the role of the practice of upcycling in raising environmental awareness was discussed.

3. Findings and Evaluation

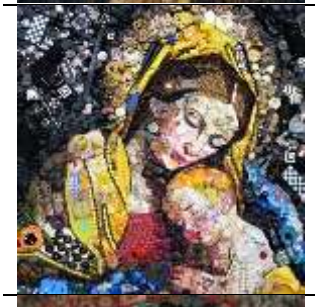
This study examines Jane Perkins' works from the Plastic Classics series, which recreate iconic works from art history using recycled materials, within the framework of upcycling and artistic reproduction approaches. Table 2 provides brief descriptions of the artist's works, which are artistic reproductions of original works by Monet, Van Gogh, Da Vinci, Hokusai, Vrubel, Vermeer, Sassoferrato, Klimt, Warhol, and Sano Pietro, along with their general characteristics and their applications to upcycling and artistic reproduction.

Table 2. Jane Perkins artwork images and analyses.

ARTWORK	ANALYSES
	1. Japanese Bridge, after Monet, 80cm x 80cm, 2011 • The artwork is a reinterpretation of Monet's "Japanese Bridge", created by upcycling waste objects such as plastic toys, buttons, and beads into an aesthetically pleasing landscape composition. • In the context of artistic reproduction, the work formally preserves Monet's depiction of nature while offering a critical reference to environmental issues through the conceptual contrast created by the plastic material.
	2. Sunflowers, after Van Gogh, 81cm x 64cm, 2014 • The artwork is a reinterpretation of Van Gogh's "Sunflowers," recreated using plastic toys and various synthetic wastes through upcycling to form flower shapes. • In the context of artistic reproduction, the work preserves Van Gogh's formal composition and color vision while establishing a conceptual contrast through the representation of a natural image using non-biodegradable plastic materials.
	3. Mona Lisa, after Da Vinci, 79cm x 71cm, 2011 • The artwork is a reinterpretation of Leonardo da Vinci's "Mona Lisa" portrait, recreated using buttons, beads, and various plastic and synthetic waste materials through upcycling. • In the context of artistic reproduction, the work preserves the facial composition and expression of the original portrait while establishing a conceptual contrast that questions the concepts of originality, permanence, and material value of the artwork through the use of everyday and seemingly worthless waste objects.
	4.The Great Wave, after Hokusai, 70cm x 56cm, 2016 • The artwork is a reinterpretation of Hokusai's "The Great Wave", recreated through upcycling plastic toys, buttons, and various waste objects into a dynamic composition. • In the context of artistic reproduction, the work formally preserves the understanding of movement and rhythm in Hokusai's original work, while offering a critical reference to environmental issues through the conceptual contrast created by the plastic material.
	5. Madonna and Child, after Vrubel, 60 x 80cm, 2020 • This artwork is a reinterpretation of Vrubel's "Madonna and Child", recreated through upcycling plastic toys, buttons, and various synthetic waste objects into a figurative composition. • In the context of artistic reproduction, the work formally preserves the figurative arrangement of the original work while offering a critical reference between the sacred theme and contemporary consumer culture through the conceptual contrast created by the synthetic material.

6. Girl with a Pearl Earring, after Vermeer, 74cm x 69cm, 2011

- This artwork is a reinterpretation of Vermeer's "Girl with a Pearl Earring", recreated through upcycling plastic toys, buttons, and various waste objects into a figurative composition.
- In the context of artistic reproduction, the work formally preserves Vermeer's figurative arrangement and understanding of light, while offering a critical reference to sustainability and environmental issues through the conceptual contrast created by the plastic material.

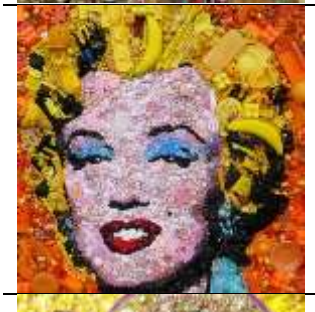


7. Madonna and Child, after Sassoferrato, 80cm x 80cm, 2017

- This artwork is a reinterpretation of Sassoferrato's "Madonna and Child", recreated through upcycling plastic toys, buttons, and various waste objects into a figurative composition.
- In the context of artistic reproduction, the work formally preserves the figurative arrangement of the original work while offering a critical reference between the sacred theme and environmental issues through the conceptual contrast created by the plastic material.

8. The Kiss, after Klimt, 80cm x 80cm, 2019

- The artwork is a reinterpretation of Klimt's "The Kiss", recreated through upcycling plastic toys, buttons, and various waste objects into a figurative composition.
- In the context of artistic reproduction, the work formally preserves Klimt's decorative and figurative arrangement while offering a critical reference to environmental issues through the conceptual contrast created by the plastic material.



9. Marilyn, after Warhol, 60cm x 60cm, 2015

- The artwork is a reinterpretation of Warhol's "Marilyn", recreated through upcycling plastic toys, buttons, and various waste objects into a figurative portrait composition.
- In the context of artistic reproduction, the work formally preserves Warhol's popular culture-based understanding of portraiture, while offering a critical reference to consumer culture and environmental issues through the conceptual contrast created by the plastic material.

10. Angel of the Annunciation, after Sano Pietro, 94cm x 74cm, 2013

- This artwork is a reinterpretation of Sano Pietro's "Angel of the Annunciation", recreated through upcycling plastic toys, buttons, and various waste objects into a figurative composition.
- In the context of artistic reproduction, the work formally preserves the figurative arrangement of the original work while offering a critical reference between the sacred theme and environmental issues through the conceptual contrast created by the plastic material.

At this stage, a summarizing graph was prepared to present the data obtained during the analysis process in a visually holistic manner. The graph was designed to present the selected original artwork, the types of waste materials used in its reproduction, and Jane Perkins' artistic reproduction work together. Thus, the

relationship between the original artwork and its reproduction, as well as the material transformation process, is made visually readable and comparable (Figure 2).

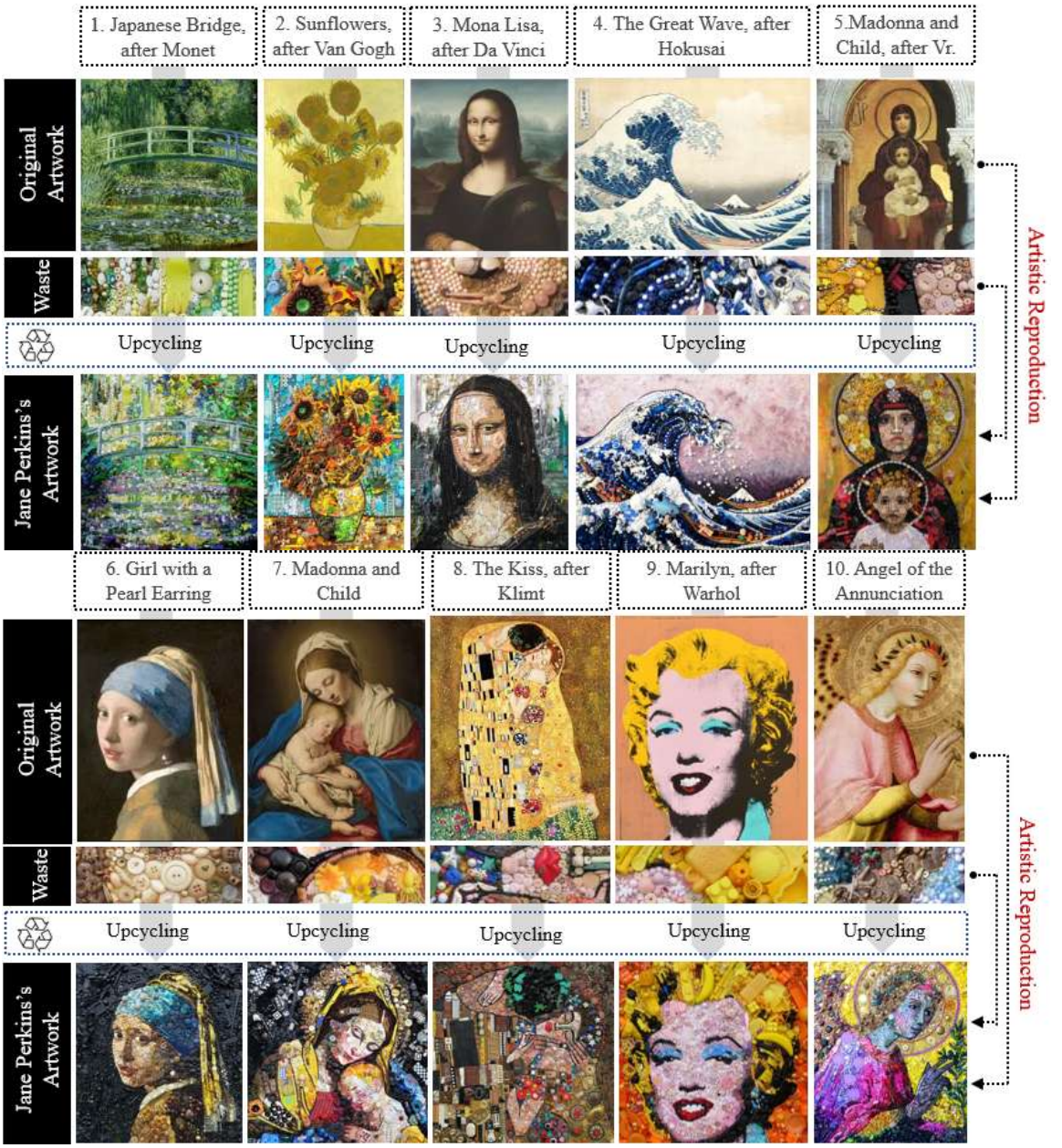


Figure 2. The relationship between original artwork and artistic reproduction.

Perkins's selected works were examined through a structured analysis matrix (Table 3). Within the framework of this matrix, the artworks were evaluated based on four principal visual and semantic parameters: material–form relationship, color accuracy, textural contrast, and conceptual interpretation. The material–form relationship refers to the role of plastic and synthetic waste materials in reconstructing the original composition; color accuracy assesses the extent to which the reproduction reflects the chromatic character of the original artwork; and textural contrast aims to reveal the visual and perceptual differences created on the surface by the materials used. The parameter of conceptual interpretation encompasses evaluations aimed at interpreting the environmental, cultural, and critical layers of meaning

generated by the materials and compositions employed in the artworks. This systematic approach enables the aesthetic and conceptual outcomes of material transformation in Perkins's works to be assessed within a comparative framework.

Table 3. Visual Analysis Matrix for Jane Perkins's Artworks

Work No.	Material–Form Relationship	Color Accuracy	Textural Contrast	Conceptual Interpretation
1	Landscape form created with plastic toys	Close to natural green tones	Hard plastic – natural surface contrast	Nature and plastic pollution
2	Flower form created with plastic fragments	Yellow–orange tones preserved	Organic flower vs. plastic surface contrast	Critique of consumer culture
3	Portrait form created with buttons	Skin and background tones preserved	Dense fragmented surface	Reinterpretation of classical art
4	Wave movement created with plastic fragments	Blue–white tones	Dynamic form – hard surface contrast	Nature and environmental crisis
5	Figurative arrangement created with plastic objects	Figure colors preserved	Fragmented surface texture	Transformation of sacred iconography
6	Portrait form created with plastic fragments	Blue and yellow tones	Rich texture with small fragments	Sustainable art approach
7	Figurative structure created with plastic objects	Blue and red tones	Fragmented surface	Sacred theme and consumption tension
8	Composition created with decorative plastic pieces	Close to golden tones	Dense fragmented surface	Transformation of decorative aesthetics
9	Pop portrait created with plastic objects	Bright contrasting colors	Glossy plastic surface	Popular culture and consumption
10	Figure form created with plastic fragments	Figure and background tones	Fragmented plastic surface	Religious iconography and environmental critique

The following conclusions can be drawn from an evaluation of Jane Perkins' Plastic Classics series of artistic reproductions within the context of upcycling, artistic reproduction, and sustainable art.

- In Perkins' artworks, plastic toys, buttons, beads, and various synthetic wastes are transformed from their original functions into art objects with aesthetic and conceptual value. This demonstrates that the upcycling approach can be used not only as a functional tool but also as an artistic and critical one.
- The artist's reproduction of iconic works from different periods of art history, such as those by Monet, Van Gogh, Da Vinci, Hokusai, Vermeer, and Klimt, reveals how the practice of artistic reproduction makes visible the relationship between historical continuity and contemporary interpretation. This approach allows for the re-reading of images from art history within the context of current environmental issues.
- In the works examined, while the original composition, figurative arrangement, and color scheme are largely preserved, the textural and conceptual contrast created by the use of waste plastic materials creates a critical awareness in the viewer. The representation of natural themes or sacred images with non-biodegradable synthetic materials produces a powerful visual discourse on environmental problems.
- The fact that the works present a sense of unity similar to the original painting when viewed from a distance, but become visible as the waste materials separate upon closer inspection, transforms the viewing experience into a multi-layered structure. This demonstrates that the artist's formal strategy consciously guides the viewer's perception.

- Perkins's upcycling practice treats waste material not merely as an alternative material, but as a narrative element that directly carries the conceptual content of the artwork. In this context, material selection becomes an integral part of the artwork's meaning-making process.
- The method of artistic reproduction reopens the discussion of fundamental concepts of art theory such as originality, value, and permanence. The transformation of seemingly ordinary and worthless waste objects into art objects presents a critical stance towards art's material hierarchy.
- Through the prepared summarizing graphic, the relationship between the original artwork, the waste materials used, and the reproduction work has been made visually comparable. This approach has more clearly revealed the conceptual structure of the upcycling process and artistic reproduction.

Jane Perkins' Plastic Classics series demonstrates a powerful intersection between upcycling and artistic reproduction within the context of sustainable art. The cyclical relationship between the original artwork, waste materials, and artistic reproduction is conceptually summarized in Figure 3. Figure 3 shows how upcycling, artistic reproduction, and sustainable art are addressed in a dynamic relationship that mutually reinforces and gains meaning together.

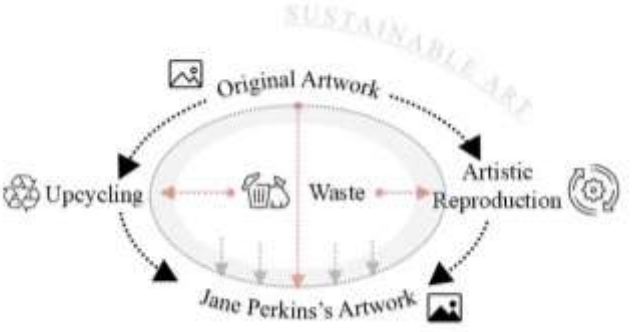


Figure 3. The relationship between upcycling and artistic reproduction in the context of sustainable art.

In Jane Perkins's artistic practice, waste is not merely a material; it is positioned as a fundamental transformative element that creates meaning between the original work and its reproduction. In this context, upcycling goes beyond being a method that enables artistic reproduction; it becomes a key component of the sustainable art concept. While artistic reproduction reinterprets images from the past in light of contemporary environmental issues, the sustainable art approach integrates this process with environmental awareness, material consciousness, and critical discourse.

4. Conclusion

This study aims to examine the aesthetic, conceptual, and critical dimensions of waste-material-based art production by considering the concepts of upcycling and artistic reproduction together within the context of sustainable art. In this regard, Jane Perkins' Plastic Classics series is evaluated as a contemporary and original example demonstrating how upcycling is integrated with the practice of artistic reproduction.

The research concluded that in Perkins' works, waste materials are not merely an environmentally friendly choice or an alternative production input; rather, they function as a fundamental transformative element that creates meaning between original artworks and their reproductions. The reproduction of iconic works from art history using plastic waste takes the upcycling approach beyond aesthetic transformation, generating a critical discourse on consumer culture, environmental destruction, and material value. This demonstrates that upcycling can be a powerful means of expression within the context of artistic production.

The preservation of the original compositions to a large extent in the examined works reveals the formal continuity of the artistic reproduction practice, while the textural and conceptual contrast created by the use of waste materials prompts the viewer to reflect on environmental issues. Thus, artistic reproduction becomes not only a reinterpretation of images from the past but also a critical space where contemporary social and ecological problems are made visible.

This study demonstrates that upcycling, when considered alongside artistic reproduction, offers a conceptual and theoretical contribution to the literature on sustainable art. Evaluations based on Jane Perkins' works show that art production based on waste materials not only raises environmental awareness but also opens up a critical space for discussion on art history, the concept of originality, and consumer culture. In this context, it is believed that the study will provide a theoretical foundation for future research on contemporary art practices based on upcycling.

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SUSTAINABLE INTERIOR SPATIAL CONFIGURATION IN THE CONTEXT OF LOCAL MATERIALS AND SPATIAL CONTINUITY: THE CASE OF PALANGA K HOUSE

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Abstract
The Palanga Art and Architecture Farm (PSMÇ) constitutes a highly distinctive spatial and intellectual experimental environment in Türkiye, bringing together the concepts of architecture, art, nature, and production. Beyond functioning merely as a "farm" or a "campus," it stands out as a platform where architectural practice intersects with nature, craftsmanship, material culture, and academic research. One of the project's most defining characteristics is its transformation of local materials, craftsmanship, and sustainable construction techniques into a contemporary architectural language. The buildings produced within this framework, designed by leading architects in Türkiye, present tangible examples of an architectural approach that minimizes environmental harm and, in some cases, allows built forms to reintegrate into natural cycles.
The Palanga settlement represents an exemplary formation that bridges local knowledge and contemporary architecture, embodying an experimental and environmentally responsive design approach. Located in the northeastern region of Türkiye, the Palanga Art and Architecture Farm functions as a laboratory for experimental rural architecture and sustainable design. The farm accommodates structures serving diverse functions, including the KA House, Poultry House, Goat Shelter, Cow Barn, Calf Shelter, and Semi-Open Cattle Fattening Facility. These projects were designed in response to local climatic conditions, topography, animal- and human-centered spatial requirements, and the use of durable, long-lasting materials. Design strategies adopted throughout the project include the pursuit of sustainable solutions, adaptation to existing conditions, the use of natural materials, the integration of traditional stone–earth–wood craftsmanship as construction techniques, collaboration with local artisans to generate collective knowledge, cooperation with academic partners, material testing, and the continuous questioning of technical decisions. This study focuses on examining the KA House within the Palanga Art and Architecture Farm in the context of sustainability.

***Keywords**: Sustainable Architecture, Rural Structures, Palanga Art and Architecture Farm, Ecological Design.*

1. Introduction

Mehmet Ali Bey Palanga was established in Erzincan in 1888 by the grandfather of artist Kutluğ Ataman. Today, the site has been re-envisioned as the Palanga Art and Architecture Farm, conceived as an experimental environment that explores the interrelations between art, architecture, nature, and production. While reactivating the family-owned land for agricultural and livestock purposes, Ataman also initiated the design of a residential structure that would allow him to retreat, develop screenplays, and occasionally host guests. This residential unit was complemented by a series of facilities enabling the farm to meet its own functional needs.

In addition to the KA House, the site includes structures such as goat, cow, calf, and cattle shelters, as well as a poultry house. Developed with sustainability as a guiding theme, all architectural structures constructed within the scope of the project demonstrate a deliberate and consistent emphasis on sustainable design principles.

2. Materials and Methods

The primary material of this study is the Palanga Art and Architecture Farm (PSMÇ), established in Erzincan. The farm comprises a series of buildings that exemplify sustainable architectural practices, within which production spaces, social and commercial relations, as well as art and architecture, are considered as an integrated whole.

The study draws upon a variety of sources, including site data belonging to the farm, architectural drawings such as plans and sections, and project documentation obtained from the archives of architectural offices that contributed to the project through their works. In addition, previously published academic articles, news reports, seminars, press materials, and digital resources related to the subject have been utilized as part of the literature review.

Within the scope of this research, the buildings located at the Palanga Art and Architecture Farm were evaluated based on sustainability criteria. A qualitative research methodology was adopted, employing documentation analysis derived from literature review, interviews, and on-site observational studies. Based on the collected data, the study presents an assessment of how the concept of sustainability is embodied not only in the architectural formation of the farm but also in the social and commercial practices that enable its continuity and long-term viability.

2.1. The Concept Of Sustainability and The Palanga Art and Architecture Farm (Pmçs)

The concept of deep ecology, introduced in the early 1970s by Norwegian environmental philosopher Arne Naess, advocates that all living beings in nature possess equal value within the Earth's delicate ecological balance (Toker, 2020). According to this perspective, humans are not positioned at the center of nature but are instead an inseparable part of it.

In architecture, the relationship between buildings and nature extends beyond their immediate physical surroundings. The life cycle of a building—from the initial conceptual phase through design, construction, use, and ultimately demolition—entails continuous interaction with the natural environment. The primary objective within this interaction is to minimize environmental harm while ensuring the most efficient use of available resources. (Aran, 2000)

Due to its emphasis on renewable energy sources and its balanced relationship with the environment, this approach has gained widespread support in contemporary discourse. Consequently, the concept of sustainable architecture has become an inevitable outcome of modern architectural design processes. Considering that the building industry is responsible for approximately 35% of global greenhouse gas emissions, the importance of energy-efficient design becomes even more evident. However, sustainable architecture should not be limited solely to energy efficiency; rather, it must be understood as a multi-layered approach encompassing environmental, social, and cultural responsibilities.

The fundamental aim of sustainable architecture is to produce long-lasting, self-sufficient buildings by incorporating climatic, technological, and cultural data specific to their context across design processes ranging from macro to micro scales. Through the use of local materials, natural resources, and appropriate infrastructure, this approach promotes an architectural paradigm that replaces short-lived, environmentally harmful buildings with structures that are environmentally responsive, resilient, and sensitive to user needs. In doing so, it enables the creation of energy-efficient, environmentally integrated living environments that remain viable for future generations.

Within this framework, the Palanga Art and Architecture Farm (PSMÇ) stands out as a distinguished example of sustainable architectural practice in Türkiye. Palanga is not merely a production-oriented farm; it is an experimental ecosystem in which nature, architecture, craftsmanship, and art coexist. Architectural production within the site prioritizes the use of local materials. Designs incorporating stone, timber, compressed earth, and similar materials are reinterpreted through contemporary construction techniques, representing a sustainable architectural approach in which craftsmanship and local knowledge are actively integrated into the building process (Ataman, 2018).

2.1.1. KA House

This settlement was constructed on a site near Erzincan inherited by an artist engaged in film production, and was designed to accommodate both personal use and seasonal residency for artists and other users. The project was conceived as a retreat that allows the artist to engage in agriculture and animal husbandry while also providing a focused environment for creative work. In parallel, an independent studio/room for international artists was incorporated into the program. In this context, the notion of "home" extends beyond a place that merely fulfills daily needs and provides shelter, evolving instead into a dynamic and adaptive environment that continuously redefines itself in response to its users and modes of occupation.

Fig. 1. KA house interior (Erginoğlu&Çalışlar,2017).

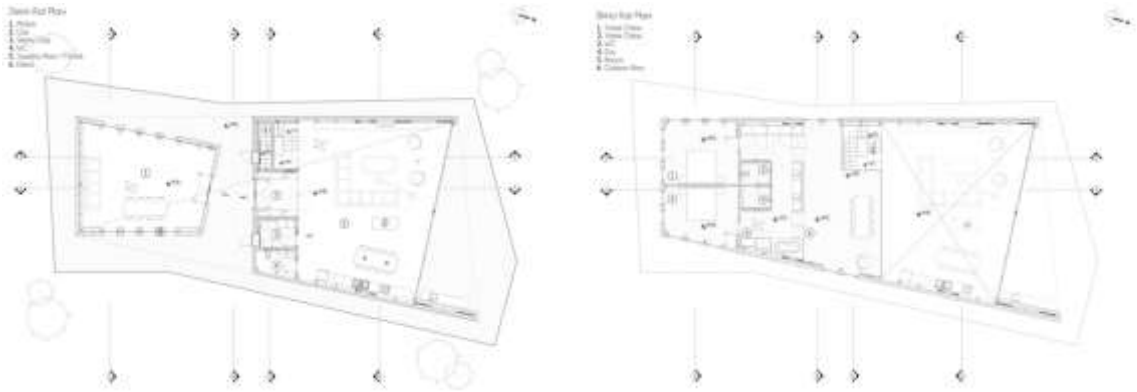

Fig. 2. KA house plan (Erginoğlu&Çalışlar,2017).

Fig. 3. KA House (Erginoğlu&Çalışlar, 2017).

Sustainable architecture is an approach that ensures the continuity of its existence by responding to the conditions of its context while prioritizing the needs of future generations through the use of sustainable and renewable materials. It embodies a design philosophy that is respectful of both the environment and human well-being, integrating health and comfort within the built environment. As the first architectural outcome of the Palanga Project, KA House is situated within a densely wooded landscape, in a location isolated from the urban fabric. The building commands panoramic views of the Munzur Mountains, particularly at sunset.

In the residence designed by Erginoğlu & Çalışlar Architects, maximum privacy was identified as a primary design criterion, with particular emphasis placed on ensuring that both outdoor spaces and interior environments remain visually shielded from the surrounding context and nearby inhabitants.

KA House was designed as a spatial manifestation of a film director's aspiration to integrate artistic practice with rural living. As the client expanded his engagement into agriculture and animal husbandry, the project emerged on a rural site inherited from his family, conceived as a multi-functional living environment accommodating residential use, retreat, and artistic production. The inclusion of an independent studio/guest unit capable of hosting international artists on a temporary basis reflects a sustainability-oriented approach that extends beyond individual use toward shared, production-driven spatial practices.

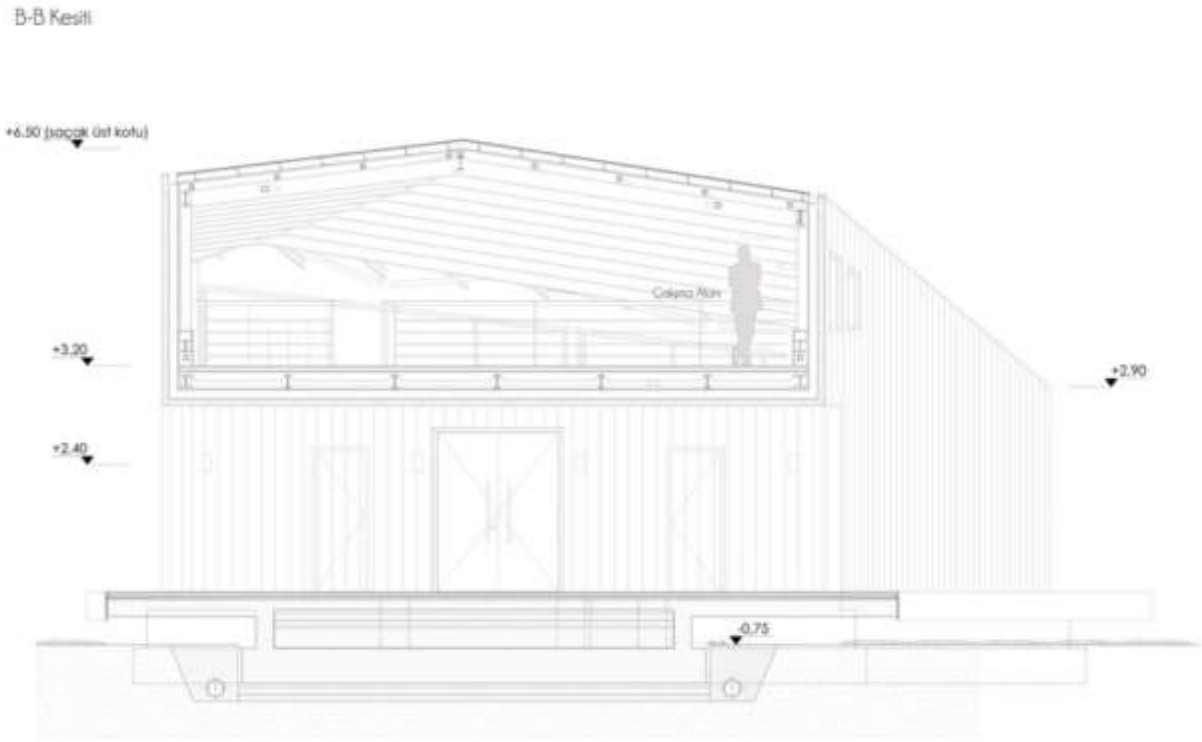

Fig. 4. KA House Section B-B (Erginoğlu&Çalışlar, 2017).

Situated within a densely wooded landscape and largely isolated from immediate environmental and social disturbances, KA House is positioned to command expansive views of the Munzur Mountains. The building's placement was informed by topography, prevailing wind directions, solar orientation, and the existing natural fabric, ensuring that its relationship with the site adheres to principles of minimal intervention. The preservation of the natural landscape and existing vegetation constitutes a fundamental component of the project's environmental sustainability strategy.

Privacy was addressed not solely as a social requirement but as a design parameter supporting energy efficiency and spatial comfort. Through an inward-oriented spatial organization, controlled openings, and the use of landscape as a natural buffer, visual isolation was achieved while simultaneously regulating wind exposure, solar gain, and heat loss. These strategies enabled the building to be supported by passive climatic design principles.

Given the site's limited accessibility in relation to the urban center of Erzincan, the selection of the structural system became a critical design decision. The building was therefore designed with a steel structural system, with components fabricated in a controlled factory environment and assembled on site. The use of prefabrication and dry construction techniques reduced material waste, shortened construction time, and minimized the environmental impact of the building process. Dry construction systems employed in the exterior walls and roof further enhanced the building's potential for disassembly and reuse, contributing to its long-term structural sustainability.

The collective memory shaped by the devastating earthquakes experienced in Erzincan in 1939 and 1992 played a significant role in informing the project's design approach. Seismic safety was considered not only as an engineering necessity but also as an integral aspect of the users' psychological relationship with the building. By allowing the steel structure to remain visible within the interior spaces, the project reinforces a perception of structural robustness while establishing a transparent and legible architectural language that strengthens the studio-house identity. This strategy can be interpreted as a spatial response addressing social and psychological dimensions of sustainability.

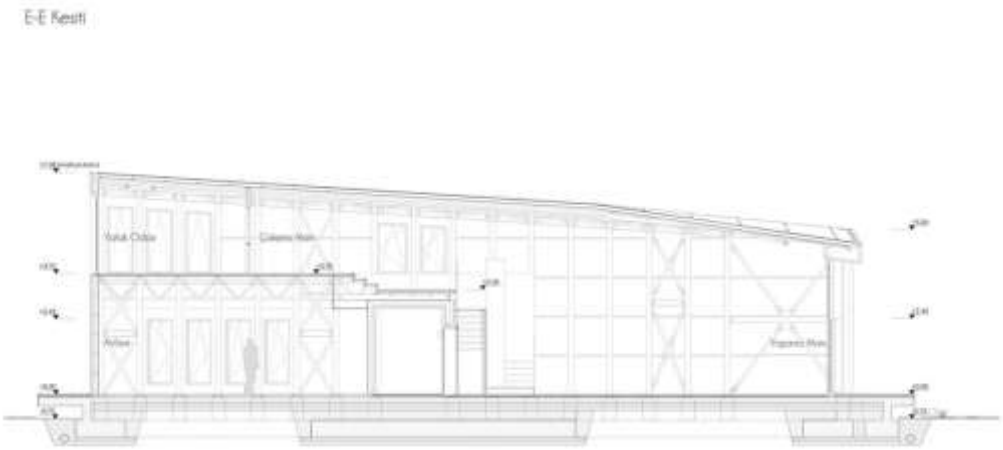

Fig. 5. KA House Section E-E (Erginoğlu&Çalışlar, 2017).

Although conceived as a single volumetric entity, the building accommodates a spatial organization in which residential and studio functions are both distinctly separated and carefully interconnected. The studio unit is accessed through an independent entrance, supporting flexible patterns of use and enabling the coexistence of different user profiles. Entrances unified beneath a shared canopy and a semi-open void introduced at the center of the volume facilitate protected transitional spaces in response to local climatic conditions. In particular, this configuration ensures continuity of use during Erzincan's harsh winter months while maintaining the perceived depth and openness of the site. Such spatial strategies align closely with passive design principles aimed at reducing energy consumption.

In the interior design, emphasis was placed on the reuse of existing resources and the personal narrative of the owner. Ceiling medallions salvaged from the family's former house were reintroduced into the new interior, while selected works from the owner's art collection were integrated into the spatial composition. These choices support cultural and material sustainability, enabling the building to attain a timeless character and fostering a strong sense of user attachment and continuity.

Fig. 6. KA House Living Area (Erginoğlu&Çalışlar, 2017).

3. Limitations Of The Study

High-tech and prefabricated building systems are frequently addressed within sustainability debates due to their technical advantages in construction processes (Kibert, 2016; Guy & Farmer, 2001). However, the application of these systems in remote and rural contexts involves a range of contextual and spatial limitations. In regions where transportation and supply infrastructures are limited, the delivery and assembly of prefabricated components can generate additional environmental and economic burdens. Moreover, the reliance of such systems on externally dependent production processes tends to weaken their relationship with local labor practices and traditional construction knowledge.

In addition, high-tech systems often require specialized equipment, spare parts, and technical expertise, making long-term maintenance and repair processes particularly challenging in rural settings. This situation increases the building's dependency on external resources throughout its life cycle (Kibert, 2016). As exemplified by the Palanga K House, spatial configurations based on local materials and low-tech construction approaches strengthen the building's relationship with its environment and redefine sustainability through spatial continuity and contextual integration.

Standardized building components and industrial materials frequently fail to fully align with local climatic conditions, regional material availability, and notions of spatial continuity. This misalignment can limit the building's capacity for transformation through local interventions over time and restrict the understanding of sustainability as a long-term and adaptive process.

Furthermore, systems based on standardized modular configurations may constrain spatial transformations and incremental interventions that respond to changing user needs over time (Guy & Farmer, 2001). However, the design solutions developed within the building enable a reinterpretation of these limitations in terms of spatial experience and sustainability.

4. Conclusion

This study has examined the role of local material use and spatial continuity in the sustainable interior design of the Palanga K House. The findings indicate that sustainability should not be understood solely as a technical issue related to structural performance or energy efficiency, but rather as a multi-layered approach that integrates material selection, spatial organization, and user experience within interior architecture.

In the Palanga K House, the explicit and restrained use of local and natural materials within the interior contributes both to the reduction of environmental impact and to the strengthening of spatial identity. The continuity of materials across structural elements, surfaces, and built-in furnishings establishes a visual and physical coherence that reinforces spatial continuity. This continuity enables a more fluid relationship between interior and exterior spaces, enhancing the interaction between the user and the surrounding environment.

Moreover, the spatial configuration examined in this study supports flexible patterns of use and offers simple yet effective solutions that accommodate everyday life. In this respect, the interior design of the Palanga K House highlights the social dimension of sustainability by fostering adaptability, longevity, and meaningful engagement with space. The project demonstrates how local building culture can be reinterpreted through a contemporary architectural language, positioning interior design as an active contributor to sustainability discourse.

In conclusion, the Palanga K House illustrates that when local materials and spatial continuity are addressed in an integrated manner, it is possible to produce sustainable living environments that are environmentally responsive, culturally grounded, and spatially coherent. This approach offers a valuable reference model for contemporary residential projects, particularly within rural contexts.

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Erginoğlu&Çalışlar Mimarlık Tasarım Merkezi Arşivi.

DECODING URBAN UNCANNINESS THROUGH A VISUAL GROUNDED THEORY APPROACH: THE CASE OF BALAT-FENER

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Abstract
Urban space operates as a multilayered field of sensory, cognitive, and affective encounters. Within this dynamic field, moments of disruption and estrangement can transform the familiar into the uncanny, producing perceptual instability and bodily unease. This study examines how such abstract and affective experiences of urban uncanniness can be rendered visible and interpretable through user-generated visual and verbal data. It proposes an analytical framework that combines Photovoice as a participatory method of data collection with Visual Grounded Theory (VGT) as an inductive approach to analysis. Designed as a qualitative case study, the research focuses on the Balat–Fener district of Istanbul, a context marked by overlapping historical layers, social contradictions, and visual tensions between the old and the new. The analysis was conducted across two main layers: the Spatial/Representational Layer (G1), which examines the visual and spatial conditions that produce the uncanny, and the Experiential/Semantic Layer (G2), which addresses participants' emotional and interpretive responses. Through iterative coding and comparison, five interrelated categories producing the experience of urban uncanniness were identified: spatial estrangement, perceptual blockage, vertical displacement, temporal decay, and public intimacy. The urban uncanniness emerges at moments when visual, spatial, and social continuity breaks down—when familiar environments become fragmented through obstructed views, shifting ground levels, material deterioration, and the exposure of private life to the public gaze. Synthesizing these findings, the core category—Disrupted Spatial Experience—conceptualizes uncanniness as a multi-layered rupture in spatial continuity, in which seeing, moving, and inhabiting no longer coincide. By translating subjective urban experiences into analyzable visual indicators, the combined use of Photovoice and VGT demonstrates how uncanniness can function both as an experiential condition and as an analytical lens, revealing the affective forces that shape urban perception.
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Key Words: *Uncanny; visual grounded theory; photovoice; urban experience; case study*

1. Introduction

Urban space, beyond being a physical environment, is a complex field of experience where sensory, cognitive, and affective encounters occur. Although these encounters may take place in routine, familiar, and predictable ways, there are moments when space becomes "uncanny" through the estrangement of what is familiar. This feeling, conceptualized by Sigmund Freud [1] as "unheimlich *(the uncanny)*", disrupts the known order of space and produces a bodily and perceptual tension within the individual. This study examines how the abstract concept of the urban uncanny can be rendered visible and intelligible through citizen-generated data, thereby demonstrating the potential of the uncanny to be approached as a concrete phenomenon through visual indicators produced by the urban gaze.

The concept was first introduced by the German psychiatrist Ernst Jentsch [2], who described the uncanny as a feeling of discomfort that arises when a person encounters an unfamiliar or ambiguous situation that cannot be easily understood, thus producing a sense of not being "at home." Building on this perspective, Freud [1] defined it as both the moment when something familiar suddenly becomes strange and disturbing, and the unsettling emergence of what has been hidden or repressed, creating insecurity and unease in the subject. In the context of architecture, this concept has been concretized through the manipulation of architectural components such as void, light, and borders, as well as through the relationship between space and urban fabric, historical layers and cinematic narratives [3], [4], [5]. In this study, the uncanny operates simultaneously as a phenomenological framework for interpreting sensory

urban experience and as an analytical lens applied to visual indicators through Visual Grounded Theory, enabling its translation from an abstract affective state into a spatially traceable mode of analysis.

Accordingly, this study seeks to address the following question: *"What spatial and visual indicators lead to the emergence of the uncanniness in urban experience, and how can these indicators be analyzed through user-generated visual data?"* Designed as a qualitative case study focusing on user-based urban experience, the research employs the "Photovoice" technique to generate visual data related to the uncanny, which are subsequently analyzed through Konecki's [6] "Visual Grounded Theory" approach. During their free explorations along the Balat–Fener axis in Istanbul, participants photographed spaces in which they perceived experiences of the uncanny, translating an abstract affective state into a system of visual indicators. Each photograph was examined in a multi-layered manner using the "Multi-Slice Imaging" technique, which takes into account the content of the visual data and how and why it was produced. Consequently, the study aims to offer original conceptual and analytical insights into the spatial and visual components associated with the uncanny, while introducing a new methodological possibility to the literature by proposing an approach for interpreting urban uncanniness through visual data.

2. Method

Qualitative analyses generally evolve through the organization and interpretation of data gathered from multiple sources into themes, and through the presentation of findings using visual and/or verbal methods [7], [8], [9], [10]. This study is based on a qualitative research design that examines the perception of uncanny in urban experience through a user-centered data production process and an inductive data analysis approach. Methodologically, the research is structured as a case study conducted along the Balat–Fener, employing "Photovoice" technique for data collection and "Visual Grounded Theory (VGT)" for data analysis (Figure 1).

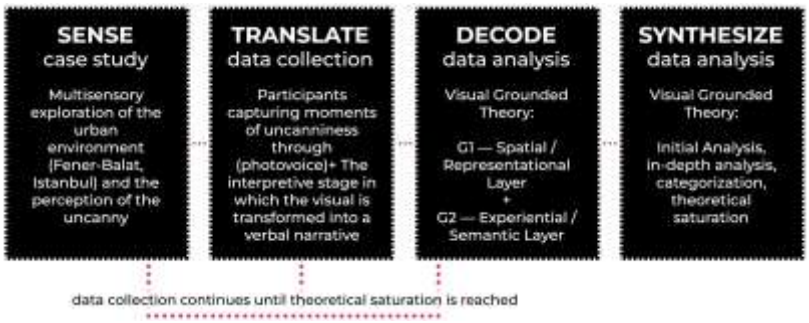

Fig. 1. Research flow (Produced by the author)

2.1 Research Approach: Case Study

The Balat–Fener in Istanbul is taken as the primary research area. This district represents an urban fabric where historical, cultural, and sociopolitical layers intersect, and where processes of touristic transformation collide with established social structures. This configuration enables the space to produce representations that are concurrently inviting and exclusionary, generating threshold conditions with high potential for the emergence of uncanny experiences. Therefore, this study selects this area as its research site in order to investigate the spatial and visual indicators of uncanniness in situ and through user-based experiential engagement.

2.2 Data Collection: Photovoice

Data collection aims to reveal the dimensions of the uncanny by generating visual-verbal data that articulate and explain the experience of uncanniness from the user's perspective. Urban experience is inherently multisensory and multilayered, shaped through the simultaneous interaction of visual, tactile, and bodily inputs [11], [12]. In this research, visual experience is conceptualized as the primary threshold that triggers the emergence of uncanniness and transforms the subject's spatial orientation.

The increasing use of visual materials in qualitative research reflects a broader paradigmatic shift in the social sciences—one that incorporates multiple forms of data beyond the textual. Glaser and Strauss's [13] principle that "all is data" provides a foundation for the idea that all forms of representation, whether visual

or verbal, can serve as valid sources for theorizing social and spatial phenomena. The inclusion of non-textual data in research broadens the interpretive capacity of qualitative inquiry by enabling urban experience to be examined in embedded ways. Photovoice is a participatory technique that allows participants to express their experiences and perspectives through photography [14], [15]. Individuals involved in the study are asked to capture images related to the research theme. After that, they could share these photographs with others during group discussions or individual interviews and narrate the meaning or story behind each image in their own words.

Participants photographed moments and places along the Balat–Fener where they experienced feelings of uncanniness during an open-ended urban exploration. Each photograph was supported by a brief interview, focusing on aspects such as the impulses that drove participants to capture specific frames, the bodily reactions they experienced during the spatial encounter, and the meanings or ambiguities concealed within the photographs. While the study does not seek to reduce urban experience solely to the visual, it aims to theorize the uncanny through the critical moment of visual rupture.

2.3 Data Analysis: Visual Grounded Theory

Grounded theory is an iterative qualitative research method that aims to develop concepts, categories, and theoretical explanations based on empirical data [16]. The visual and verbal data collected in this study were analyzed using the Visual Grounded Theory (VGT) approach developed by Konecki [6], which integrates visual data into the Grounded Theory (GT) methodology.

2.3.1 Multislice Analysis

Within the framework of Visual Grounded Theory, the Multislice Imagining steps constitute a four-stage framework for analyzing the layered structure of visual data [6]. It contends that every image is a process that necessitates several readings in various situations and consists of the examination of the act of creating the visual (Slice A), the observation of the process of sharing or presentation of the visual (Slice B), the analysis of the formal and content-related structure of the resulting visual product (Slice C), and the evaluation of how this visual is perceived by the viewer (Slice D). These "data slices" include the context, function, and performative quality of each image in the analytical process [6].

Konecki's [6] four-stage Multislice Imagining approach was adapted to the analysis of the deconstruction of the uncanny experience and restructured in two main dimensions (Table 1):

- G1 – Spatial / Representational Layer: Formal, content-related, and spatial analysis of the images identifies the visual clues that cause the uncanny.
- G2 – Experiential / Semantic Layer: The affective and interpretive transformation experienced by the subject from the moment of taking the photographs to their reinterpretation is examined.
-

Table 1. Adaptation of the "Multislice Imaging" stages to the case study (Adapted from [6])

Data slice	Focus Point (Multi-Slice Imaging)	Data Type	Implementation in the Case Study
G1 — Spatial/ Representational Layer	Visual product and its content (Slice C)	Visual data	Spatial cues in the photographs
G2 — Experiential/ Semantic Layer	Act of creation (Slice A) + Presentation/Communication (Slice B) + Reinterpretation (Slice D)	Verbal data	The meaning relation established by the participant while taking the photograph and conveying it to the researcher

2.3.2 Theoretical Development

In the initial analysis phase, visual and verbal data are labeled through open coding to establish the foundational concepts of the analytical process. At this stage, the analysis moves gradually from concrete descriptions toward more abstract conceptual indicators. In parallel, memo writing accompanies the process, systematically recording contextual observations and theoretical reflections to uncover the underlying meaning relations within the data. As the study progresses to the categorization stage, comparative analysis of the visuals enables the identification of a "core category" that forms the conceptual backbone of the research. Finally, during the stage of theoretical saturation, additional visual data may be purposefully collected to address emerging conceptual gaps and to ensure that the categories attain sufficient depth and stability within the analytical framework [16].

3. Case Study

This section presents the findings obtained from the analysis of the visual and verbal data produced during the case study conducted along the Balat–Fener axis, using the Visual Grounded Theory (VGT) approach. Each photograph was analyzed both in terms of spatial indicators (G1: Spatial/Representational Layer) and affective themes derived from participant narratives (G2: Experiential/Semantic Layer).

The case study area is located in the Fener–Balat district, situated on the northeastern edge of Istanbul's historical peninsula. It extends along the coastal line defined by Abdülezelpaşa Street and Ayvansaray Street, encompassing the area around the Phanar Greek Orthodox College to the north. The area was not delineated by fixed boundaries; instead, it was conceived as an open-ended urban territory shaped by the participants' free exploration routes. Eight participants (four females, four males; ages 25-55) who live in Istanbul, do not reside in the Balat-Fener district, but have visited the area in the past participated in the study. Each participant photographed spaces that evoked a sense of uncanniness during their free exploration walks and took part in a brief photo-elicited interview for each photo. Since the study followed an inductive approach grounded in the principles of Visual Grounded Theory, data collection continued until conceptual saturation was reached—when no new categories emerged from the analysis. At this point, the dataset comprised 80 photographs produced by eight participants, which were sufficient to establish recurring patterns and achieve theoretical depth.

Each photograph was coded separately in terms of its spatial representational strategies and experiential narratives. Then, intersections among themes were identified to derive the core category related to the indicators of urban uncanniness. Below, the analysis of sample visuals are presented (Table 2; Table 3; Table 4; Table 5; Table 6). "P01_V01" denotes the initial photograph shot by Participant 1, since "P" stands for the participant and "V" for the visual.

Table 2. Sample analysis/ P01_V01 (Produced by the author)

Fig. 2. P01_V01

G1: Spatial/Representational Layer		
No	**Description of the photo by researcher**	**Open codes**
1	The photograph frames a descending brick pathway between two weathered walls, leading the eye toward a distant urban panorama.	visual containment; directed gaze; controlled movement
2	There are barbed wires on top of the walls on the right and opposite sides.	visual blockage; confinement; vertical tension; control
3	The left wall is covered with bricks and partially hidden by dense vegetation.	organic intrusion; edge dissolution; material blending
4	The pathway is composed of red and white bricks, some cracked, displaced, or missing.	surface irregularity; material fatigue; aesthetic decay
5	No human figures are visible in the frame.	absence of presence; atmospheric stillness
6	The brick pavement shows areas of darker staining, likely from moisture or use.	trace of use; environmental impact; temporal layering
7	The photograph is taken from an eye-level viewpoint, slightly tilted downward, following the slope of the path.	camera angle; bodily viewpoint
8	The walls create a corridor-like space where the visual field is restricted laterally.	enclosure; spatial compression; confinement
9	The path narrows perceptibly toward the end, limiting the view of what lies beyond.	visual blockage; ambiguity; spatial compression
G2: Experiential/Semantic Layer		
No	**Participant statement**	**Open codes**
1	"I remember slowing down here—the path felt like it was closing around me."	spatial compression; bodily hesitation
2	"While I was walking down, I couldn't see the end—it made me uneasy."	visual blockage; ambiguity

3	"I took the photo quickly, almost instinctively."	spontaneous act; embodied perception
4	"The graffiti was one of the first things I noticed—it seemed like a trace of someone."	urban marking; human absence
5	"When I saw the photo later, I realized how empty the street felt."	delayed recognition; emptiness, human absence
6	"The air was colder here, maybe because of the walls—I felt detached from outside."	sensory contrast; environmental isolation

Table 3. Sample analysis/ P02_V04 (Produced by the author)

Fig. 3. P02_V04

G1: Spatial/Representational Layer

No	Description of the photo by researcher	Open codes
1	The photograph captures a corner space where a rough, patched wall meets a grey façade with a red door.	spatial junction; material contrast; visual anchoring
2	The old wall shows exposed bricks beneath layers of cracked plaster and cement repair.	temporal layering; erosion trace; environmental impact
3	A handwritten sign in white paint on a black patch reads "ÇIKIŞ VAR → (THERE IS AN EXIT)".	textual intervention; spatial instruction
4	A piece of pink artificial vine or flower hangs loosely against the rough wall surface.	artificial nature; color anomaly; playful intrusion
5	A small table beneath the flower holds used cups, bottles and straws.	residue of activity; domestic trace; trace of use

G2: Experiential/Semantic Layer

No	Participant statement	Open codes
1	"I paused because the phrase 'THERE IS AN EXIT' seemed ironic; it seemed like there really wasn't a way out and that must be why they had to write it."	spatial entrapment; bodily hesitation; textual dissonance
2	"Those empty cups made me think someone had just been here, but no one was around."	trace of absence; latent human presence; temporal disjunction
3	"The space felt intimate but strangely exposed, like a leftover corner of someone's life."	spatial intimacy; affective residue; domestic uncanny
4	"I felt like I had walked into a scene after it ended."	absence of presence; frozen temporality
5	"It felt as if I had entered someone's home or kitchen, yet I had only turned a corner and found myself here."	boundary confusion; spatial displacement; familiar estrangement

Table 4. Sample analysis/ P04_V05 (Produced by the author)

G1: Spatial/Representational Layer

No	Description of the photo by researcher	Open codes
1	The photograph captures a narrow cobblestone street turning sharply around a massive stone wall in the foreground.	directional redirection; transitional passage; directed gaze
2	The foreground wall is rough, made of irregular stones and red brick fragments.	material erosion; temporal layering; tactile decay
3	Beyond the curve, a monumental historical building rises under warm light.	architectural dominance; historical monumentality; temporal contrast
4	The red façade, illuminated by the setting sun, contrasts sharply with the shadowed stones in the foreground.	chromatic tension; light polarity; visual drama
5	The building's towers and battlements evoke a	defensive imagery; symbolic power

Fig. 4. P04_V05

	fortress-like silhouette.	
6	The mid-ground wall conceals part of the façade, allowing only a partial, framed view of the building.	partial visibility; framed revelation
7	The street is empty; no figures are visible.	absence of presence; suspended stillness; deserted urbanity
8	The image has a vertical orientation emphasizing the towering scale of the background structure.	vertical dominance; hierarchical contrast
G2: Experiential/Semantic Layer		
No	**Participant statement**	**Open codes**
1	"The space was silent, but the building felt alive, like it was observing."	ambient silence
2	"It felt like the past was staring back at me from that façade."	historical gaze; temporal haunting
3	"The building evokes different feelings when seen from different angles — it's a very intriguing structure."	affective multiplicity; dynamic encounter; aesthetic intrigue
4	"Although it's quite a touristic place, I felt different when I walked to this side of the building. I think the position of the stone walls and the point from which I viewed the building evoked that feeling."	spatial reorientation; situated perception; unexpected mood transition; latent atmosphere

Table 5. Sample analysis/ P06_V03 (Produced by the author)

Fig. 5. P06_V03

G1: Spatial/Representational Layer		
No	**Description of the photo by researcher**	**Open codes**
1	The photograph was taken looking down a very sloping street and offers a very wide view of the surroundings.	spatial compression; vertical tension; directed gaze
2	The façades show rhythmic yet irregular repetition; laundry hangs between the windows.	formal repetition; rhythmic irregularity; traces of everyday life
3	Colors are vivid but surfaces show peeling paint, rust, tangled cables, and satellite dishes.	surface decay; temporal layering; aesthetic tension
4	A crowd moves along the street.	anonymous crowd; movement; transience
5	The modern skyline across the water contrasts sharply with the historic texture in the foreground.	visual blockage; anticipatory tension
G2: Experiential/Semantic Layer		
No	**Participant statement**	**Open codes**
1	"While walking here, I felt the buildings leaning toward me."	spatial pressure; bodily constriction; sensory tension
2	"The colors look cheerful at first, but the longer you look, the more tired they feel."	superficial renewal; repressed history
3	As I was climbing the hill, I looked back for a moment and realized how high above sea level I had climbed, and for some reason I felt uneasy, and I was also very tired.	loss of orientation; body–space tension; spatial estrangement
4	"It's such a touristic place, yet when you look up, you see laundry hanging above. It feels as if we've entered someone's home — but not just me, hundreds of people.	public-private; spatial intrusion; contrast

Table 6. Sample analysis/ P07_V06 (Produced by the author)

Fig. 6. P07_V06

G1: Spatial/Representational Layer		
No	**Description of the photo by researcher**	**Open codes**
1	The photograph depicts a narrow cobblestone street descending between two old walls.	spatial constriction; descending perspective; confined passage
2	At the end of the street, a block of red-brick residential buildings closes the view.	visual blockage; architectural closure; spatial termination
3	The buildings have symmetrical windows with metal bars.	architectural dominance; repetitive rhythm; surveillance motif; containment
4	There are no human figures present in the scene.	absence of presence; still urbanity; suspended moment
5	The narrow perspective and the blocked view together generate a sense of halted motion.	visual blockage; anticipatory tension
6	The mid-ground wall conceals part of the façade, allowing only a partial, framed view of the building.	partial visibility; framed revelation
7	The street is empty; no figures are visible.	absence of presence; suspended stillness; deserted urbanity
G2: Experiential/Semantic Layer		
No	**Participant statement**	**Open codes**
1	"Although the buildings share the same shape along the slope, the openings on the façades are irregular, which creates a strange feeling."	formal repetition; structural deviation; cognitive dissonance
2	"The buildings looked almost identical—like copies of each other, but they were not."	architectural repetition; loss of individuality; ambiguity
3	"It's a residential area, but it felt strangely empty, like life was paused."	inhabited absence; temporal stillness; latent domesticity
4	"The slope made it hard to see what's ahead."	perceptual obstruction; directional suspense

4. Findings

Across the dataset of 80 photographs produced by participants, the analysis proceeded through three iterative cycles: initial open coding of G1 and G2, constant comparison across visuals, and the inductive development of categories. In this section, the focus is on how recurring intersections between spatial indicators and affective themes were synthesized into conceptual categories that decode urban uncanniness.

4.1 Initial Analysis

At the first stage of analysis, the photographs were examined as G1 (Spatial/Representational Layer), while the participants' accompanying verbal accounts were treated as G2 (Experiential/Semantic Layer); both layers were coded through an open-coding process. Uncanniness emerged within the Spatial/Representational layer (G1), through constricted areas, downward slopes, irregular facade repetitions, obstructed views, hybrid textures combining old and new materials, and scenes filled with traces of human presence yet devoid of people. These indicators disrupted the perceptual continuity of space, producing a suspended atmosphere. Within The Experiential/Semantic layer (G2), this condition manifested as participants' feelings of bodily tension, isolation, and perceptual uncertainty in narrow or sloping spaces. The coexistence of human traces and emptiness generated a sense of temporal disjunction, while shifts in direction or perspective were noted to abruptly alter the emotional tone of space.

Together, these two layers reveal how the uncanny materializes at the intersection of visual form and affective resonance—how the urban environment simultaneously *shows* and *feels* estrangement.

4.2 Categorization

Following the initial open-coding stage, visual and verbal codes generated from G1 and G2 were systematically compared through constant comparative analysis. Codes that repeatedly co-occurred across multiple photographs and narratives were clustered based on shared spatial conditions and affective responses. For example, codes such as *visual blockage*, *spatial compression*, and *directed gaze* were

frequently associated with participants' expressions of hesitation and uncertainty, leading to the formation of the category "Perceptual Blockage." Similarly, *erosion trace*, *temporal disjunction*, and *temporal layering* converged into the category "Temporal Decay." Through this iterative process of clustering and abstraction, five interrelated categories emerged, each representing a recurring configuration of spatial indicators and experiential meanings. These categories were refined until theoretical saturation was reached, ensuring their conceptual stability and analytical coherence within the framework of Visual Grounded Theory. Below, the five categories are summarized with brief descriptions:

- Category 1 – Spatial Estrangement: The photographs and narratives reveal that the feeling of uncannines is most intensely experienced in spaces where human presence is absent. In areas that bear traces of use—such as graffiti, hanging cables, laundry lines, or discarded objects—but where no one is actually present, this sense of emptiness becomes dominant. Participants consistently framed such spaces without including human figures, suggesting a perceptual association between emptiness and unease. Moreover, some participants noted that even the more crowded areas were mostly populated by tourists, which made them feel as if they were disturbing the residents in their own homes.
- Category 2 – Perceptual Blockage: In scenes where the line of sight was obstructed by fences, corners, or walls, participants reported feelings of uncertainty and hesitation. The built environment imposed perceptual limits that destabilized orientation and heightened spatial tension. The interruption of sight and movement by these natural or constructed elements created a sense of blockage, evoking uncanny sensations through the temporary loss of both visual and sensory control. At this point, the presence of the "unknown" became an active component of spatial experience.
- Category 3 – Vertical Displacement: Topographic variation, particularly in steeply sloped streets, generated a bodily awareness of imbalance. The act of looking downward from an elevated position often resulted in a temporary loss of balance and orientation, typically accompanied by physical fatigue. The slope, while in some cases obstructing the view of the surroundings, in others allowed a wider and more distant visual field—emerging as a powerful spatial element that evoked different sensations for different individuals.
- Category 4 – Temporal Decay: In many photographs, traces of erosion, cracking, and material wear are perceived by the participants as silent witnesses to past lives and former uses. When the past remains materially visible in the present, suspending the gap between memory and neglect, an uncanny state emerges.
- Category 5 – Public Intimacy: The coexistence of domestic traces and transient observers transforms the home into an object of observation, reflecting the conversion of dwelling into display. In particular, the touristic fabric near the historical school gradually gives way to quieter residential units as the elevation increases, positioning tourists as visitors to the homes of local residents. This condition led participants to feel like uninvited guests within the everyday spaces of others.

4.3 Core Category: Disrupted Spatial Experience — The Multi-Layered Generators of the Uncanny

The synthesis of five categories showed that, rather than just what is seen, the disturbance of spatial experience across visual, physiological, and social aspects is what creates urban uncanniness. This concept emerges through the interdependence of absence, obstruction, imbalance, decay, and exposure; each of these elements functions as a layer that fragments the continuity of urban experience. Across the categories, uncanniness arises through inhabited traces without inhabitants, where familiar domestic signs persist but dwelling gives way to observation. It also emerges through physical boundaries that impose bodily hesitation and perceptual uncertainty, rendering movement itself uncanny. The persistence of erosion and material decay creates temporal dissonance, making spaces appear suspended between past and present while evoking a sense of neglect and latent danger.

The uncanny emerges as a multi-layered disruption in which visual perception, bodily orientation, and social meaning diverge. Framed as "Disrupted Spatial Experience," it is conceptualized as the outcome of interacting visual, spatial, bodily, and social disruptions made analytically visible through user-generated visual data.

Table 7. Disrupted spatial experience — The multi-layered generators of the uncanny (Produced by the author)

Category	G1 – Spatial / Representational Indicators	G2 – Experiential / Semantic Indicators
1. Spatial Estrangement	Empty alleys and enclosed passages with traces of use (graffiti, cables, laundry, residues) but no visible human presence.	Participants describe a sense of unease, silence, and alienation; discomfort intensified by the dominance of tourists instead of residents.
2. Perceptual Blockage	Fences, corners, and walls interrupting the line of sight; confined spaces restricting visual and bodily movement.	Feelings of uncertainty, hesitation, and spatial disorientation; the "unknown" becomes a tangible component of perception; participants slow down or avoid moving forward.
3. Vertical Displacement	Steep slopes and elevation differences creating divergent viewpoints	Physical fatigue and bodily imbalance; some feel empowered by the extended view, while others experience disconnection or loss of control.
4. Temporal Decay	Visible material erosion, cracking, and layers of repair; wall inscriptions and signs of prior use.	Participants interpret these traces as residues of past lives; the past feels "too present."
5. Public Intimacy	Domestic elements (laundry lines, balconies, curtains) intersecting with touristic circulation and photography.	Feelings of intrusion, awkwardness, and being an uninvited guest; recognition of the contrast between local privacy and tourist exposure.

5. Discussion and Conclusion

This study set out to decode urban uncanniness through user-generated visual data by integrating Photovoice with Visual Grounded Theory. Rather than treating the uncanny as a purely psychological or representational phenomenon, the research approached it as a spatially and experientially produced condition, emerging through the interaction between visual form, bodily orientation, temporal traces, and social relations. Visual Grounded Theory enabled the parallel coding of visual and verbal data, allowing the simultaneous reading of the representational and experiential layers. By comparing these two dimensions, main categories that structure the experience of uncanniness were inductively developed. These categories, when examined together, revealed a recurring pattern across the data, which was synthesized under the core category of "Disrupted Spatial Experience."

Across the photographic dataset, participants consistently focused on spaces marked by the absence of people yet saturated with traces of everyday life. Graffiti, laundry lines, cables, worn surfaces, and abandoned objects visually signaled habitation while simultaneously foregrounding emptiness. This contradiction produced what the category of *Spatial Estrangement* conceptualizes as an affective rupture between presence and absence. The uncanny, in this sense, emerges where signs of habitation endure while human presence withdraws.

The bodily dimension of this experience became particularly evident through the categories of *Perceptual Blockage* and *Vertical Displacement*. Obstructed sightlines, narrow passages, and abrupt changes in elevation destabilized participants' spatial orientation, producing hesitation, imbalance, and physical discomfort. These findings reinforce phenomenological perspectives that understand perception as inseparable from bodily engagement with space; the experience takes on an uncanny quality when the body's habitual relation to space is interrupted.

Temporal disruption constitutes another critical layer of urban uncanniness. Through the category of *Temporal Decay*, material erosion and accumulated repairs were interpreted as visible condensations of time. Participants' descriptions suggest that the uncanny arises when the past becomes excessively present—when surfaces appear to retain memories, neglect, and former lives without clear resolution. Here, the urban environment functions as a temporal palimpsest, in which decay produces a sense of suspended time rather than linear progression.

The social dimension of uncanniness is articulated most clearly through *Public Intimacy*. In the Fener–Balat context, touristic circulation intersects with residential life, transforming domestic elements into objects of observation. Participants frequently described feelings of intrusion and discomfort when encountering intimate details of everyday life in public space. This condition reveals how uncanniness can emerge from shifts in the boundaries between public and private, particularly when dwelling becomes exposed to an external gaze.

Synthesizing these five categories, the core concept of *Disrupted Spatial Experience* frames urban uncanniness as a multi-layered breakdown of continuity. Visual perception, bodily orientation, temporal meaning, and social boundaries no longer align; instead, they diverge and conflict. The uncanny is thus

conceptualized as a condition produced through everyday urban configurations that destabilize habitual modes of seeing, moving, and inhabiting.

One of the central contributions of this study lies in its methodological proposition. By combining Photovoice with Visual Grounded Theory, the research demonstrates how subjective and affective urban experiences can be translated into analyzable visual indicators without reducing their complexity. This approach positions the uncanny as both an experiential phenomenon and an analytical lens, capable of revealing subtle ruptures in urban life that often remain overlooked in conventional spatial analyses. Future research may extend this framework to different urban contexts and cultural settings, allowing for comparative investigations of how uncanniness is shaped by varying spatial, social, and historical conditions. Ultimately, this study suggests that attending to moments of uncanniness offers valuable insights into the fragile continuities through which urban experience is constructed, negotiated, and occasionally undone.

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LUXURY BRANDING IN INTERIOR SPACES AS A STAGE FOR SYMBOLIC CONSUMPTION: THE SIMULACRUM OF LUXURY AND BRAND IDENTITY IN BRANDED RESIDENTIAL INTERIORS IN ISTANBUL

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Abstract
The socio-cultural dynamics of the information society have transformed the ontological structure of space, shifting the home from being merely a physical shelter to becoming the primary stage for the performance of social status, lifestyle, and identity construction. The main objective of this study is to examine the evolution of the concept of luxury throughout history and its reflections in contemporary interior design. The research accepts the transition from Veblen's concept of 'conspicuous consumption' based on material status representation to Baudrillard's concept of 'simulacra' constructed through images and codes as a theoretical basis. In this context, the rapidly increasing number of 'branded housing' projects, particularly in metropolises such as Istanbul, and the model apartment designs associated with these projects are examined. The study examines how the object-oriented understanding of luxury between 1975 and 2000 transformed into a global lifestyle and promise of prestige after the 2000s. The show apartments designed within the scope of branded houses are analyzed as stages of 'hyperreality' (simulacra) that replace reality, are perfected, and are devoid of lived experience. These spaces offer consumers a symbolic image of luxury constructed not only through physical walls but also through new indicators such as smart home technologies, luxury co-branding, and the use of 'pure' materials. The study concludes that in contemporary luxury consumption dynamics, space has transcended physical requirements to become an interface for brand identity. In today's consumer culture, interior design practice has evolved from being a simple space producer to a strategic 'image and identity producer' that guides the desires, status, and sense of belonging of the masses.

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Key Words: *Branded housing; The simulacrum of luxury; Interior design; Luxury branding; Semiotics*

1. Introduction

Space is not merely an area where the body exists and physical actions take place. It is also a stage of existence where mental, social, and cultural patterns are shaped, produced, sustained, and transmitted [1]. While shaping space, humans construct a physical environment and express their identity, affiliations, and social culture through spatial elements [2]. In this context, it is possible to say that spaces contain a sign system that embodies cultural meanings, individual stories, and social codes beyond physical requirements.

This sign system is being reshaped by today's dynamics, referred to as the information society, network society, etc., and by new forms of production, consumption, and expression. Space, whose boundaries are being redefined with communication technologies [3], is becoming a narrative tool for identity and culture through symbols, images, and digital representations that are constantly in circulation [4].

As the most fundamental spatial unit reflecting individuals' identity, lifestyle, and status, housing constitutes one of the most prominent areas of interpretation in this transformation. In modern societies, housing appears not only as a physical structure that meets the need for shelter but also as a central stage for consumer culture and identity construction. In this social structure, individuals consume not only the

residential space but also the lifestyle, social belonging, and prestige that it represents. The concept of luxury, frequently addressed in the discipline of interior architecture, is being reproduced in this new social order not through fixed and material indicators but through the symbolic meanings attributed to the space rather than its physical qualities. One of the areas where this symbolic production can be observed most intensely and currently is in branded housing projects, which are rapidly increasing, especially in metropolises such as Istanbul. These projects are complex systems that create a promise of lifestyle and identity through architectural and interior design practices, image, sign production, and marketing discourse. Within this system, model apartment interiors are designed and marketed as simulacra of the identity and concept of luxury being offered. Therefore, model apartment applications and marketing discourses associated with branded housing provide an ideal field of study for understanding the changing signs of luxury in the information society and the spatial representations of these signs.

The main argument of the research is developed along two main lines, based on Veblen's concept of 'conspicuous consumption' based on material status representation and Jean Baudrillard's concept of 'simulacrum', defined as an appearance that wants to be perceived as reality. Based on this, the study's main argument is that interior design is one of the main indicators of identity and status in today's information society based on image consumption, and that this identity construct redefines the role and practice of the interior design discipline.

The concept of luxury has evolved from the material representation of status based on the practice of physical display, defined by Veblen as 'conspicuous consumption', to a 'simulacrum' constructed through images, experiences, and codes conceptualized by Baudrillard in today's information society. In this process, space has become a primary signifier where identity and status are constructed, beyond being merely a place of shelter, and branded residential interior designs have become a fictional reality that stages this desired identity construction through the image of luxury. Therefore, interior architecture practice has positioned itself as an active and strategic constructor of this symbolic system within today's consumption dynamics.

The study first focuses on the material and object-oriented representations of luxury in the historical period between 1975 and 2000. While questioning which design elements and concrete indicators were used to construct the concept of luxury in interior design, the study aims to analyze how the discourse of luxury in periodicals of the time presented this objectivity and the role of these spatial representations in the construction of social status/identity.

Against this historical backdrop, the concept of 'Simulacrum' and the relationship with 'Branded Housing' are examined through semiotic dimensions in order to understand the transformation of luxury and its contemporary spatial counterparts. The study examines how the relationship between the advertising and marketing discourses of branded residences in Istanbul and their model apartment projects is constructed, and how the image of luxury is materialized through specific discourses and objective indicators.

2. Theoretical Framework: The Evolution of Luxury and the Simulacrum from Veblen to Baudrillard

The concept of luxury has evolved beyond being merely a physical necessity throughout history, transforming into a fundamental motivational tool through which individuals construct their social status and identity. The inseparable link between luxury and the development of capitalism demonstrates how production and consumption relationships have become structural in modern society [5]. The theoretical foundations of this traditional understanding of luxury and status are based on Thorstein Veblen's concept of "conspicuous consumption." In Veblen's approach, individuals consume objects visibly and extravagantly to prove their privileged position in the social hierarchy and their economic power. During this period, symbols of luxury and status were constructed through material realities that were rare, high-cost, and physically displayable to others [6]. Luxury was equivalent to the physical presence and ownership of the object.

However, with the conflicts and sociological changes in modern culture [7], the transition from an industrial society to an information society has created a fundamental break in the nature of luxury. The physical and use values of objects have given way to communicative and symbolic values. This transformation finds its clearest expression in Jean Baudrillard's 'System of Objects' and theories of the consumer society. According to Baudrillard, in today's consumer society, the individual consumes not the object itself (its function) but the 'sign-value' that the object represents within social networks. Veblen's

ostentatious consumption based on physical display has given way to the symbolic consumption of codes, brands, and images [4, 8]. In this context, when focusing on how companies create new-generation luxury products, it is seen that consumers no longer desire the product itself, but rather the new worlds of meaning and sense of privilege that the product promises [9].

Baudrillard's theories of 'simulacra' and 'simulation' define the extreme point of this semiotic stage reached by luxury. A simulacrum is a copy that replaces the real thing, without an original. When considered in the context of space, today's branded residential interiors offer a perfectly designed 'luxury simulacrum' rather than a physical luxury shelter. Luxury has evolved from being a physically displayed object to a hyper-reality constructed through discursive codes and digital images. Consequently, the transition from Veblen's phase of 'conspicuous consumption' based on physical property and display to Baudrillard's 'simulacrum' universe operating through images and codes clearly demonstrates the transformation of luxury from a material entity to a semiotic construct of the information society.

3. The Development of Branded Housing in Istanbul

Turkey's urban spaces and consumer culture experienced a sharp historical break with the adoption of outward-looking neoliberal economic policies in the 1980s. Prior to 1975, under the import substitution economic model, the concept of luxury was largely reduced to a concrete, ostentatious consumption practice centered on 'rare imported furniture', 'classic materials requiring heavy labor', and the square footage of physical space, largely inaccessible due to the limitations of a closed market. However, the process of integration into global capitalism after 1980 fundamentally transformed consumption habits by liberalizing the circulation of commodities, thus transforming luxury from a physically inaccessible object into a means of identity construction through the circulation of global images [10]. This period marks the beginning of a process in Istanbul where the upper and newly emerging upper-middle classes abandoned the traditional apartment typology in the city center and began to construct gated communities that reflected their class habitus.

By the 1990s, housing production practices had evolved beyond meeting mass housing needs into an institutional sector marketing new 'lifestyle' images brought about by globalization. According to Öncü's [11] observations in the literature on cultural readings of Istanbul's urban transformation, during this period, the Western-derived myth of the 'ideal home' was translated into Istanbul's urban space through the media and the rapidly growing advertising industry [11]. In the marketing of housing projects and interior design, luxury is now produced through discursive codes such as 'modernity', 'hygiene', 'isolation from urban chaos', and 'security' promised by that space, rather than the sheer quality of the material or the object itself. The interior space has become a symbolic showcase where these abstract concepts are staged and an international aesthetic language is adopted.

This transformation in interior design practices forms the historical foundation for the shift of luxury from a material entity to a semiotic image within branded residences. The first 'gated communities,' which rapidly emerged on the peripheries of Istanbul in the 1990s, presented interior designs not merely as aesthetic arrangements, but as a standardized global 'illusion of exclusivity'[12]. Model apartments in these projects blended American suburban aesthetics and technological amenities, marketing to consumers not physical building materials but the codes of 'belonging to the global elite club'. Therefore, the period between 1975 and 2000 represents the most critical threshold in Istanbul's interior design practice, shifting away from the objective weight of luxury towards Baudrillardian 'image and simulacrum' production.

In global metropolises such as Istanbul, the phenomenon of 'branded housing' represents a process that began in the 2000s, whereby housing evolved from being merely an architectural structure that met the need for shelter to becoming a complex 'lifestyle promise' and 'prestige object'. This transformation has brought with it a market dynamic in which the commodity nature of housing is constructed through the symbolic values offered and corporate brand identity rather than the physical space [12]. This shift in Istanbul's urban morphology gained momentum as the upper-middle class gravitated toward the peripheries—which offered 'secure' and 'standardized luxury'—and housing thus became a signifier that validates an individual's position within the social hierarchy [11].

Today, under the influence of neoliberal urbanization policies and global capital flows, Istanbul's housing market has evolved from merely producing living spaces into a highly competitive and financialized sector.

Since the 2000s, branded housing projects rapidly constructed both on the city's peripheries and in its transforming centers have become the main arenas where real estate developers fiercely compete to attract the upper and newly emerging upper-middle classes [13]. In this intensely competitive environment, traditional architectural patterns and a luxury concept based solely on building materials are insufficient to convince consumers. Consequently, brands are making strategic investments not only in spatial solutions but also in the image they project, the lifestyle they promise, and the 'social identity' of the project to differentiate their projects from their competitors and increase their profitability.

The most obvious result of this competitive market structure is that luxury in branded residential projects is no longer a physical boundary or mere square footage, but is marketed as a carefully defined, meticulously crafted 'privileged lifestyle package'. Consumers are offered an integrated elite lifestyle scenario featuring high security walls that isolate them from urban chaos, private landscaping areas, sports complexes, closed-circuit social clubs, and smart home technologies [14]. Packaging and branding the space in this way transforms the home from merely a physical structure to live in into a pre-designed 'status and identity' project. When a customer purchases a branded residence, they are not just buying four walls, but also becoming part of the security, exclusive isolation, and perfected 'simulation' lifestyle (in the Baudrillardian sense) promised by the brand's advertising.

4. Luxury Branding and Interior Design Strategies: The Role of Model Apartments as Simulacra

Model apartments in branded residential projects function not merely as simple previews of an architectural structure, but as strategic marketing environments conceptualized as servicescapes, where luxury branding strategies are physically constructed. These spaces are artificial scenes where consumers interact with the brand physically and sensually, and where every detail, from lighting to furniture selection, scent to sound design, is designed to create a specific psychological response and desire [15]. The interior design of the model apartment conveys the codes of the elite lifestyle promised by the brand to potential buyers, not just the physical walls they will purchase, thereby transferring the luxury consumption experience to a spatial plane.

When examined in the context of consumer culture and postmodern theories, model apartments are hyperreality spaces that have no direct counterpart in real life, bear no organic traces of lived experience, and are completely 'perfected'. In the discipline of marketing, the aestheticization of space to this extent and its detachment from reality presents itself as a concrete reflection of Jean Baudrillard's concept of 'simulacrum', as the model apartment is a perfect copy of a fictional life scenario that does not exist in reality and entices consumers to join this simulated universe by offering them an appeal that is 'more real than reality' [16]. In this context, model apartments function as idealized scenes of consumption, stripped of the ordinary irregularities of daily life, representing luxury and status.

The fundamental function of the model apartment as a luxury branding strategy is to push the purely functional values of objects into the background and maximize their 'sign-value'. With the normalization of shiny and flashy artificial materials standardized by global mass production processes, contemporary luxury, influenced by a shift toward the rare, the 'natural' and the 'pure' in interior design, has led to artworks displayed indoors, rare imported cladding materials, or integrated smart home systems actually move beyond being mere decorative elements and are positioned as symbolic codes of wealth, integration into global trends, and belonging to a privileged class [17]. Therefore, when experiencing the model apartment and making a purchase decision, the consumer is not buying a physical living space, but rather the symbolic image of luxury constructed by the brand and the new social identity (simulacrum) that comes with that space.

In branded residential projects, interior design is strategically conceived through 'luxury co-branding' partnerships to reinforce the global perception of luxury and respond to consumers' need for status. Today, the prestige of an interior space is measured not only by its architectural proportions or construction quality, but also by the symbolic capital that world-renowned luxury fashion, automotive, or design brands bring to the space when integrated into the project. In consumer behavior and marketing literature, the 'co-branding' strategy is defined as a synergistic tool that aims to create a stronger, invincible, and privileged perception of quality in the consumer's mind by combining the image values of two different brands [18]. In interior design practices, this situation serves the function of transforming the home from a mere shelter into a spatial

extension of internationally recognized status and aesthetic taste, thus allowing spatial luxury to transcend the physical structure and be consumed entirely through the 'aura' created by the brand collaboration [19]. When considered in the context of branded housing projects, the design process is structured around how a space will project an 'aura of exclusivity' in marketing catalogs and digital presentations, rather than how walls or floors will be covered. This situation demonstrates that the physical reality of the space is pushed into the background, and the image (simulacrum) produced visually and discursively becomes the main object of architectural practice.

In this context, contemporary interior designers are no longer merely 'space organizers' but also 'identity producers' who make the status desired by the user visible through spatial codes. In summary, as clearly seen in branded residential examples in Istanbul, interior design practice has evolved into a semiotic activity concerned with producing the 'hyper-real image' that will increase the brand value of the project, promise a flawless identity to potential buyers, and become the centerpiece of marketing campaigns, rather than the physical reality to be experienced within the space.

5. Discussion: The Transformation of Luxury from 'Possessed Objects' to 'Atmosphere'

Analyses of contemporary consumption practices and representations of interior spaces reveal that the concept of luxury has undergone an ontological shift, evolving from the purely material act of 'ownership' to a holistic 'experience' process. While luxury was defined in traditional marketing as the accumulation of rare and high-cost physical objects, contemporary brand strategies have shifted their focus to the concept of 'experiential luxury', where the user interacts on a cognitive and sensory level [20]. Findings from branded residential projects reveal that consumers now value the emotional and symbolic engagement constructed within the space as a whole, rather than the objective quality of isolated objects within it. In this context, luxury has evolved from being an item on a shelf or on display to becoming an inclusive 'state' that re-creates the individual's identity and status [21].

This experiential shift places the concept of 'atmosphere' at the very center of architectural and luxury branding strategies in space production. In aesthetic theory, atmosphere is defined as a 'semi-objective' spatial reality that actively shapes human perception and mood through a combination of architectural proportions, light, acoustics, and tactile surfaces, beyond being a simple background decoration for space [22]. When examining the model apartment designs and advertising discourse of branded residences, it is evident that the main element being marketed is not square footage or the quality of concrete used, but rather a carefully orchestrated, sterile, and exclusive 'aura' (atmosphere). Therefore, the interior space has lost its function as a box displaying luxury objects and has become luxury itself—that is, a tactile and visual climate of feeling that the consumer 'resides in' rather than owning in the traditional sense [22].

A semiotic analysis of marketing discourse also confirms that competitive advantage in the luxury housing market is achieved not through objects, but through these fictional atmospheres. In the digital renderings and promotional films of these projects, spaces are depicted as flawless "simulation atmospheres," completely isolated from the chaos of everyday life, where only codes belonging to a specific class habitus circulate. This situation definitively proves that value production in branded residences transcends physical boundaries, and luxury is marketed as an abstract atmospheric experience that 'infuses' the user with a pervasive sense of exclusivity and security[20].

The concept of luxury offered in branded residential projects is built on a contradictory structure: while aiming to reach the masses and maximize profit, as is inherent in capitalist real estate production, it simultaneously promises consumers a sense of uniqueness and absolute privilege. In contemporary consumer culture literature, this contradiction is explained by a new branding strategy called the 'mass prestige' of luxury, where privilege and high status codes are mass-produced [23]. In the marketing of luxury housing in Istanbul, consumers are also promised a completely unique, personalized, and one-of-a-kind living space (interior), but behind the scenes, this 'uniqueness' comes from a standardized production line where global interior design trends and specific status codes are copied identically into hundreds of homes. While consumers think they are buying a unique space that belongs solely to them, they are actually purchasing a mass-produced identity package industrially designed by global consumption networks.

When branded housing projects in Istanbul are examined spatially, it becomes apparent that this promised uniqueness is actually based on a generic 'elite space' template that repeats itself. These projects, produced

by different construction companies in different parts of the city, offer a homogeneous interior luxury that is almost identical to each other, with smart home infrastructures, standardized imported built-in products, cladding materials confined to a specific color palette, and isolated social amenity areas [12]. This interior design concept, embraced by consumers as 'privileged', is not so much an organically developed design or one that reflects the individual's unique character, but rather a pragmatic repetition of a 'standardized' spatial pattern determined by neoliberal urbanization practices [14]. Architectural decisions focus on packaging the standard comfort codes (security, hygiene, technology) desired by a specific income group in the most risk-free way, rather than being personalized.

This standardized spatial production, read through a Baudrillardian semiotic lens, demonstrates that luxury has detached itself from physical reality and originality, transforming entirely into a 'simulation' universe. In these interiors, which are physically and structurally identical copies of each other, uniqueness exists not in the walls, marble, or wooden surfaces, but only in the hyper-real 'image' world constructed through the brand's advertising discourse [16]. While living in a massive block with hundreds of similar apartments and floor plans, users do not experience physical spatial uniqueness. Instead, they consume a 'standardized simulacrum of uniqueness' (a copy of a copy) constructed through the brand's symbolic codes, creating an illusion of belonging/privilege in the consumer's mind. Therefore, the interiors of branded residences in Istanbul are scenes of mass production where uniqueness is not architecturally constructed but rather constructed and simulated semiotically.

In the advanced stages of the information society, luxury branding strategies applied in residential design have a high potential to completely relegate the physical and structural reality of the space to a secondary position. In the hyper-reality dimension reached by consumer culture, the fundamental utility value of a residence (shelter and physical protection) tends to be completely erased, and the architectural shell becomes merely an empty interface displaying the brand's symbolic codes, digital images, and lifestyle promises [24]. In future interior designs, it is predicted that individuals will purchase ownership of the fictional 'atmosphere' and abstract 'image value' created by luxury brands rather than the physical boundaries or construction materials of the home. This situation represents the extreme point of Baudrillard's simulation theory in the context of housing, where image completely replaces reality.

In this transformation process, the phenomenon of 'branded spaces' transcends the traditional boundaries of architectural practice, turning design directly into a marketing and simulation instrument. In future housing projects, as static physical materials are increasingly replaced by digitally enriched brand experiences (augmented reality surfaces, smart home automation coded with brand identity, etc.), users will begin to live not within physical elements such as concrete or natural stone, but within the 'meaning universes' constructed by global luxury brands [25]. The danger is that architectural form and spatial reality will be completely crushed under the intensity of brand identity and become invisible, causing design to survive only as the production of a 'fictional simulacrum'.

This scenario scientifically suggests the possibility that interior architecture and design disciplines will transform into digital/semiotic architects who encode discursive and visual 'luxury illusions' (simulations) that replace physical reality, rather than being practices that construct space in the future.

6. Conclusion: The Strategic Position of the Interior Architecture Discipline in Today's Consumption Dynamics

The socio-cultural dynamics of the information society have transformed the ontological structure of space, shifting the home from being merely a physical shelter to becoming the primary stage for the performance of social status, lifestyle, and identity construction. The transition of the concept of luxury from traditional material display practices to a simulated universe constructed through images, symbols, and codes has fundamentally changed the role of space and space producers. In this context, the discipline of interior architecture has evolved from being a simple 'space producer' in today's consumer society to a complex 'image and identity producer'.

Branded residential projects in Istanbul and the model apartment designs at the heart of these projects are the most concrete evidence of this structural transformation within the discipline. In these projects, space is designed as a strategic system where architectural decisions, marketing discourses, and images of luxury are intertwined. Interior designers use spatial staging strategies to present consumers with the fictional reality of

a desirable lifestyle. When individuals experience these interiors, they are not just purchasing a physical structure, but also consuming a sense of social belonging and privilege made tangible through interior design. In light of all these assessments, it is clear that interior design practice is not a passive physical environment arrangement activity in today's consumption dynamics, but an active and strategic 'constructor'. In this new order, where the boundaries between reality and representation are blurred and material ownership is replaced by symbolic values, the construction of space is directly linked to the construction of individual and class identity. The discipline of interior architecture functions as a strategic communication interface that directs the desires and expectations of the masses by organizing the new codes of luxury imposed by consumer culture at the spatial level. This powerful and strategic position necessitates the redefinition of the discipline not merely within an aesthetic or functional framework, but as a center of sociological and cultural meaning production.

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THEMATIC EVOLUTION ANALYSIS of CO-LIVING RESEARCH: a BIBLIOMETRIC STUDY

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Abstract
"Co-living" or "coliving" is a multidisciplinary field of research that is growing rapidly. It encompasses diverse disciplines such as sociology, architecture, urban planning, real estate and sustainability. This study aims to examine the thematic evolution of the concept of Co-living in scientific literature, to determine which themes this concept is associated with over time, which sub-topics have emerged and how it has changed direction. The material of the study consists of English-language publications indexed in the Scopus and Web of Science databases. The research employed quantitative design and followed a five-step methodological process using the SciMAT software. In the first step of the study, the data set was created through stratified sampling. After the source elimination stage, bibliometric analysis was performed on a total of 1027 materials and keywords were grouped in five periods: 1996-2001, 2002-2007, 2008-2013, 2014-2019, 2020-2025. The study shows a clear thematic evolution over time. In the first period (2008–2013), research was predominantly oriented toward human- and society-centered themes. During the second period (2014–2019), the field became more interdisciplinary, branching into areas such as sustainability, creativity, and participatory approaches. By the third period (2020–2025), the thematic landscape had reached a stage of maturity characterized by technological innovation, the rise of digital nomadism, and emerging investment-oriented perspectives. This study offers originality by systematically mapping the thematic evolution of co-living research and revealing conceptual continuity across periods. In conclusion, the findings of the study show that the research field has undergone a significant transformation over time. While human and social issues dominate publications in the first period, the second period sees a shift towards more interdisciplinary themes such as sustainability, creativity and participation. In the last five years, technological innovations, digital nomadism and investment-oriented approaches have come to the fore, indicating that the field has moved into a more mature, transformational phase.
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Key Words: Co-living, coliving, thematic evolution analysis, bibliometric analysis, review of literature.

1. Introduction

Global population growth, migration, sociocultural change after the pandemic, and increases in housing prices due to the economic crisis have led to the search for different solutions for housing. Examples of architectural solutions such as co-housing, shared housing, co-living, etc., which provide flexibility at different spatial scales and a balance between private and common use, are found in literature and architectural practice. Although the co-living approach is considered as one of the first solutions to these problems, its basic philosophy is based on feminist and utopian arguments [1]. The first traces of co-living can be seen in the suburban life in Stockholm in the 1940, where women over 35 years of age formed the "Elfvinggården" approach to their desire for a safe and common life for themselves. Still in use today, Elfvinggården's architecture and many of its original details are well preserved [2]. It still serves its original purpose, providing housing for single women with the same motivation as when it was first built. With an addition in 2014, there are now 290 living units (Fig. 1a). Another example is the low-rise, densely clustered housing known as "Bofællesskab", which emerged in Denmark in the early 1970s (Fig.1b).

Due to the large number of working women at the time, the first examples and different alternatives of these projects can be found in the Scandinavian countries. Danish Jan Gudmand-Høyer, one of the pioneering architects of collective living, sought to answer the question "What is the real need of Western industrialized society in the late twentieth century?" [5]. He sought solutions by emphasizing that different generations had different needs, the number of working mothers was increasing, families were having fewer children and people were living longer. Gender equality, the quest to serve more with less, and the desire to create a sustainable social life complex are the basis of these approaches.

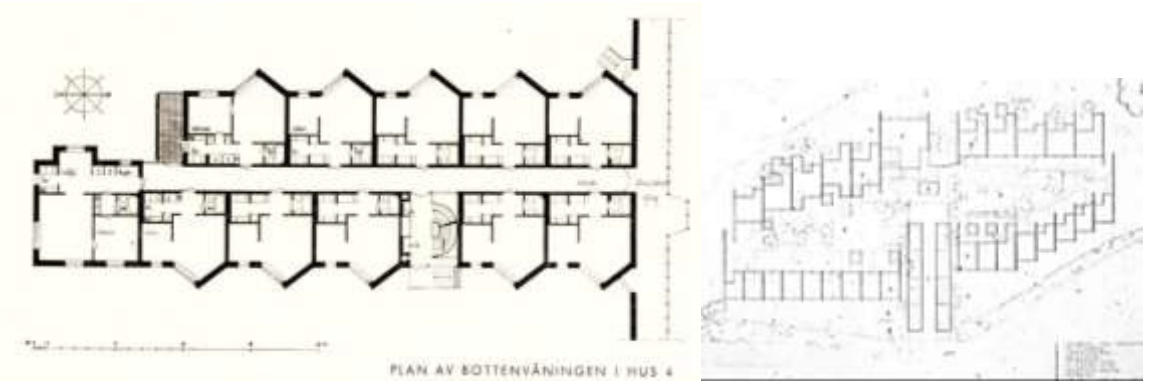

Fig. 1. (a) Plan of Elfvinggården [3] (b) Sættedammen as an example of Bofællesskab [4]

In the 1980s, American architects McCamant and Durrett visited Denmark to study these co-living models and subsequently introduced the concept to the United States, where it gained traction [6]. Other European countries, including Spain, Italy, Germany, and the Netherlands, developed their own co-living projects, each with distinct characteristics compared to the Danish model. From the past to the present, it is seen that co-living projects have changed and diversified in a user-oriented manner. There are different examples such as the transformation of idle office buildings into co-living spaces in the USA, the construction of living spaces for the elderly, especially in Europe, and projects built from scratch for digital migrants and students. The projects in Figure 2 reflect contemporary co-living approaches.

Fig. 2. (a) Tetuan Coliving / ch+qs arquitectos [7] (b) High Street House / Teatum+Teatum [8] (c) Appartement Spectral / Betillon [9]

In these projects smart space optimization and innovative design strategies for co-living spaces provide functional, dense environments [9]. The interiors are characterized by open concept layouts, multifunctional furniture and the use of vertical space to create solutions that enhance the functionality of the compact units. Communal living has existed throughout history due to both common needs and the concentration of resources. The main purpose of the study is to explore the transformation of the concept of co-living from a literary perspective. The research questions formulated in this context are as follows:
RQ1: How has the scientific literature on the concept of "co-living" evolved thematically over time?
RQ2: What are the main themes that stand out in different periods?
RQ3: How does the thematic evolution and overlapping between these themes evolve?
RQ4: Which themes have emerged as motor themes (high centrality and intensity) and which have remained isolated?

1.1. *Sample of the Study*

The search for the sample for the study was conducted using the Scopus and WoS databases. As a filter, only the English language was selected, no other filtering was done. The terms "co-living" and "coliving," as well as "both co-living and coliving" were searched for separately in the Scopus and Web of Science

databases. A total of 1,060 sources were accessed in Scopus, and 662 sources were accessed in Web of Science. We transferred 1,722 sources to Zotero and scanned them according to their indexes (Table 1).

Table 1. Data Sets of the Study

	SCOPUS	WoS	n
Co-living	725	471	1196
Coliving	252	131	383
Co-living and Coliving	83	60	143
n	1060	662	1722

In the obtained sources, 695 publications related to "nutrition, health and medicine" were eliminated. Bibliometric analysis was performed on a total of 1027 publications.

1.2. *Methodology*

The study used a quantitative research design with five steps in the methodology. In the first step of the study, the data set was created through stratified sampling (Fig.3).

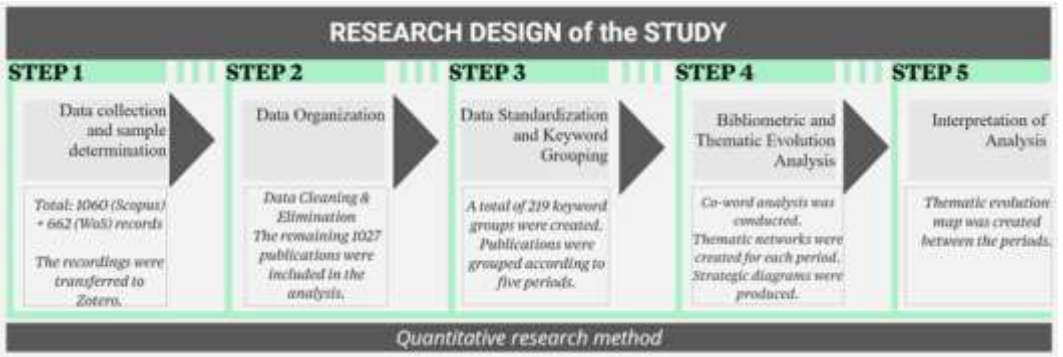

Fig. 3. Methodology of the study

A total of 1027 publications were included in the sample. The data obtained was transferred to the SciMAT (Science Mapping Analysis Tool) software program. The reason for using this software in the study is that, as well as offering the advantages of similar bibliometric scanning software, it also allows for the analysis of longitudinal and thematic evolution. A keyword-based bibliometric analysis approach was adopted in SciMAT [10]. Conceptual networks were created based on the co-occurrence relationships of keywords. During the data cleaning and standardization process, keywords with similar meanings were combined, forming a total of 219 keyword groups. Thematic analysis was performed for three periods, each based on a five-year period depending on the publication year of the articles. The SciMAT software analysis process consists of 10 steps in total (Table 2).

Table 2. Steps of Analysis on SciMat

1.	Select Periods	6.	Normalization
2.	Select Unit of Analysis	7.	Clustering algorithm
3.	Data Reduction	8.	Document mapper
4.	Select kind of Matrix	9.	Quality measures
5.	Network reduction	10.	Longitudinal

In the first stage, five periods were selected as 1996-2001, 2002-2007, 2008-2013, 2014-2019, 2020-2025. Although the data set was initially coded in five-year periods, the final evaluation was made over three periods due to the longitudinal analysis logic of SciMAT software. SciMAT groups the periods according to thematic continuity and overlap index rather than fixed years; therefore, the points at which the conceptual links between themes begin to strengthen constitute natural break periods. Five-year periods are preferred because they allow for a balanced observation of thematic stability and change as recommended by SciMAT. Shorter time periods produce data too scattered to form meaningful clusters, while longer periods obscure

the details of thematic evolution. The aggregation of periods into three phases is therefore based entirely on the natural thematic breaks revealed by the data distribution and SciMAT's overlap analyses. In the second step, words (authors, sources and added options) were selected since the analysis will be based on the number of words. In the third step, all periods were selected and at least 1 frequency value was defined. In the fourth step, "Co-occurrence matrix" was selected as a kind of matrix to analyze how many times the concepts occur together in the same publication [11]. In the fifth step, in the network reduction section, relationships that occur together at least 2 times were included. In the sixth step, the "equalization index" was used for normalization to make the co-occurrence data comparable. The equivalence index (1) is a special similarity coefficient that measures the strength of the co-occurrence of two keywords. It was used in this study because it is the recommended default method for thematic evolution analysis in SciMAT software. *(Cij: Number of occurrences of keywords i and j together, Ci: Total number of occurrences of keyword i, Cj: Total number of occurrences of keyword j)*

$$EI_{\{ij\}} = \frac{\left(C^2_{\{ij\}}\right)}{\left(C_i \; x \; C_j\right)} \tag{1}$$

In the seventh step, Simple Centers Algorithm was used to create thematic clusters. In order to balance the size of the clusters and ensure that both small and large-scale themes are represented in the analysis, a minimum limit of 2 and a maximum limit of 50 keywords were set. These parameters aim to group the 219 keywords used in the study under meaningful themes and increase the readability of the thematic maps. In step eight, Core Mapper was used to improve the readability of the nodes and links in the thematic network and focus on central themes in literature. In the ninth step, the h-index, g-index, and sum of citations were used to evaluate scientific impact. For the final step of creating a longitudinal thematic evolution map, the Jaccard and Inclusion indexes were used to measure continuity and relationships between themes over time. The Jaccard index shows the general similarity and common keyword ratio between themes, while the inclusion index reveals the direction of evolution by determining the extent to which themes from the previous period are included in the next period [12]. For each five-year interval, co-word relationships between keywords in SciMAT were calculated, and thematic clusters were formed. Strategic diagrams were produced, classifying the themes of each period according to their centrality and density values. Additionally, thematic transitions between periods were visualized through a thematic evolution map. The map illustrates the development of the concept of "co-living" and the evolution of related sub-themes over time.

1.3. *Limitation of the Study*

The analysis includes only English-language publications in Scopus and WoS databases and excludes publications in other data sources and languages. Furthermore, keyword-oriented bibliometric methods and SciMAT's parameter choices (normalization, clustering, network reduction) affect the interpretation of the thematic structure. The time periods and data filtering processes used in the study may also have limited the visibility of some sub-themes. Finally, as the field of co-living is a rapidly changing discipline, developments after 2025 were excluded from the analysis.

2. Findings

Firstly, when the distribution of publications according to years is examined, it is seen that this issue was first mentioned in 1958. However, it can be said that the studies published in this field have gained continuity since 2010. The 10 journals with the most publications on co-living are given in Table 3. It is listed as Sustainability (14), Housing Studies (13), Buildings (12), International Journal of Housing Policy (9).

Table 3. Journal list based on frequency of Co-living related publications

Journal	f	Journal	f
1. Sustainability	14	6.World Leisure Journal	8
2.Housing Studies	13	7.Urban Studies	7
3.Buildings	12	8.Urban Planning	7
4.International Journal of Housing Policy	9	9.Lecture Notes in Civil Engineering	7
5.Housing, Theory and Society	8	10.Journal of Housing and the Built Environment	6

The distribution of publications by year shows that research on co-living has attracted increasing attention in recent years (Figure 4). While literature was limited and scattered from 1996 to 2013, thematic density increased, and dominant themes emerged from 2014 to 2019. From 2020 to 2025, the number of publications and thematic diversity reached their highest levels, indicating that co-living has become a mature, multidisciplinary research area. Furthermore, keyword density and distribution increased, indicating a deepening and broadening of the literature.

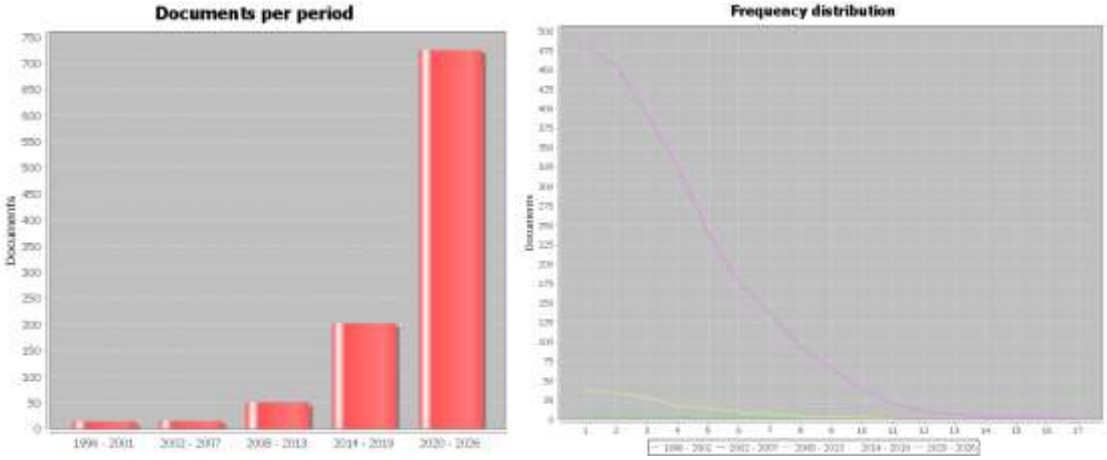

Fig. 4. (a) documents per period; (b) frequency distribution

The Table 4 shows that, in the first period (1996-2001), units are always 0. This indicates that publications were very limited during this period and keyword density was low. In the 2020-2025 period, Max 216 and Mean 3.38. It is clear that some themes are very strong and have high keyword density in this period. The standard deviation value is the highest in this period. This indicates a clear diversification and deepening of literature.

Table 4. Statistical distribution of themes according to periods

Periods	n	Units	max	min	mean	median	Std.Devision	Variance
1996 -2001	14	0	0	0	0	0	0	0
2002 -2007	15	1	1	0	0.13	0	0.35	0.12
2008 -2013	51	25	8	0	0.63	0	1.78	3.16
2014 -2019	202	78	11	0	0.79	0	1.98	3.92
2020 -2025	725	216	17	0	3.38	3	3.33	11.07

After grouping by keywords in SciMAT, the distribution of documents was 14 between 1996 and 2001, 15 between 2002 and 2007, 51 between 2008 and 2013, 202 between 2014 and 2019, and 725 between 2020 and 2025. In this case, it shows that the number of publications on Co-living increased approximately 3.58 times after 2020. As mentioned, the study was initially grouped into 5 periods. However, due to the insufficient number in the first years, thematic analysis results were obtained on the last 3 periods. As a result of this situation, data is presented in 3 periods: 2008-2013; 2014-2019; 2020-2025. Table 5 provides a detailed analysis of the themes of the three periods. Centrality shows the strength of the theme in relation to other themes; density shows how consistent and strong the theme is within itself. In SciMAT, these two values are used to classify themes into four categories [11]. If it has *high centrality and high density*, it is both the central and strong theme of the domain and is called *"motor theme"*. If it has *high centrality and low density*, it is classified as the central but immature *"basic & transversal theme"*. If *low centrality has a low density*, it is considered to be a very new or declining theme in the area and is classified as *"emerging / declining theme*". Finally, a theme with *low centrality and high density* is strong but little related to other themes. These themes are classified as "*highly developed but isolated"*.

Table 5. Strategy Diagram of Themes based on periods

Years	Cluster	Centrality	Centrality Range	Density	Density Range
2008-2013	HUMAN	32.5	1	153.61	0.67
	URBAN AREAS	0	0.33	350	1
	SOCIAL	29.17	0.67	108.33	0.33
2014-2019	SUSTAINABILITY	177.82	1	127.91	0.9
	CREATIVITY	68.5	0.9	68.33	0.7
	PARTICIPATION	30	0.7	108.33	0.8
	WELL-BEING	20.14	0.5	48.61	0.3
	REAL-ESTATES	40.75	0.8	146.67	1
	SHARED-HOUSING	23.38	0.6	25	0.2
	MIGRANTS	3.33	0.1	50	0.4
	HEALTH-BEHAVIORS	5	0.2	50	0.5
	RISK-FACTORS	5	0.3	50	0.6
	SOCIAL-INTEGRATION	10.05	0.4	12.5	0.1
	SUSTAINABILITY	177.82	1	127.91	0.9
2020-2025	HOUSE	240.68	0.95	23.08	0.58
	HUMAN	178.67	0.89	22.13	0.53
	DIGITAL-NOMADS	244.05	1	8.61	0.16
	BUILDINGS	27.69	0.79	17.46	0.47
	COMPUTATIONAL	35.35	0.84	59.86	0.84
	COLORS	19.1	0.74	150	1
	INVESTORS	14.53	0.63	100	0.95
	INTERGENERATIONAL-SHARED-SITE	11.06	0.53	66.67	0.89
	PROTOTYPICAL-URBAN-INTERVENTIONS	15.88	0.68	36.11	0.74
	PLANNING	8	0.32	12.5	0.21
	SHARED-HOUSE	11.19	0.58	2.44	0.05
	ABANDONED-ARCHITECTURE	8.83	0.37	50	0.79
	RESIDENTIAL-BUILDINGS	9.83	0.47	25	0.63
	CONTRACT	8.87	0.42	25	0.68
	GENERATIVE-ADVERSARIAL-NETWORKS	5.34	0.16	16.67	0.37
	MODULAR-APPROACH	2.14	0.05	16.67	0.42
	CO-PRESENCE	6.33	0.26	12.5	0.26
	ORDINARY-LEAST-SQUARES	5.63	0.21	12.5	0.32
	SPACE-STANDARDS	4.98	0.11	5	0.11

Each period will be analyzed in detail under sub-headings in line with this information.

1.4. *Findings of First Period 2008-2013*

Between 2008 and 2013, only 3 themes *(human, social and urban areas)* stand out (see Fig.5). Human theme has a high density and medium centrality value. This shows that "human" is a strong and mature theme in itself, close to the center of the field. "Human" is considered as the most studied "motor" theme in the relevant period. Urban areas have high density but very low centrality. It can be inferred that it is a strong but isolated theme. Social, on the other hand, has a medium centrality and high-density value, so it can be said that it is both an important and mature theme. However, the "social" theme was seen to be a developing theme at that time, while the urban-areas theme was found to be a highly developed and isolated theme. It is clear that while human-oriented and social issues were at the forefront of "co-living" research in 2008-2013, urban issues were examined in a more isolated manner.

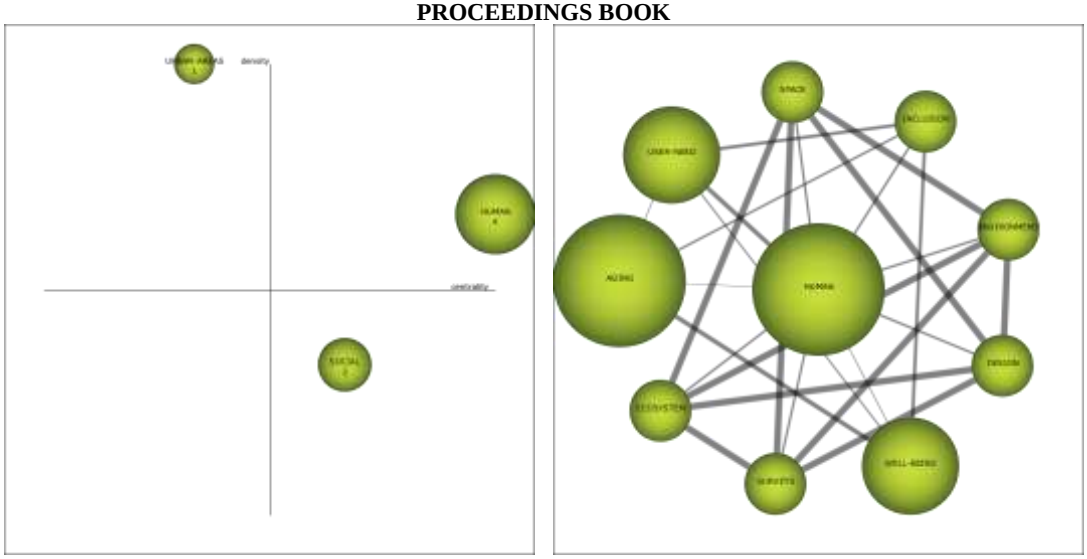

Fig. 5. (a) 2008-2013 strategic diagram; (b) cluster's networks of themes

1.5. *Findings of Second Period 2014-2019*

Between 2014-2019, a total of 10 themes *(sustainability, creativity, participation, real estate, well-being, shared housing, social integration, migrants, risk factors, health- behaviors)* were obtained. In this period, there was an increase in the number of motor themes along with the general theme. The theme with the highest centrality and high-density value is "sustainability". In this period, the most dominant theme "sustainability" was obtained as the motor theme. Creativity, participation and real-estates themes have medium centrality and high-density values. These themes can be considered as developing and important themes. Migrants, health-behavior, risk-factors themes have low centrality values. Therefore, they can be considered as new or less relevant themes in the field. In this period, literature has both matured and new themes have started to emerge. Sustainability and real-estates seem to be at the center of co-living research.

1.6. *Findings of Third Period 2020-2025*

Between 2020 and 2025, 19 themes *(human, house, digital nomads, buildings, shared house, computational, modular approach, co-presence, planning, space standards, abandoned architecture, residential buildings, generative adversarial networks, intergenerational shared site, urban intervention, investors, color, ordinary least squares)* are listed. During this period, literature has grown both in quantity and quality, with new sub-themes and multidisciplinary connections. Digital-nomads and house themes have very high centrality and medium/low density. They are considered as the central and trending related themes of the Co-living space in recent times. Colors and computational themes have high density and low centrality. These themes are considered as strong but more isolated themes. A large number of small themes were obtained in this period. This shows that literature has become more multidisciplinary and broadened in the last five years compared to other periods. It can also be noted that new sub-themes have emerged rapidly. With the pandemic, post-2020 co-living research has expanded the field by adding new concepts and technological connections (digital nomads, computational, generative networks).

1.7. *Findings of All Periods*

As a result of the analysis of all periods, the thematic evolution analysis map was obtained (see Fig.6). The nodes on the map represent themes that emerged in specific periods, and the arrows between these nodes indicate intellectual or conceptual continuity between themes. Themes connected by arrows represent themes that conceptually persist or develop from one period to the next, whereas disconnected themes represent new or declining themes emerging in the relevant period.

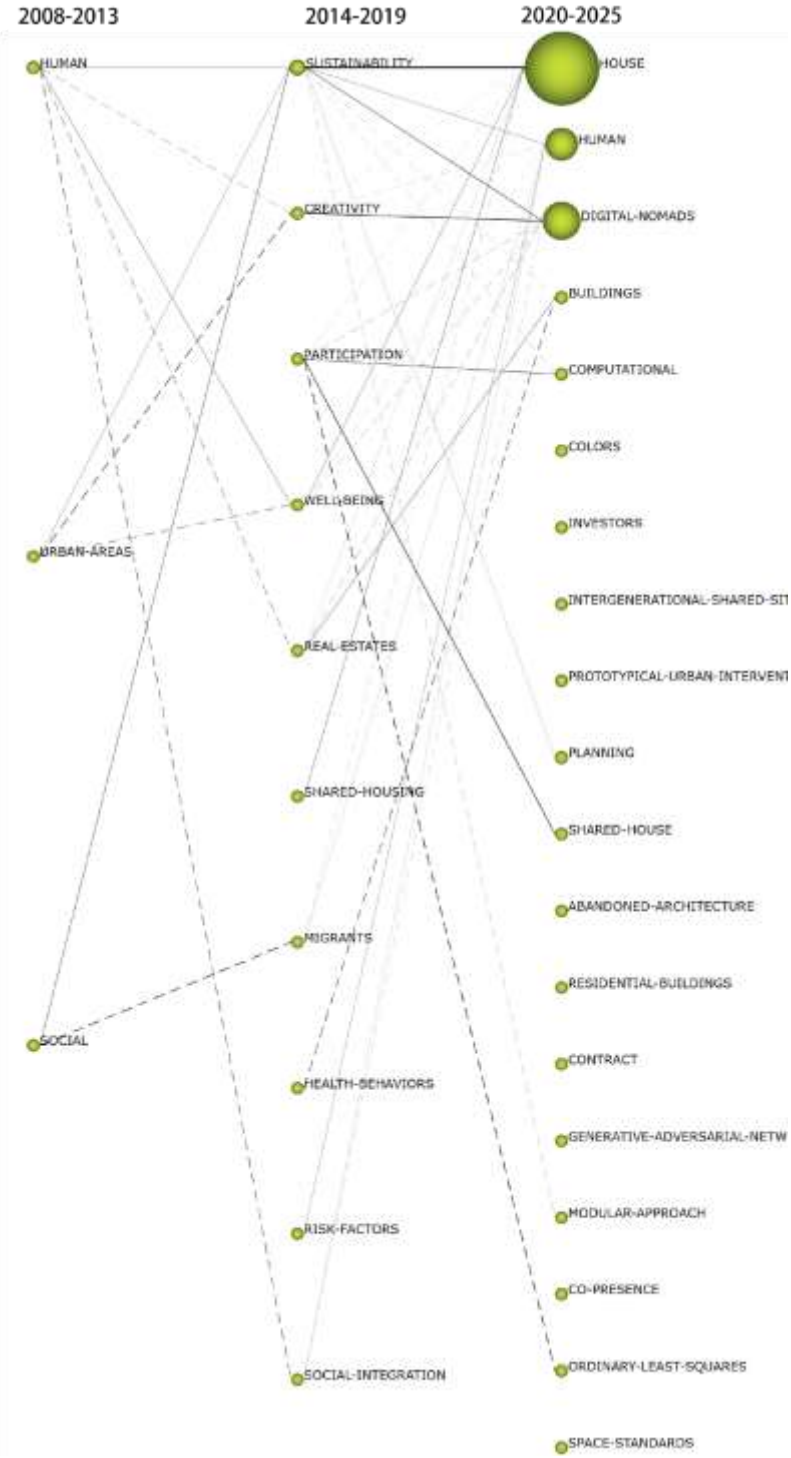

Fig. 6. Final map of thematic evolution analysis of Co-living (2008-2013, 2014-2019, 2020-2025)

Solid arrows indicate that a theme has direct conceptual continuity with the theme from the previous period, while dashed lines indicate that there are some common keywords or weak conceptual similarity between the two themes. It shows that co-living literature grew rapidly between 2008 and 2025, evolving thematically from human-social themes to sustainability/real estate and then to digital/technological themes.

Bubble sizes reflect the number of themes / core documents in each period; columns smaller to the left and larger to the right reflect the quantitative growth of the literature over time. The map shows that the themes of "human" and "social" in the 2008-2013 period are connected to the themes of "sustainability" and "social integration" in the 2014-2019 period. This shows that the human and community-oriented approach of early studies have expanded with the concepts of sustainable living and social integration in the later period. Similarly, the fact that the theme of "sustainability" in the 2014-2019 period is connected to the themes of "house", "digital nomads" and "computational" in the 2020-2025 period shows that co-living research has evolved into spatial, digital and technological dimensions. Themes such as "generative-adversarial-networks" or "co-presence, space standards" in the map do not show any connection to any previous theme.

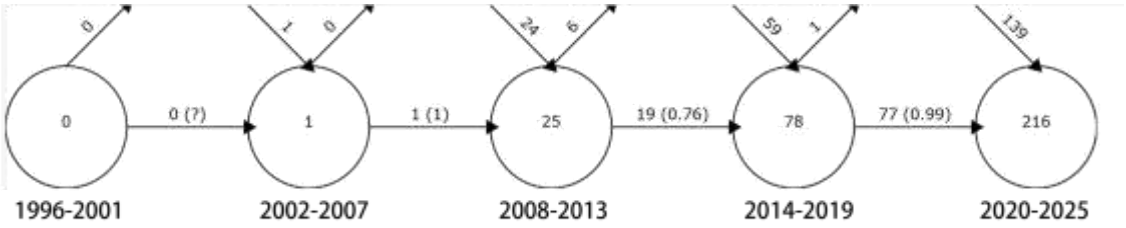

Fig. 7. Overlapping map

The Overlapping Map shown in Fig. 7 above reveals the conceptual continuity and thematic expansion of the co-living literature across periods. In the period 1996-2001, no theme emerged in this field. The appearance of only one theme in the 2002-2007 period indicates the first appearance of the concept of co-living in literature. The increase in the number of themes to 25 in the 2008-2013 period, 78 in the 2014-2019 period and 216 in the 2020-2025 period shows the rapid expansion in literature. The overlap analysis shows that 2008 is a significant threshold in literature. Before 2008, the number of publications and common keyword density were insufficient for thematic clustering; however, after 2008, there is a sudden increase in the volume of publications and a significant strengthening in the links between themes. Therefore, 2008 was taken as the starting point of the first meaningful thematic phase. The strengthening of the connections between the periods reveals that the concept of co-living has transformed into an integrated conceptual structure, starting from sociological foundations on the axis of sustainability, participation, creativity and finally digitalization. This trend also shows that the field has become a multidisciplinary and mature research area in the post-2020 period. This thematic evolution shows that co-living literature has moved from a human-social centered beginning to a digital and technological maturity stage through sustainability and social integration. increasing number of connections between themes shows that literature is becoming increasingly multidisciplinary and the integration between themes is strengthening. As a result, it is seen that co-living projects have started to be built with the motivation of circular and social sustainability and have undergone transformations such as the use of methods such as spatial syntax sequencing in spatial analysis, the preference for robotic furniture, the integration of smart energy systems and the development of foldable mechanisms. It is possible to observe this transformation not only in literature but also in spatial design.

3. Conclusion

The thematic analysis conducted in this study shows that co-living research has undergone a significant conceptual and structural transformation over the years. Strategy diagrams and centrality-intensity values clearly show which themes have come to the fore in different periods of this transformation and how the field has matured. Strategy diagrams and centrality-intensity values reveal how co-living research has evolved over time. In the 2008-2013 period, human and social-oriented themes were prominent, while sustainability and real-estates themes became the central motor themes of the field in the 2014-2019 period. In the 2020-2025 period, digital nomads, house and computational themes stand out as trending and central themes in literature with high centrality values, while themes with high density but low centrality such as colors and computational are identified as strong but isolated sub-themes. These findings suggest that co-living research is both maturing and expanding with new concepts. The thematic evolution map (Figure 6),

created through SciMAT software, reveals how the themes related to the concept of co-living have developed over time and how they relate to each other. In the 2008-2013 period, human and social themes were at the forefront, while these themes merged with the concepts of sustainability and participation in the 2014-2019 period. In the 2020-2025 period, this line has expanded with digitalization and spatial innovations (e.g. digital-nomads, computational design, smart housing). The lack of connection of some themes with previous periods indicates the emergence of new research areas (e.g. AI-based design, modular housing). This thematic evolution is directly reflected in the practice of interior architecture and spatial design. The strengthening of themes such as digital nomadism, modular housing, and computational design indicates the growing importance of flexible, adaptable, and technology-integrated interiors. The concepts of co-living, social integration and compact living reveal the need for new spatial constructions that protect individual privacy while supporting communal use. Themes such as "computational", "generative networks", "AI-based design", "digital nomads", which come to the fore especially after 2020, show that topics such as artificial intelligence-supported design methods, data-driven space planning, housing typologies optimized according to digital platforms, smart-home / smart-interior applications have gained importance in interior architecture. In addition, robotic multifunctional furniture and self-assembling movable divided walls are increasingly preferred in co-living applications. This transformation in co-living studies points to the need to reconsider interiors not only in terms of physical layouts, but also in the context of the relationship between social behaviors, digital technologies and new ways of living. These findings reveal that co-living research offers a knowledge base that will shape not only a way of life, but also future interior typologies and design strategies.

To sum up, the expansion of thematic networks indicates that co-living studies have reached maturity. The literature is now being redefined not only in terms of the sharing of living spaces, but also in terms of social sustainability, economic solidarity, digital platform economics and urban sociology. Overall, the thematic evolution of co-living literature shows that this field has transformed from a social phenomenon into a multi-layered research area around technology, economy and sustainability. These findings point to emerging and underexplored themes in co-living research and suggest opportunities for interdisciplinary work. Exploring these areas more thoroughly in future studies will strengthen the field's theoretical foundations and help develop practical policy and design recommendations.

Acknowledgements

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INTEGRATING SEISMIC SAFETY AND ENERGY EFFICIENCY IN EXISTING BUILDINGS

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Abstract
Improving both the seismic resilience and energy efficiency of existing buildings has become a key challenge in the pursuit of sustainable and climate-resilient development. Traditionally, these two goals have been approached separately, often resulting in higher costs and limited overall benefits. This study focuses on the emerging concept of integrated retrofitting, which aims to enhance structural safety and thermal performance within a single, coordinated strategy. Building on recent research, the paper discusses integrated retrofit methods grouped into three main categories: material-based hybrid systems, building-envelope solutions, and modular exoskeleton applications. The findings suggest that holistic retrofitting can lower life-cycle environmental impacts, improve occupant comfort and safety, and provide more cost-effective rehabilitation outcomes. The study emphasizes the importance of interdisciplinary collaboration and standardized design approaches to advance integrated retrofitting as a sustainable pathway for the renewal of seismically vulnerable building stocks.
Key Words: *Integrated retrofit, energy efficiency, seismic resilience, sustainable renovation*

1. Introduction

The accelerating impacts of climate change and the increasing frequency of natural hazards have brought the resilience of the existing building stock into sharp focus. Globally, buildings account for around 40% of total energy consumption and about one-third of greenhouse gas emissions, making the sector one of the main targets for achieving carbon reduction and sustainability goals [1]. According to the priorities outlined in the European Green Deal [2], achieving lower energy use, cutting pollutant emissions, and creating healthier environmental conditions will depend heavily on a broad set of actions. A key component of this effort is the systematic upgrading and renewal of the existing building stock. At the same time, a large portion of these structures was built before the introduction of modern seismic and energy efficiency standards. Many therefore suffer from inadequate thermal performance and poor structural safety, a combination that poses serious risks to both occupants and the environment [3].

In seismically active regions such as Türkiye and the Balkans, recent earthquakes have repeatedly shown how vulnerable older buildings can be [4]. Addressing only one deficiency, either energy or seismic, often leads to limited or even counterproductive results. For example, improving a building's energy efficiency without strengthening its structure may result in financial and environmental losses if earthquake damage occurs. Conversely, seismic retrofitting that disregards thermal performance can negatively affect comfort and energy demand. This interdependence has encouraged researchers to explore integrated retrofitting, a holistic approach that combines energy and seismic improvements within a single, coordinated intervention.

Over the last decade, this integrated perspective has gained significant attention in both research and practice. Pohoryles et al. [5] highlighted how combining structural and thermal upgrades can enhance life-cycle performance and reduce environmental impacts. Similarly, Belleri and Marini [4] demonstrated that neglecting seismic risk can offset the long-term carbon savings of energy renovations in earthquake-prone areas. More recent studies have explored practical ways to apply this combined strategy. For instance, Günay [6] evaluated various façade-based interventions across Türkiye's five climate zones using energy simulations, while Savić et al. [7] examined masonry buildings in Serbia and proposed a hybrid strengthening and insulation method that meets both seismic and energy standards.

Despite these advances, integrated retrofitting is still an emerging field with limited large-scale implementation. Technical challenges remain regarding the compatibility of materials and systems, the lack of unified design codes, and the need for multidisciplinary collaboration between engineers, architects, and energy specialists. Addressing these gaps is essential to make integrated retrofitting not only a technical solution but also a sustainable policy and design framework for the future of the built environment.

In this context, this paper aims to provide a structured overview of integrated seismic and energy retrofit approaches, while critically discussing their applicability through selected case insights.

2. Integrated Retrofit Concept

The concept of integrated retrofitting has emerged from the growing realization that building performance cannot be improved effectively through isolated interventions. While seismic and energy retrofitting have traditionally been treated as separate processes each with distinct objectives, disciplines, and design methods the increasing complexity of modern sustainability goals demands a more holistic approach (Figure 1). Integrated retrofitting seeks to combine these two dimensions within a single, coordinated strategy that enhances a building's safety, comfort, and environmental performance simultaneously [5].

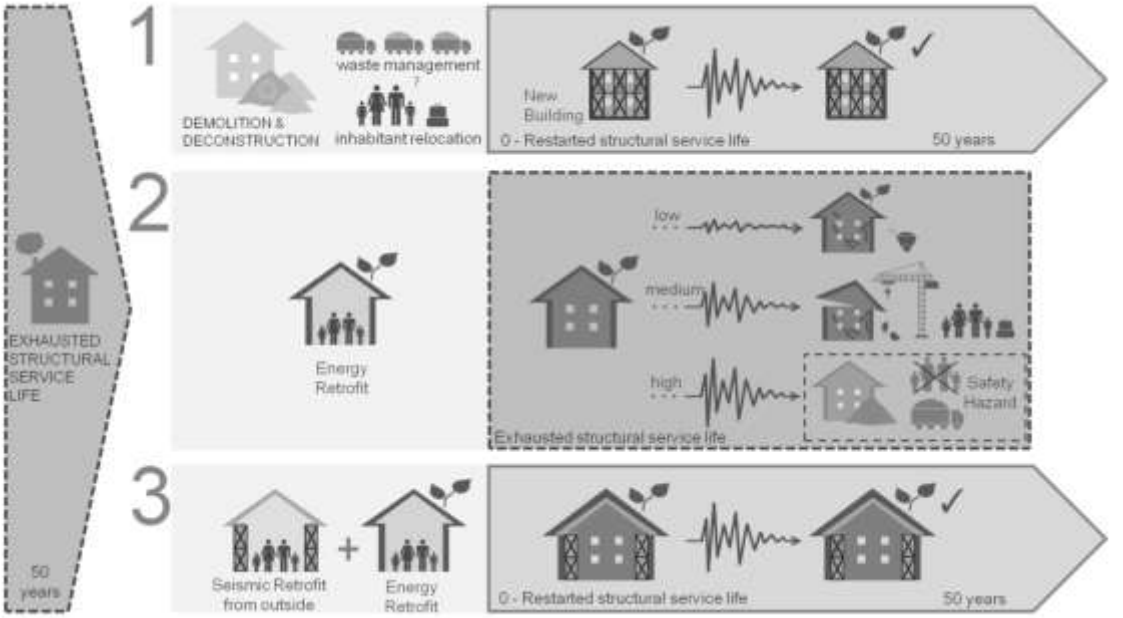

Fig. 1. Possible rehabilitation scenarios: 1) demolition and reconstruction for structural retrofit; 2) only energy efficiency improvements; 3) integrated retrofit concept [3]

At its core, the integrated approach is based on compatibility, efficiency, and life-cycle optimization. Compatibility refers to ensuring that structural and thermal interventions do not conflict, for example, avoiding insulation layers that weaken structural anchorage or strengthening systems that create thermal bridges. Efficiency involves reducing costs and disruptions by implementing both upgrades in a unified construction process. Life-cycle optimization focuses on minimizing environmental impact and maximizing long-term resilience, considering embodied energy, maintenance needs, and end-of-life recyclability [3].

Günay [6], defines this approach as the intersection of three domains: structural performance, energy efficiency, and architectural design. From this perspective, integrated retrofitting is not only a technical procedure but also a design methodology. The building envelope becomes a key mediator, acting as both a thermal barrier and a potential seismic strengthening surface. Similarly, Savić et al. [7], describe integrated retrofitting as a stepwise process that begins with a comprehensive assessment of the building's seismic capacity and energy profile, followed by the selection of interventions that complement each other in material behavior, installation method, and performance objectives.

Based on recent studies, integrated retrofitting methods can generally be grouped into three main categories:

-Material-based hybrid systems - use of multifunctional materials such as textile-reinforced mortars (TRM), fiber-reinforced polymers (FRP), or cementitious composites (FRCM) that provide both structural reinforcement and thermal insulation.

-Building-envelope-based solutions - façade renewals that integrate insulation layers, reinforced coatings, or prefabricated panels designed to improve seismic resistance and reduce energy loss simultaneously.

-Modular and exoskeleton systems - external frames or prefabricated modules that enhance lateral load resistance while serving as carriers for insulation, shading, or photovoltaic components.

What distinguishes the integrated retrofit concept from conventional methods is its systemic view of building performance. Rather than focusing solely on individual targets such as increasing energy ratings or strengthening structural members, it emphasizes the synergy between them. This synergy not only reduces total intervention time and cost but also contributes to broader sustainability objectives, including lower embodied carbon, improved indoor comfort, and enhanced post-disaster resilience.

3. Methods and Applications in Literature

Recent literature presents a broad variety of methods for integrating seismic and energy retrofitting. Although each study adopts a different focus, ranging from material performance to design integration, most approaches can be classified into three main categories: material-based hybrid solutions, building-envelope systems, and modular or exoskeleton applications. These categories share the common goal of enhancing safety, comfort, and sustainability within a single intervention framework.

3.1 Material-based hybrid solutions

Material-based strategies focus on the development of composite or multifunctional materials that provide both structural reinforcement and thermal improvement. One prominent example is the use of textile-reinforced mortars (TRM) (Figure 2) or fiber-reinforced polymers (FRP) (Figure 3), which have been widely studied for their ability to increase load-bearing capacity without significantly adding weight. When combined with insulating mortars or aerogel plasters, these materials offer dual benefits, strengthening masonry walls while enhancing their thermal resistance.

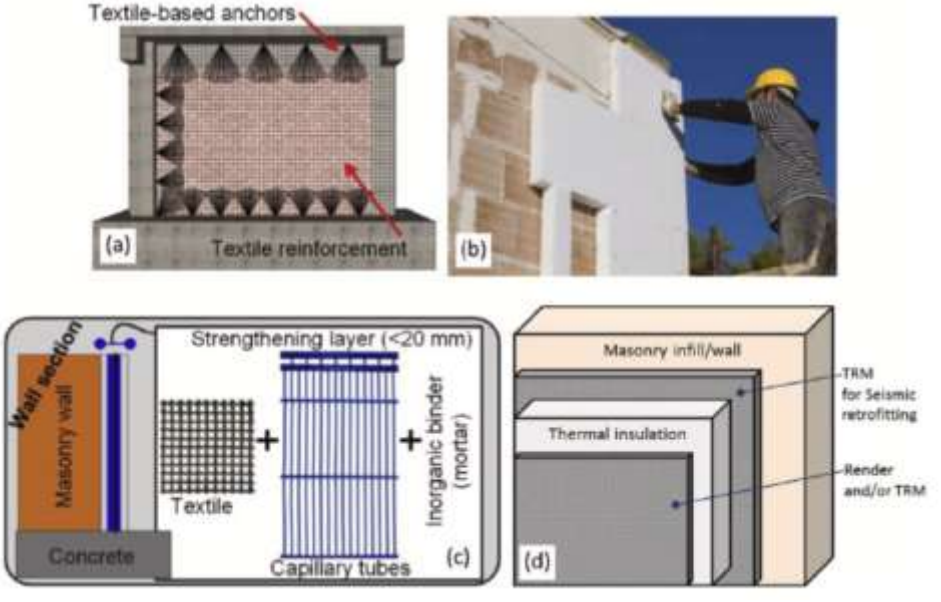

Fig. 2. Illustration of several configurations combining TRM applications with energy-efficiency measures: a) strengthening of infill walls and the reinforced-concrete frame using TRM, b) application of external insulation on the building envelope, c) TRM combined with capillary heating pipe systems, and d) TRM integrated with thermal insulation layers [8].

Such materials are particularly advantageous for heritage or masonry buildings, where invasive structural interventions are limited. Studies reviewed by Pohoryles et al. [5] show that hybrid FRP-insulation composites can achieve up to 40% reduction in energy loss while improving shear resistance by more than 25%. Similarly, Savić et al. [7] implemented a combined cement-based coating and thermal insulation system in masonry buildings in Niš, Serbia, demonstrating notable improvements in both seismic performance and operational energy demand.

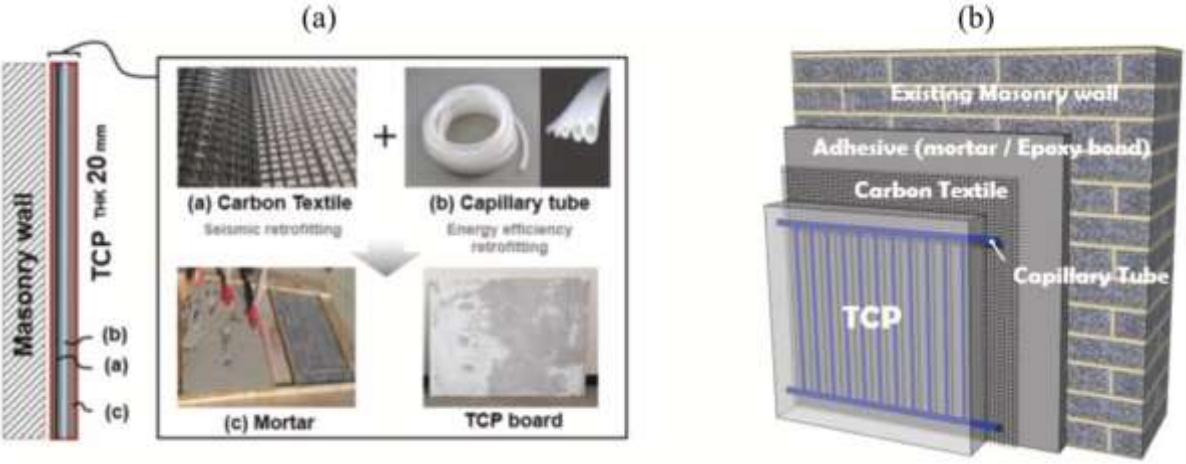

Fig. 3. Integrated Textile-Capillary Tube (TCP) panel used for simultaneous seismic strengthening and energy upgrading: (a) schematic representation of the panel's layered composition, and (b) example of its installation on a masonry wall [9].

3.2 Building-envelope-based systems

Envelope-based methods represent another significant branch of integrated retrofitting (Figure 4,5). These strategies treat the building's outer shell as the interface where energy and seismic needs intersect. Günay [6] conducted a comprehensive simulation study using DesignBuilder software across five different Turkish climate zones, showing that façade retrofit options -such as external insulation, solar shading, and reinforced cladding- can simultaneously reduce annual energy consumption by 25–35% and increase façade stiffness and integrity.

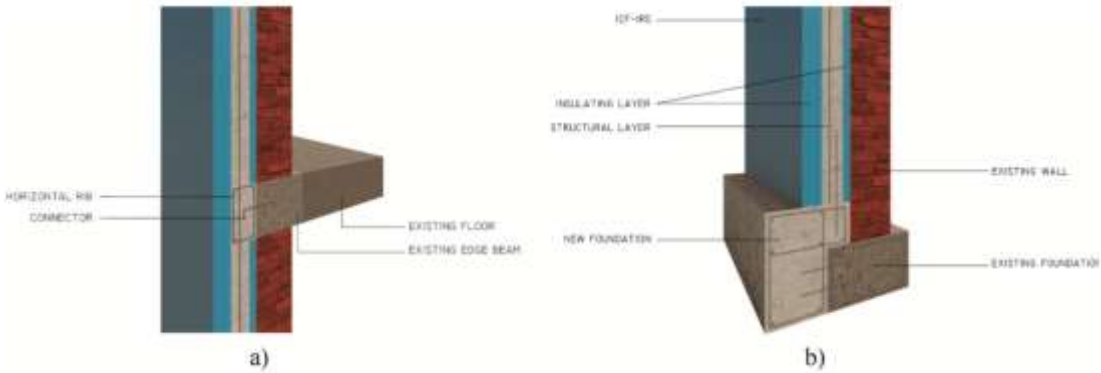

Fig. 4. Insulating concrete formwork system: (a) detail showing how the formwork is connected to the floor beams, and (b) example of its integration with the foundation elements [10].

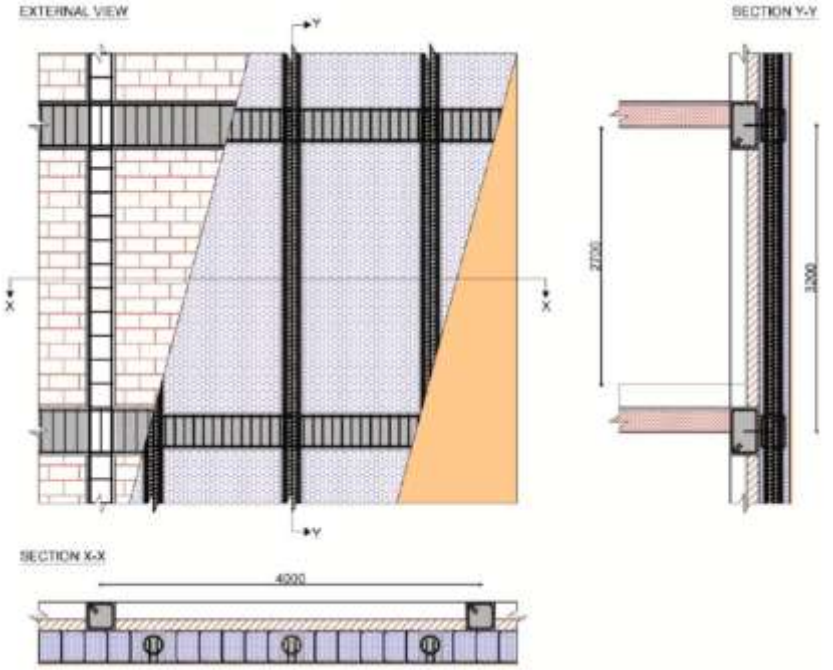

Fig. 5. Reinforced-concrete (RC) frame–based double-skin façade configuration [11].

According to Belleri and Marini [3], combining seismic and thermal renovation within façade renewal processes not only enhances safety but also reduces the embodied carbon associated with post-earthquake repairs, making it a key step toward sustainable urban renewal.

3.3 Modular and exoskeleton applications

The third and increasingly popular method involves modular or exoskeleton systems, external load-bearing structures, that wrap around existing buildings (Figure 6, 7, 8, 9). These systems provide additional lateral stiffness and load resistance while integrating energy components such as photovoltaic panels, green façades, or advanced shading devices. Exoskeletons application offers several advantages: they avoid internal disruption, allow architectural renewal, and can be designed to host energy-efficient or renewable technologies.

Fig. 6. (a) Example of a shear-wall structural system, and (b) an exoskeleton-based energy retrofit configuration incorporating adjustable shading louvers, solar greenhouse elements, and intermediate buffer spaces [12].

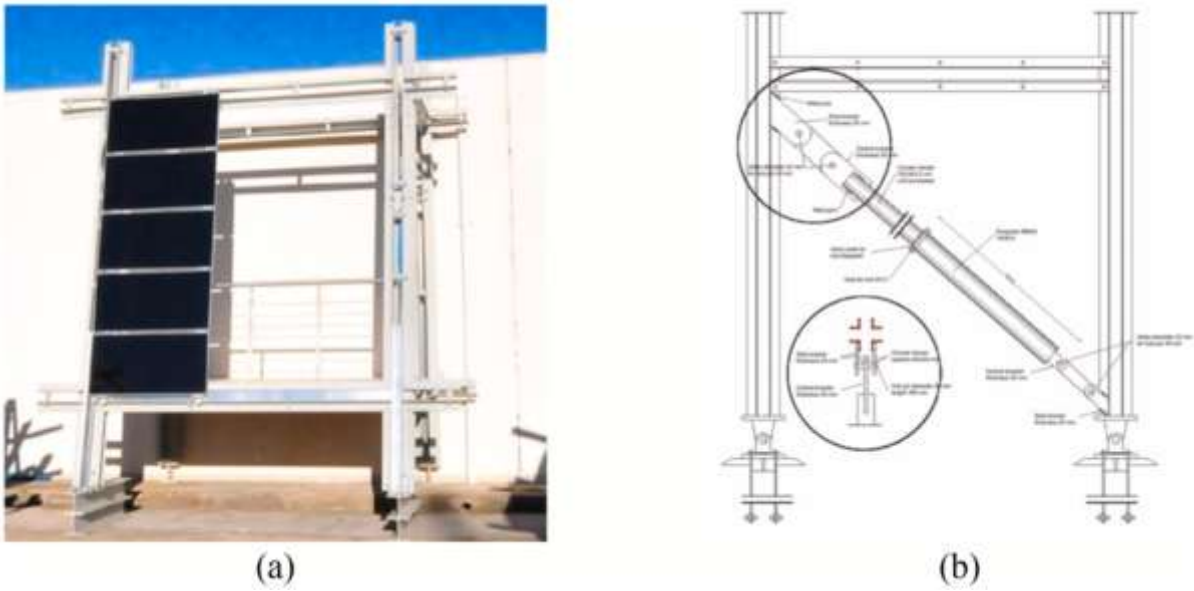

Fig. 7. (a) Prototype segment of a dissipative exoskeleton frame incorporating photovoltaic (PV) panels, and (b) the dissipative Buckling-Restrained Brace mechanism positioned within the perpendicular framing elements [13].

Examples include the 'Sismo-Green' prototype developed in Italy, which combines a steel exoskeleton with ventilated and insulated façade panels to simultaneously improve seismic resistance and thermal performance [16], as well as other experimental steel exoskeleton systems that have been tested in pilot projects across Europe and Japan. Günay [6] also highlights the potential of such systems for Türkiye, emphasizing their flexibility for different building types and their ability to meet both structural and energy targets under diverse climatic conditions.

Integrated retrofitting methods in the literature clearly demonstrate that structural and thermal goals are not mutually exclusive. By using innovative materials, multifunctional façades, and adaptable exoskeleton systems, researchers and practitioners have shown that performance-based retrofitting can simultaneously address safety, comfort, and sustainability. However, despite encouraging results, large-scale implementation remains limited due to cost, regulatory, and coordination challenges—issues further discussed in the following section through comparative case analyses.

Fig. 8. Alternative design configurations illustrating holistic seismic and energy upgrading of a reinforced-concrete (RC) building with a diagrid exoskeleton system [14].

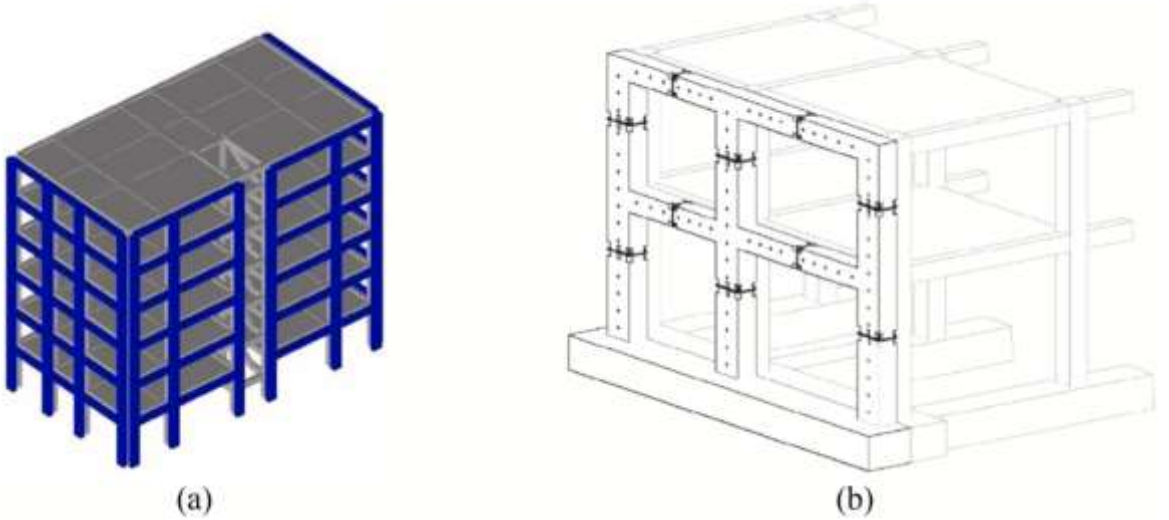

Fig.9. (a) Model of a reinforced concrete frame exoskeleton case study structure and (b) exoskeleton joint detail [15]

4. Case Examples, Methodological Selection Criteria and Discussion

To better understand how integrated retrofitting can be applied across different scales and decision contexts, three representative studies are examined. These cases were strategically selected to validate the integrated retrofit categories (defined in Section 3) through three distinct methodological lenses: simulation-based design, practical field application, and life-cycle decision-making.

4.1 Case 1: Simulation-based façade and energy retrofit study in Türkiye [6].

Günay employed DesignBuilder simulations across five Turkish climate zones to evaluate façade retrofit options, including external insulation, solar shading, photovoltaic integration, and reinforced façade elements, applied to a representative residential building. The results indicate that façade-based interventions can reduce annual heating and cooling demands by approximately 25-35% in favorable scenarios, while also providing a potential surface for seismic strengthening elements that contribute to lateral resistance.

A key contribution of this study lies in its climate-sensitive approach, demonstrating that retrofit priorities vary significantly between cold and hot-humid regions, insulation thickness being more critical in colder zones, while solar control dominates in warmer climates. However, as the study is simulation-based, the seismic contribution of façade-integrated elements remains conceptual and would require detailed structural analysis and validation for real-world implementation.

4.2 Case 2: Field-applied masonry retrofit in Niš, Serbia [7].

Savić et al. presented a practical integrated retrofit solution for post-World War II masonry apartment buildings in Niš, combining a one-sided reinforced cement-mortar overlay with external thermal insulation. Through experimental testing and analytical assessment, the study demonstrated measurable increases in lateral resistance, alongside envelope performance improvements that meet contemporary thermal regulations.

This case represents a low-invasiveness and implementable solution, particularly suitable for dense residential contexts where interior disruption must be minimized. Nevertheless, its applicability remains dependent on local construction practices, workmanship quality, and masonry typologies, limiting direct transferability without contextual adaptation.

4.3 Life-cycle–oriented environmental impact assessment [3].

Rather than proposing a specific retrofit technique, Belleri and Marini [3] developed a framework to assess how seismic risk impacts the environmental benefits of energy upgrades. Their study reveals that in earthquake-prone regions, the carbon footprint of repairing structural damage can equal or even exceed the

energy savings gained from thermal renovations alone. This emphasizes that ignoring seismic safety can effectively cancel out the environmental advantages of energy-efficient retrofitting.

This study provides a strong life-cycle rationale for integrated retrofitting, highlighting that energy-only renovations may fail to deliver genuine sustainability benefits if seismic risk is neglected. In this sense, it complements the previous two cases by framing integrated retrofitting not only as a technical or design strategy, but also as a necessity for informed environmental decision-making.

Table 1 summarizes the objectives, methods, and main findings of three key studies addressing integrated seismic and energy retrofitting across different building types and regional contexts.

Table 1. Comparative Summary of Representative Integrated Retrofitting Studies

Study (year)	What was researched	Method / Tools	Key improvements shown	Notes / limitations
Günay (2024) [6]	Effect of façade-based retrofit options on energy loads and potential for façade-integrated seismic elements across 5 climates	Building energy simulation (DesignBuilder); parametric scenarios (insulation thickness, glazing, PV, shading); conceptual addition of façade seismic elements	Up to ~25–35% reduction in annual heating/cooling loads in favorable scenarios; shows façade solutions can serve dual role (thermal + stiffness/strength) when reinforced layers added	Simulation study (no full structural testing). Results depend on assumed retrofit details and boundary conditions for seismic behaviour.
Savić et al. (2025) [7]	Integrated seismic + energy retrofit for post-WWII masonry apartment buildings (case study Niš)	Field/experimental + analytical: one-sided reinforced cement mortar overlay + external insulation; structural assessment and energy upgrade assessment; on-site applicability discussed	Increased lateral resistance, improved envelope U-values meeting current regulations; demonstrated practical, low-invasiveness package and favorable cost/feasibility	Case-specific (masonry typologies of the region). Performance depends on workmanship, anchorage quality and local materials.
Belleri & Marini (2016) [3]	How seismic risk influences environmental impact (embodied CO_2e) of energy refurbishment	Probabilistic PEER-PBEE framework extended to environmental variables (expected annualized embodied CO_2e due to seismic damage); comparative scenarios: energy retrofit only vs energy + seismic retrofit	Found that expected annual embodied CO_2e from earthquake damage (for buildings in high seismicity) can approach annual operational CO_2 savings from thermal retrofit - i.e., ignoring seismic risk can erase the environmental benefits	Conceptual and quantitative LCA-oriented study; does not prescribe specific retrofit systems but argues for including seismic risk in LCA and decision frameworks.

The comparative analysis of the three case studies highlights that integrated seismic and energy retrofitting operates across different levels of intervention and decision-making. While the façade-based simulation study in Türkiye [6] focuses on design exploration and climate-sensitive optimization, the masonry retrofit in Niš [7] demonstrates the feasibility of integrated solutions through on-site implementation. In contrast, the work by Belleri and Marini [3] addresses integration from a life-cycle and environmental risk perspective, emphasizing long-term performance rather than immediate design or construction outcomes.

Despite these differences, all three studies converge on a common finding: energy-only retrofit strategies are insufficient in seismically active regions. Whether examined through simulation results, experimental performance, or environmental impact metrics, neglecting seismic strengthening can undermine both safety and sustainability objectives.

Key differences emerge in terms of scale and applicability. Façade-based approaches offer high flexibility and are particularly relevant for architectural design, as they allow seismic and energy measures to be incorporated within a single building layer. Field-based masonry solutions prioritize constructability and low invasiveness, making them suitable for large residential stocks. Life-cycle-oriented studies, meanwhile, provide a critical decision-making framework that justifies integration even when short-term energy gains appear sufficient.

From an architectural perspective, these findings suggest that integrated retrofitting should not be understood as a single technical solution, but rather as a design framework that adapts to building typology, climate, and seismic context. Effective integration therefore requires early-stage collaboration between architects, structural engineers, and energy specialists, positioning architects as key mediators of integrated retrofit strategies.

5. Conclusions

This study reviewed and critically discussed recent developments in integrated seismic and energy retrofitting, demonstrating that coordinated interventions can significantly enhance both the resilience and environmental performance of existing buildings. The literature and case-based evidence indicate that addressing seismic safety and energy efficiency as a unified process leads to more effective construction strategies, improved life-cycle outcomes, and reduced environmental impacts when compared to isolated retrofit actions.

The three main categories of integrated solutions -hybrid material systems, envelope-based approaches, and modular exoskeleton structures- highlight that no single solution fits all contexts. Instead, successful integration depends on building typology, climatic conditions, seismicity, and the level of intervention, reinforcing the need for context-specific retrofit strategies.

The examined cases from Türkiye and Serbia confirm that integrated approaches are applicable at both the design and implementation levels, with simulation-based studies supporting early-stage decision-making and field applications demonstrating technical feasibility and performance gains. Beyond technical benefits, the reviewed environmental impact studies underline that neglecting seismic risk can compromise the long-term sustainability of energy-oriented renovations.

Overall, integrated retrofitting should be understood not merely as a technical solution, but as a design and decision-making framework that supports safer, more energy-efficient, and climate-resilient building stocks. Future research should therefore focus on standardized assessment methods, improved material compatibility, and policy instruments that foster interdisciplinary collaboration between architects, engineers, and energy specialists.

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CONSTRUCTION OF SENSORY ATMOSPHERE: THE CONCEPT OF SILENCE IN SACRED SPACES

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Abstract

This study is a theoretical investigation conducted within a qualitative research framework, examining how silence operates as a constitutive component of the sensory atmosphere in the formation of sacred space experience. Within this scope, the concepts of sacred space, atmosphere, and silence are addressed through conceptual and descriptive analysis grounded in architectural and interior architecture literature. The study does not rely on empirical data collection; instead, phenomenological approaches form the theoretical foundation of the research. The conceptual framework is structured around Zumthor's understanding of atmosphere, Eliade's conception of sacred space, Otto's notion of sacred experience, Böhme's approach to sensory atmosphere, and Pallasmaa's emphasis on embodied perception. In this context, silence is examined as a multilayered phenomenon experienced in sacred space across three interconnected levels: physical, sensory, and spiritual. The findings indicate that silence emerges as a structural component of atmosphere at the intersection of spatial order, bodily awareness, and faith-related layers of meaning. Accordingly, the "Diagram of the Physical, Sensory, and Spiritual Dimensions of Silence in Sacred Space" offers a conceptual framework for understanding the role of silence in sacred space design and proposes a theoretical perspective for rethinking sensory atmosphere within the context of interior architecture.

Key Words: *Sacred Spaces, Silence, Spatial Atmosphere, Spatial Perception, Sensory Atmosphere*

1. Introduction

The impact of spaces on individuals emerges through atmosphere formed at sensory, emotional, and intuitive levels. This atmosphere functions as an invisible mode of communication between the user and the space, simultaneously engaging bodily presence, perceptual awareness, and spiritual experience [1].

People attribute sacredness to certain places for various reasons. Such spaces are encountered across nearly all religious traditions and are widely regarded as sacred areas [2]. The conception of sacred space is established by drawing a boundary around a place, separating it from the surrounding non-sacred environment and thereby endowing it with sacred meaning [3]. As structures in which individuals orient themselves toward the spiritual and engage with it while practicing their faith within communal contexts, sacred spaces constitute one of the most explicit physical and architectural expressions of belief systems [4]. The experience of sacred space does not unfold solely within the physical boundaries of a place; rather, it materializes within a multilayered field of meaning in which the sacred is continually reconstituted in the world through the interaction of ritual, symbol, and belief [5,6].

The *numinous*, as defined by Rudolf Otto, refers to a distinctive state of consciousness in which individuals intuitively experience the mysterious influence of the sacred without being able to conceptualize it at sensory, emotional, or intellectual levels. In this context, the perception of the sacred within the given scene can be interpreted through Otto's concept of *mysterium tremendum et fascinans*, which describes a profound inner disturbance simultaneously marked by fear and awe, as well as attraction and fascination, experienced on both bodily and spiritual levels [7]. According to Böhme, atmosphere constitutes the "felt reality of space," and thus, in sacred architecture, phenomena such as acoustic resonance or the depth of spatial voids serve as mediators of the perception of the sacred [8]. Consequently, sacredness emerges not from the materiality of stone, marble, or ornamentation alone, but within the relational void between them—an intermediate zone where silence intensifies and where individuals become aware of their own existence [8].

Peter Zumthor similarly emphasizes that "atmosphere is the essence of architecture." The sacredness of a church, mosque, or temple is related less to visually perceptible forms than to the transmission of an inner

state of being to the user. This transmission occurs through light, warmth, resonance, and spatial void, elements that constitute the spiritual material of architecture [9,10]. Through the nine atmospheric principles he proposes, Zumthor provides a significant framework for understanding how sensory coherence is established in architecture. Among these principles, the "sound of space" stands out as a fundamental element in shaping the meaning of silence within sacred spaces. For Zumthor, a well-designed space is characterized by an acoustic order in which resonance, silence, and even breathing is perceived in a balanced and measured manner. In sacred buildings, such silence reinforces both bodily awareness and inner tranquility. Accordingly, when considered in relation to all the principles, silence emerges as a complementary element that contributes to the construction of architecture's sensory atmosphere [9,10].

This study aims to examine how sensory atmosphere is constructed in sacred spaces through the concept of silence, employing a descriptive analysis approach. Within this framework, the ways in which silence generates atmosphere in sacred space are explored. Grounded in theoretical approaches within interior architecture, architecture, and design literature, the research seeks to evaluate the experience of sacred space as a coherent sensory whole, offering an analytical framework that addresses not only the visible form of space but also the perceptual qualities shaped by silence.

2. Sacred Space

Belief is commonly defined in dictionaries as a form of acceptance that holds meaning in an individual's mind, regardless of whether its truth is proven, and that gradually acquires an emotional dimension. Throughout history, traces of beliefs formed within human consciousness have been reflected in different spatial arrangements, leading to the emergence of spatial typologies associated with specific belief practices. In this way, individual beliefs have not remained solely as inner experiences but have also contributed to the formation of spaces in which these beliefs become materialized [11].

In the history of architecture, religious buildings that constituted the monumental structures of their periods were often constructed to demonstrate power and authority. Frequently positioned at the center of the urban fabric, these structures are understood to carry multilayered meanings expressed both outwardly and inwardly. The most immediately apparent layer is the symbolic meaning imbued with divine qualities. While these spaces, in which rituals are performed, are regarded as the house of God across different belief systems, they simultaneously represent the level attained by human intellect, engineering capability, and technological advancement [12].

Spaces constructed for the purpose of worship have, over time, shaped the formation of religious architecture. Variations in worship practices and rules across different belief systems have led to architectural diversity within these structures. While each religion develops distinctive spatial arrangements in accordance with its own rituals, these spaces simultaneously interact with the cultural values of the societies in which they exist. As a result, sacred spaces, shaped as cultural elements, have become powerful indicators reflecting the social and cultural transformations of their respective periods [13].

Sacred spaces are predominantly protected areas characterized by a taboo status, grounded in hierophanic beliefs, which refer to the manifestation of a supernatural presence in a specific location, and engagement with these spaces requires adherence to particular ritual orders. Being present in such places is considered significant due to the belief that they confer both worldly and otherworldly privileges upon the individual. Pilgrimage sites and temples belonging to various religious traditions constitute fundamental and well-established examples of such spaces [14]. Structures regarded as sacred form the focal point of a society's religious life, serving as spaces that guide individual existence and imbue it with meaning. Regardless of religious affiliation, it is evident that human beings require such spaces, and that the sense of sacredness has remained a continuous component of human experience since its earliest periods [15].

As emphasized in Tuan's analyses of sacred space, architectural experience extends beyond a purely formal phenomenon and constitutes a spiritual encounter in which individuals, through their senses, are able to perceive and intuit a presence beyond the material world, namely the divine [16].

3. Spatial Experience and Sensory Atmosphere

The conceptual counterpart of experience within the field of architecture is the notion of spatial experience. This concept gains meaning at the intersection of the body and space. At the moment the human body comes into contact with space, perception begins, and over time this interaction evolves into a process of spatial experience. At the same time, the manner in which space is perceived through the body's senses and memory plays a decisive role in shaping the diversity of this experience, since the body itself is the agent that evaluates and interprets the data provided by space [17]. This shift in architectural thinking has rendered the relationship between body and space more complex and multilayered. Pallasmaa explains architectural experience through the concept of "existential sense," emphasizing that it constitutes a profound experience grounded in bodily existence and self-awareness. According to him, architecture provides a setting that materializes the individual's "being-in-the-world"; therefore, identification with space extends beyond sensory perception to reach a level of existential awareness, thereby deepening the sensory experience itself [18,19].

Atmosphere conveys the meaning and spirit inherent in a space. In a manner similar to the adjectives used to describe weather conditions, such as "foggy," "misty," "gloomy," "spacious," or "warm," spaces may also be characterized through comparable descriptors, allowing one to speak of an atmosphere, understood as the spirit of the place. In this sense, atmosphere constitutes a holistic configuration that emerges from the interplay of all elements composing a space and that defines its unique identity [1]. According to Griffero, atmosphere is conceived as a qualitative and affective precondition through which individuals engage with the world via their senses, implying that every interaction with the environment unfolds within a specific emotional tonality (*Stimmung*). From this perspective, atmosphere is understood not merely as a physically perceived environment, but as a sensorial field that shapes an individual's mode of existence and inner resonance [20,21].

Architect Peter Zumthor, who approaches spatial atmosphere within the context of experience and interprets it through subject–object interaction, examines this concept in detail in his book *Atmospheres* [9]. By articulating his reflections on the formation of atmosphere through both the spaces he has experienced and the projects he has designed, Zumthor draws attention to the emotional and sensory dimensions of space. According to Zumthor, atmosphere is perceived through human sensitivity and intuitive modes of perception [9]. To clarify this idea, he refers to the discipline of music, noting that just as emotional responses to a piece of music are often anticipated intuitively, reactions to architectural space likewise emerge at an intuitive level prior to rational cognition [10]. He maintains that this process is equally applicable to the perception of atmosphere in architecture [9]. Within this framework, silence emerges as a critical threshold in Zumthor's understanding of atmosphere, deepening the sensory intensity of space as an invisible yet influential layer. Zumthor systematically examines the objective aspects of atmosphere and the ways in which spatial atmosphere may be constructed, organizing them under nine fundamental factors:

1- The body of architecture: The massing of a building, together with its structural integrity and spatial organization, constitutes a fundamental element that shapes bodily perception and the sense of being present within space.

2- Material compatibility: It explains how the harmony between the tactile, visual, and acoustic properties of materials influences the sensory continuity of atmosphere.

3- Sound of space: It emphasizes the decisive role of the auditory environment that is formed through the interplay of resonance, silence, and spatial acoustics in shaping atmosphere.

4- Temperature of a space: It describes the relationship between the physical and perceptual warmth of space and the emotional responses and sense of comfort experienced by the user.

5- Surrounding objects: It supports the secondary sensory effects of objects, details, and surfaces surrounding the space that contribute to the completion of atmosphere.

6- Between composure and seduction: It demonstrates how the balance established between tranquillity and attraction within a space influences the user.

7- Tension between interior and exterior: It makes visible how the boundaries and transitions between interior space and the external environment shape the perception of atmosphere.

8- Levels of intimacy: It determines the emotional distance established between the space and the user through scale, proportion, and degrees of proximity.

9- Light on things: It reveals the manner in which the effects of light on surfaces and objects make the sensory and atmospheric qualities of space perceptible.

Peter Zumthor defines atmosphere, in essence, as "the core of architecture," emphasizing sensory awareness as the primary factor shaping the meaning of space [9]. According to him, the value of a building is measured by the intensity of the feelings it evokes in the user. Elements such as light, resonance, warmth, and materiality are regarded as mediators in the formation of this experience. Zumthor's principles of "Light on Things" and "Sound of Space" demonstrate that space is not merely something to be seen, but an environment to be heard and felt [9].

Within this framework, the nine principles proposed by Zumthor provide a comprehensive conceptual ground for understanding the multidimensional nature of architectural atmosphere. Among these principles, however, the notion of the sound of space is addressed within the scope of this study due to its capacity to make visible the role of silence in the experience of sacred space. Silence emerges as a fundamental atmospheric component that deepens bodily and spiritual perception in conjunction with spatial volume, materiality, and the configuration of voids.

4. Method and Methodology

Within the scope of this research, which theoretically examines the concept of silence in sacred spaces in depth, descriptive analysis, one of the qualitative research methods, has been employed. In the study, the concepts of sacred space, atmosphere, and silence are addressed in light of interior architecture and architectural design literature, and the physical, sensory, and spiritual components through which silence shapes spatial experience are evaluated within a theoretical framework. This tripartite classification is developed on the basis of theoretical approaches in the literature on sacred space and architectural atmosphere that address silence in different contexts. In accordance with the descriptive analysis approach, written sources related to the subject are systematically reviewed, the concepts obtained are classified to establish a thematic structure, and the role of silence within the atmosphere of sacred space is articulated through these themes.

In line with the theoretical approaches adopted in this study, the physical dimension is structured through the architectural body, the sound of space, and material qualities emphasized in Peter Zumthor's understanding of architectural atmosphere, including light, resonance, void, and materiality. The sensory dimension is grounded in the phenomenological approaches of Juhani Pallasmaa and Steven Holl, who conceptualize spatial experience through embodied perception, multisensory engagement, and intuitive awareness. The spiritual dimension is framed in accordance with Rudolf Otto's concept of the *numinous* and Mircea Eliade's interpretations of sacred space and the manifestation of the sacred. Within this framework, each dimension draws upon distinct theoretical discussions, yet they are brought together under a shared analytical structure in order to elucidate the multilayered experience of silence in sacred space [6, 7, 9, 10, 22, 23].

The methodology of the research is structured in three stages. In the first stage, silence at the physical level is examined in relation to the bodily and perceptual effects produced by the architectural body, spatial volume, and the configuration of voids. In the second stage, silence at the sensory level is evaluated as a factor that shapes bodily awareness and the individual's mode of integration with the atmosphere of space. In the final stage, silence at the spiritual level is interpreted as a phenomenon that deepens existential awareness and enables the individual to establish a relationship with the sacred.

5. The Sound of Space: The Concept of Silence in Sacred Space

Silence may be described as a distinctive field of meaning that lies beyond the expressive limits of language and carries what has not yet been articulated in words [24]. It opens a narrative interval in which meaning deepens and the perception of time expands. This interval holds an unlimited potential that allows thought to flow in multiple directions [25].

Silence comes to the fore in certain spaces as if it were an invisible layer. Among the spaces in which silence is distinctly perceived are halls, corridors, rooms, and houses shaped by various decorative arrangements, as well as different types of structures such as churches, libraries, castles, and prisons [26]. Although churches and monasteries differ in character from the silence encountered in domestic spaces such as living rooms, corridors, and rooms, they are nevertheless among the environments in which silence is most intensely experienced. According to Max Picard, cathedrals are structures shaped around the idea of silence. In his view, the Catholic cathedral, by its very presence, produces an almost material form of silence. As Picard states, the cathedral creates the effect of a "silence carved into stone" and rises like a volume that contains an immense accumulation of silence [26,27]. This profound quality of silence, which permeates the texture of space, forms part of a broader sensory framework that determines how space is perceived. For this reason, silence may be regarded, much like sound, as a component that shapes the character of space, since it contributes to the sensory structure of atmosphere together with resonance, vibration, and subtle traces of sound.

The study titled *Architecture: The Condition of Silence* defines silence as "the condition of existence of architecture." Where sound recedes, the essence of space, understood as its volumetric dimension, together with the relationship between light and material, becomes perceptible [28]. Silence is described not as an absence, but as a distinctive "mode of reality" inherent to existence itself. Within this framework, the essence of architecture is revealed through the auditory depth of void, through which silence endows space with a tangible presence. Auditory depth refers to a domain in which individuals establish a simultaneous engagement with space and their own existence, and where the sacred is experienced at an intuitive level beyond verbal articulation [28].

According to Peter Zumthor, the sound of space emerges together with the mode of existence of space and constitutes a field that establishes experience in a holistic manner. Zumthor approaches interior spaces as bodily volumes that contain, transmit, and transform sound; within this framework, sound acquires a quality that is shaped through the interaction of form, scale, materiality, and surfaces, and therefore cannot be considered separate from space itself. In his work *Atmospheres*, Zumthor positions the sound of space as one of the constitutive components of architectural atmosphere and emphasizes that how a building is heard is as decisive as how it is seen. From his perspective, space is experienced as a multilayered whole that is not only visually perceived, but also encountered through bodily contact, hearing, and sensation. For this reason, sound becomes a fundamental sensory parameter that deepens the intuitive perception of space [9].

The auditory environment that emerges within a space is shaped by the presence, movements, and interactions of users, together with the acoustic properties of the materials employed. In this context, Peter Zumthor defines interior spaces as large instruments that absorb, amplify, and transform sound [9]. Describing architecture as a ground that carries the rhythm of everyday life, Zumthor notes that auditory traces such as footsteps, conversations, echoes, and pauses invisibly shape the character of space. From this perspective, sound becomes not merely an indicator that explains architecture, but a constituent presence that establishes the internal order and atmosphere of space itself. The sound of space can neither be fully controlled nor entirely predicted, and it is precisely this indeterminacy that strengthens the living and experiential quality of atmosphere [29]. This approach is clearly exemplified in the Swiss Pavilion at Expo 2000, where the convergence of users walking, speaking, and producing sound within a labyrinthine spatial

configuration, together with ambient sounds, allows sound to be experienced in multiple ways and to become an active component of spatial perception [30].

The expression "the sound of space" refers not to a single tone or a specific sound, but to the holistic effect produced by the coexistence of all sounds present within a space. These sounds converge without being separated, collectively transforming and shaping the atmosphere of the environment. While the sound of space may be directed or controlled depending on the materials employed, the diversity of sounds perceived in each space contributes to the formation of its distinctive character [10]. Interpreting the notion of the sound of space through its opposite, the silence of space, Le Breton emphasizes the significance of lived sensory experience by stating that "silence is not constituted by the disappearance of sounds, but by the quality of listening, by the subtle pulses of life that give space its vitality." [31].

Zumthor's approach to the sound of space enables the auditory experience to be interpreted through perceptual states in which spatial awareness becomes intensified. Within this framework, silence may be understood not as a condition of rupture signifying the absence of sound, but as an experiential threshold through which the auditory and sensory layers of space become more distinctly perceived.

5.1 The Three Dimensions of Silence

Zumthor's conception of atmosphere approaches space as a holistic domain of existence experienced through the body, the senses, and intuitive perception. Within the scope of this study, silence is examined across three dimensions, physical, sensory, and spiritual, based on Zumthor's principles such as *the sound of space, the architectural body, and the effects of light on objects.*

An examination of various classifications in the field indicates that the factors influencing space are fundamentally shaped across physiological, psychological, and sociological dimensions. Within this framework, spatial experience is understood to develop through the interaction of these three factors [32]. In a similar manner, the phenomenon of silence in sacred spaces may also be conceptualized as a holistic field experienced across three dimensions, namely physical-physiological, sensory-psychological, and spiritual-sociological. This tripartite structure is schematically illustrated in Figure 1 in order to conceptually render visible the relationship between silence and sensory atmosphere in sacred space.

Fig. 1. Diagram of the Physical, Sensory, and Spiritual Dimensions of Silence in Sacred Space (developed by the authors based on theoretical approaches).

In sacred space, the sensory dimension articulated through silence encompasses perceptual processes such as sense, depth, intuition, experience, and interaction [9, 22, 32, 33, 36], whereas the spiritual dimension is defined through layers including the sacred, spiritual orientation, symbol, experience, ritual, and belief [5, 6, 7, 8]. The physical dimension, positioned at the lower level of the diagram, reveals how these layers of meaning become visible in space through tangible spatial components such as color,

volume, surface, texture, scent, and light [32, 34]. The overlapping field formed at the intersection of the three dimensions, constituted by the perceptual components of the sensory dimension, the elements of the spiritual dimension, and the components of the physical dimension, represents the core area in which meaning emerges in spatial experience and is transmitted to space through bodily perception (Figure 1).

This tripartite structure of silence provides a general framework for describing how silence emerges in the construction of sensory atmosphere in sacred space, how it interacts with various elements, and how it generates meaning for the user.

5.1.1 Physical Dimension

In Zumthor's conception of atmosphere, the physical environment is defined through the direct effects of the architectural body on the senses. Within this context, Zumthor's principles of the architectural body, material compatibility, and the sound of space are regarded as fundamental references constituting the physical dimension of atmosphere. The sense of presence generated by the architectural body, when combined with the tactile and auditory qualities of materials, enables silence to be experienced as a physical component of atmospheric formation.

Within the physical order, silence becomes prominent as an atmospheric component established through the acoustic structure, volumetric proportions, and material qualities of architectural organization. Particularly in sacred spaces, this order provides the conditions for silence to be bodily perceived and for spatial experience to intensify.

At the foundation of the relationship individuals establish with space lie physiological, psychological, and sociological patterns of behavior. Depending on the qualities of a given space, variations may occur in an individual's physiological perceptual processes, and these processes may differ according to the characteristics of the environment [35]. Formal attributes such as color and texture play a decisive role in the perception of the physical effects that emerge within space [34]. Such physiological and perceptual responses correspond with Zumthor's conception of the architectural body, which emphasizes the direct sensory impressions that space leaves on the user [35].

Psychological perception is shaped by the associations formed through an individual's past experiences, the physiological environment in which they are situated, and the stimuli they encounter. Over time, the nature of perception may change, and particularly with the acceleration of technological developments, responses to the surrounding environment are observed to undergo transformation as well [37]. Individuals develop responses in relation to environmental stimuli, and when these factors generate discomfort, they may lead to various physical or psychological difficulties [38]. Within Zumthor's understanding of atmosphere, such bodily and perceptual responses are directly associated with the intuitive effects produced by the physical characteristics of space on the user. Elements present within a space can evoke specific emotional associations; for instance, a roof element may carry symbolic meaning for many individuals by triggering feelings of safety and tranquility [39].

Users' physical needs may vary depending on the cultural environment in which they live and the prevailing climatic conditions [40]. Although the fulfillment of physical needs constitutes a fundamental factor that strengthens the interaction between a space and its user, this interaction is not determined solely by such requirements. Even in cases where a space does not fully meet physical needs, it may still be perceived positively by users through the activation of other qualities [32]. The elements most commonly recognized as directly influencing space are its physical characteristics. Attributes such as spatial dimensions, colors, lighting arrangement, texture, and scent form the concrete basis of perception and constitute the primary components shaping user experience [32]. This condition indicates that, within Zumthor's conception of atmosphere, the bodily and sensory effects of space play a decisive role beyond considerations of physical comfort alone.

In accordance with Zumthor's principle of the sound of space, silence becomes an atmospheric element configured within the physical structure of space and one that deepens bodily awareness. In this sense,

silence extends beyond an auditory condition and emerges as a fundamental quality that shapes the physiological comfort and physical atmosphere of space.

5.1.2 Sensory Dimension

In Zumthor's understanding of atmosphere, sensory experience is defined as an intuitive process of perception that precedes the rational analysis of space. Architectural atmosphere emerges through the simultaneity of auditory, visual, and bodily engagement between the individual and space, and the integration of these modes of contact enables space to be intuitively felt. In sacred spaces, silence intensifies the sensory relationship between the individual and space, thereby strengthening the intuitive dimension of experience.

The senses may be considered not only as physiological functions, but also in relation to their psychological and sociological dimensions. Stimuli received from the environment at specific frequencies are converted into electrical signals through sensory organs and transmitted to corresponding regions of the brain. There, these signals interact with various factors, are processed, and ultimately transformed into perception [32]. As emphasized in Zumthor's conception of atmosphere, this process is directly related to the immediate and intuitive impressions that space leaves on the user. Architectural atmosphere is experienced through the bodily resonance of sensory data prior to rational analysis.

From a psychological perspective, an individual's process of perception is informed by their cognitive framework and personal history. As the brain processes data received from the sensory organs, it evaluates this information in relation to expectations, cultural references, and prior experiences. Certain stimuli are selectively emphasized, while others are filtered out through a process of classification. For this reason, perception remains in continuous interaction with an individual's accumulated knowledge, value judgments, and lived experiences, resulting in a psychological relationship between person and space that is complex and multilayered [33].

The spaces in which individuals live and interact generate various psychological effects. In the formation of these effects, factors such as environmental conditions, cultural context, personal experiences, and individual expectations play a significant role [41]. Psychological perception contributes to the functional use of space and to the fulfillment of user needs. Knowledge related to this form of perception enhances the quality of spatial experience, strengthens functionality, and provides a basis for the creation of sustainable spaces by enabling a deeper understanding of emotional, cognitive, and behavioral processes [32, 41]. This perspective aligns with Zumthor's approach, which conceptualizes atmosphere as a holistic entity encompassing physical, sensory, and emotional dimensions.

In light of these considerations, silence in sacred spaces emerges as a fundamental sensory element that directly influences psychological perception. The tranquility provided by silence contributes to the strengthening of the emotional connection individuals establish with space, supporting mental concentration and enabling the emergence of feelings of peace and calm in the user. Within the framework of Zumthor's principle of the sound of space, silence is understood as an atmospheric threshold that allows the senses to be perceived in a more heightened and holistic manner.

5.1.3 Spiritual Dimension

Zumthor's conception of atmosphere reveals that architectural experience is lived not only on material and sensory levels, but also within an intuitive and meaning-laden depth. This approach allows silence in sacred spaces to be understood as a field of experience that intensifies an individual's existential awareness and inner orientation. In this context, silence transcends the material presence of space and becomes a spiritual threshold through which the relationship with the sacred is intuitively perceived. This spiritual threshold deepens the relationship individuals establish with space through ritual, belief, and symbolic meanings, thereby rendering the spiritual dimension of sacred space experience more perceptible. Within Zumthor's understanding of atmosphere, such experiences derive their significance not from directly explicable spatial qualities, but from the inner resonances and intuitive responses they evoke in the

individual. It is precisely at this point that silence constitutes an experiential domain in which sensory intensity recedes and the layers of meaning embedded in space become more profound.

Individuals continue their learning processes through interaction with society, and what they learn and how they learn are closely related to the cultural structure and belief system in which they are embedded [42]. Human beings experience their initial interactions with the environment within the cultural context into which they are born, and over time they become socialized within this cultural framework. Through the process of socialization, individuals make sense of their existence by learning the value systems, rituals, and behavioral patterns of their society. This condition corresponds with Zumthor's view of atmosphere as a field of experience that is not only individual, but also collective in nature.

At the foundation of the concept of need, which shapes mental perception and behavior, lie physiological, psychological, and sociological factors. Sociological perception provides the basis for the formation of fundamental human needs such as protection, belonging, and togetherness [32]. The sociological perception that emerges within a space is of great significance in explaining how people comprehend the social meanings they attribute to that space. Spaces are designed with the aim of offering users a more qualitative experience and of creating socially sustainable living environments [32]. In this context, spaces are regarded as fields of meaning that accommodate not only individual experiences but also collective consciousness and ritual practices.

In sacred spaces, silence acquires a spiritual dimension that brings together both collective and individual layers of meaning, thereby strengthening the spiritual character of space. Silence supports the harmony of the ritual environment by functioning as a background regulator of shared belief practices that ensures their continuity, while also contributing to a deeper and more intense experience of the individual's connection with ritual. In line with Zumthor's understanding of atmosphere, silence is regarded as an intuitive threshold through which contact with the sacred becomes possible. In this way, silence constitutes a field of experience that both nurtures the collective state of consciousness of the congregation and supports the individual's personal spiritual orientation, rendering its spiritual significance more pronounced.

6. Discussion and Conclusion

This study has examined the role of silence in the formation of sensory atmosphere in sacred spaces through a descriptive analysis approach, demonstrating that silence constitutes a fundamental element that shapes spatial experience in a multidimensional manner. The review of the literature and conceptual analyses indicate that silence is not merely an auditory state of stillness in its simplest form, but a structural component that gains meaning at the intersection of the physical environment, sensory perception, and spiritual context. By assuming a decisive role in the construction of sacred spatial atmosphere, silence aligns with contemporary theoretical discussions that conceptualize spatial experience as a multilayered and relational process.

In the study, the physical dimension demonstrates that when silence is considered together with volume, void, and material order in sacred space, it emerges as a fundamental atmospheric component that intensifies spatial experience at bodily and perceptual levels. In this respect, silence gains significance as an element that can be consciously constructed within the architectural design process and endowed with spatial quality. The sensory dimension indicates that silence functions as a factor that deepens the mental and emotional engagement individuals establish with space. By reducing distraction, silence supports concentration and strengthens processes of bodily awareness and calmness within a ritual context. It may thus be regarded as an experiential threshold that intensifies the user's sensory relationship with space and enables the deepening of intuitive perception.

The spiritual dimension, in turn, reveals that silence endows space with meaning through its connection to ritual order, communal experience, and personal spirituality. Silence functions as an invisible regulatory element within shared belief practices, strengthening the user's relationship with ritual and providing a

background that supports the sense of sacredness within space. In this way, silence becomes a factor that determines the spiritual intensity of spatial atmosphere, and it may be interpreted as a spatial backdrop that sustains the continuity of collective ritual experience alongside individual inward orientation. When these three dimensions are considered together, silence emerges as a multilayered structure that establishes a bridge between the physical environment and user experience.

Based on all these findings, *the diagram of the physical, sensory, and spiritual dimensions of silence in sacred space* enables the relationships among the physical, sensory, and spiritual components of silence to be examined within a systematic framework. This diagram contributes to the literature on the sensory atmosphere of sacred spaces within the fields of interior architecture and design.

The limitation of the study lies in the fact that its findings have been developed on the basis of a theoretical framework. Since the experience of sacred space varies according to users' belief practices and cultural backgrounds, future field studies may contribute to the empirical support of this framework. Observations, user interviews, and acoustic measurements conducted in worship spaces belonging to different religions and cultures would provide opportunities for a comparative examination of the spatial effects of silence. In conclusion, the study demonstrates that considering silence as an active design instrument shaping the atmosphere of sacred space offers new perspectives for both theoretical discourse and design practice.

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GENERATIVE AI IN ARCHITECTURAL DESIGN: MAPPING ITS POSITION ACROSS DESIGN PHASES AND IMPLICATIONS FOR THE ARCHITECT'S ROLE

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Abstract
Generative Artificial Intelligence (GenAI) is increasingly integrated into architectural design workflows, raising questions about its impact on creativity and the professional role of the architect. While existing research often focuses on technical performance or isolated case studies, less attention has been devoted to systematically mapping how GenAI is positioned within architectural design processes. This paper offers a narrative review of recent architectural case studies involving Generative AI, analyzed through the combined frameworks of Strobel et al.'s GenAI taxonomy and the Hasso Plattner Design Thinking model. By structurally mapping the distribution of GenAI tools across design phases and system configurations, the study identifies recurring patterns in their functional and technical deployment. The findings reveal a strong concentration of GenAI applications in the Ideate and Prototype phases, with a predominance of Generation-oriented systems operating through image-based and one-to-many modalities. Early analytical stages (Understand, Observe) and evaluative stages (Test) remain marginally represented. These results suggest that GenAI currently intensifies exploratory creativity by expanding the solution space, while problem framing and evaluative responsibility remain largely human-driven. Rather than displacing architectural expertise, GenAI appears to redistribute creative labor, shifting the architect's role toward critical mediation, contextual integration, and responsible selection within an expanded computational design landscape. By grounding theoretical reflection in empirical mapping, the study contributes to ongoing debates on the transformation of architectural identity in an increasingly computational design ecology.
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Key Words: *Generative AI; AI-aided architectural design; AI-driven design; Architect's role; Design thinking phases.*

1. Introduction

Architecture has historically evolved in close dialogue with technological innovation. From the introduction of Computer-Aided Design (CAD) to the diffusion of Building Information Modeling (BIM) and parametric modeling environments, each technological shift has not only transformed representational techniques but has also reshaped the cognitive and epistemological foundations of architectural practice. The rapid emergence of Generative Artificial Intelligence (GenAI) represents another pivotal moment in this trajectory, raising fundamental questions about how architectural creativity is configured, distributed, and exercised.

Generative AI refers to computational systems capable of producing novel content, such as text, images, or three-dimensional models, by learning statistical patterns from large-scale datasets [1]. Unlike earlier digital tools primarily oriented toward drafting, optimization, or rule-based parametric control, GenAI systems operate probabilistically and can generate multiple alternatives from minimal input. This shift introduces a condition of computational multiplicity within design workflows, potentially altering the rhythm and structure of architectural exploration.

Recent architectural experiments and professional practices illustrate this transition. Computational designers such as Arturo Tedeschi integrate generative algorithms into façade systems and spatial configurations, blending parametric precision with AI-driven form exploration (see Fig. 1, left side). Similarly, Zaha Hadid Architects has incorporated AI-based generative tools into speculative and research-oriented workflows, exploring complex geometries and digital environments (see Fig. 1, right side).

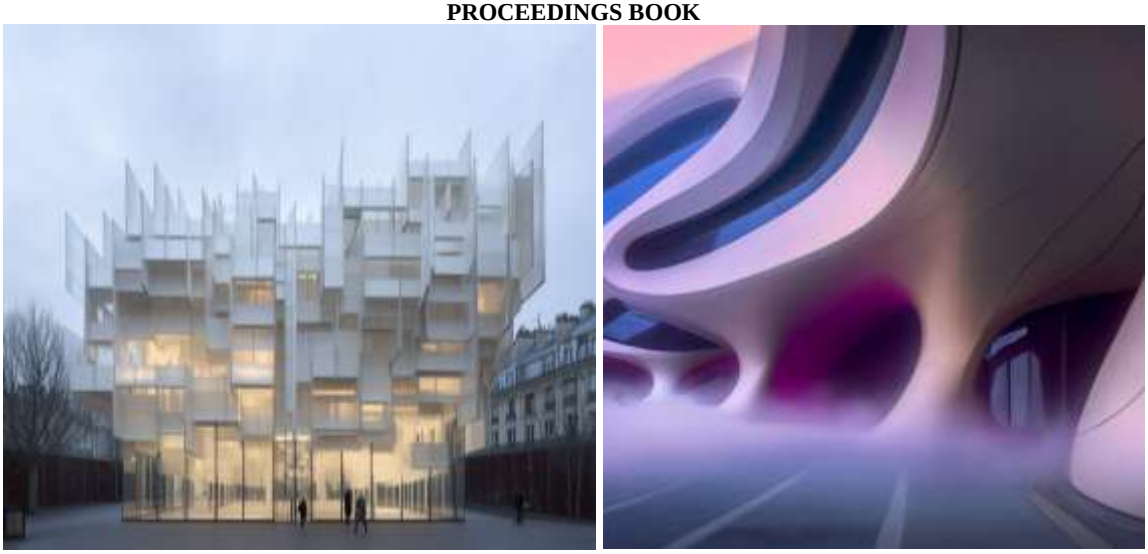

Fig. 1. (on the left) Example of AI-assisted architectural imagery generated using Midjourney. Source: Arturo Tedeschi, *AI Architecture-MidJourney.* Available from: https://www.arturotedeschi.com/aiarchitecturemidjourney. (on the right) AI-driven research visualization using OpenAI DALL-E 2. Source: Zaha Hadid Architects, *Architecting the Metaverse*. Available from: https://www.zaha-hadid.com/design/architecting-the-metaverse/.

Yet, the growing presence of GenAI in architectural contexts also introduces a critical tension: the balance between computational generation and architectural intentionality. If generative systems derive outputs from large-scale datasets, the forms they produce may reflect statistical regularities embedded within those datasets. This raises concerns regarding aesthetic homogenization, stylistic convergence, and the potential dilution of context-specific design reasoning. Architecture, unlike purely digital creative domains, entails material, social, environmental, and regulatory responsibilities. The delegation of exploratory phases to probabilistic systems therefore demands careful theoretical and professional scrutiny.

Architectural design has long been understood as a co-evolutionary process in which problem and solution spaces develop iteratively and reciprocally [2; 3]. Within this framework, creativity emerges from cycles of divergence, evaluation, and reframing rather than linear execution. Drawing on Boden's [4; 5] distinction between combinational, exploratory, and transformational creativity, the integration of GenAI appears particularly aligned with exploratory processes, rapidly expanding the accessible solution space. However, whether such systems contribute to transforming problem framing itself, or primarily intensify recombination within existing conceptual boundaries, remains an open question.

While existing research has examined AI in architecture predominantly from technical or performance-oriented perspectives, focusing on optimization, parametric generation, or simulation, less attention has been devoted to systematically mapping how Generative AI is positioned within architectural design processes and what implications emerge for the architect's professional role.

To address this gap, this paper offers a narrative review of recent architectural case studies involving Generative AI. By analyzing the selected studies through the dual framework of Strobel et al.'s [6] GenAI taxonomy and the Hasso Plattner Design Thinking model [7], the research provides a structured mapping of where and how generative systems are currently embedded within architectural workflows.

Rather than assuming either technological substitution or seamless collaboration, the study investigates how GenAI is functionally configured across design phases and how this configuration may be reshaping the distribution of creative labor and architectural intentionality. Through this empirically grounded and theoretically informed approach, the paper contributes to an ongoing debate on the evolving identity of the architect within an increasingly 'computationally mediated' design workflow.

2. Methodology

2.1 Study design

This study adopts a narrative review approach grounded in a previously conducted Systematic Literature Review (SLR) on the intersection between Generative Artificial Intelligence (GenAI) and Design Thinking across multiple design domains. While the original SLR aimed to provide a cross-disciplinary overview of GenAI applications in design, the present study isolates and re-examines the subset of papers specifically related to architecture in order to develop a focused and theoretically oriented analysis.

The objective of this secondary analysis is not to reassess the methodological rigor of the included studies, but rather to reinterpret their findings through a disciplinary lens, identifying how GenAI tools are positioned within architectural design processes and examining their implications for the architect's professional role.

2.2 Selection Criteria and Dataset

The original SLR included peer-reviewed papers, which were selected by adopting the following inclusion criteria:

- Papers published between 2019 and 2024
- Papers published in English
- Papers reporting case studies related to design studies
- Papers related to the application of GenAI tools to support Design Thinking processes.

Consequently, the keywords employed in the search string included "generative ai" and its variations (i.e., "genai," "gai," "gen ai") along with "design thinking." The search was conducted on keywords, abstracts, and titles of documents within the ACM Digital Library, IEEE Xplore Digital Library, Scopus, SpringerLink, and Web of Science databases.

From the entire set of selected studies covering various design disciplines (e.g., graphic design, industrial design, UX design), a subset of 16 articles specifically focused on architectural design was extracted for this paper. These studies explore applications of GenAI tools in architectural ideation, spatial configuration, conceptual visualization, and planning processes. By concentrating exclusively on architectural case studies, this research narrows the analytical scope while maintaining consistency with the inclusion criteria and systematic selection procedure adopted in the original review.

2.3 Analytical Framework

To ensure analytical consistency, this study retains the two classification frameworks previously employed in the SLR:

- GenAI Tool Features Framework [6]

GenAI tools were analyzed according to the taxonomy proposed by Strobel et al. [6], which examines systems across three meta-dimensions: System Design (input, output, modality, operation); System Access (interface, openness, fine-tuning, extension); System Value (value proposition and revenue model). This framework enables a structured understanding of how GenAI systems technically operate and how they generate value within architectural workflows.

- Design Thinking Process Framework [7]

To identify where GenAI tools are positioned within the architectural design process, the studies were mapped onto the six phases of the Hasso Plattner d.school model: Understand, Observe, Define, Ideate, Prototype, and Test. The model was selected due to its clarity, non-linear structure, and widespread recognition within design research, allowing for a coherent categorization of GenAI applications across different architectural case studies.

2.4 Analytical Strategy

Building upon the structured classification provided by Strobel et al.'s [6] taxonomy and the Hasso Plattner Design Thinking model, the architectural subset was analyzed through a two-step strategy combining quantitative mapping and qualitative narrative synthesis. First, each case study was coded according to: (i) the Design Thinking phase(s) in which the GenAI tool was employed; and (ii) the GenAI system configuration, focusing on System Design (input, output, modality) and System Value (value proposition) dimensions. The coded data were then aggregated to identify frequency distributions across design phases

and GenAI configurations. These distributions were visualized through heatmaps and matrix diagrams, allowing patterns of concentration and dispersion to emerge clearly. The visual representations were not intended as statistical inference tools, but as analytical devices to support pattern recognition and interpretative reasoning. Second, the identified patterns were examined through a qualitative narrative synthesis aimed at interpreting their implications for architectural creativity and professional practice. Rather than limiting the analysis to descriptive frequency reporting, the study connects empirical distributions to broader theoretical constructs introduced in the literature review, such as co-evolutionary design processes and models of creativity. This combined approach enables the study to move from structured mapping to theoretically informed interpretation, grounding critical reflection in empirically observable configurations.

3. Results: Mapping the use of generative AI in architecture

The architectural case studies included in this review consistently position Generative AI within experimental, exploratory, and visually oriented design contexts. Across the analyzed articles, GenAI systems are primarily employed to generate conceptual alternatives, refine visual representations, or automate aspects of spatial configuration. The studies document applications ranging from façade exploration and atmospheric renderings to layout generation and territorial planning proposals. In most cases, generative systems are integrated within iterative workflows, where prompts, sketches, or preliminary models are progressively transformed into multiple design outputs. While the contexts vary, from academic research prototypes to professional practice experiments, the reported uses share a recurring emphasis on alternative production and accelerated iteration. The analysis of the architectural subset enables a structured mapping of how Generative AI tools are currently integrated within architectural design processes. By cross-referencing the Design Thinking phases according to the Hasso Plattner model [7] with Strobel et al.'s [6] taxonomy of GenAI systems, the results provide a detailed overview of both functional positioning and technical configuration.

3.1 Distribution of GenAI Across the Design Thinking Phases

When mapped onto the six phases of the Hasso Plattner Design Thinking model, Generative AI applications display a clearly uneven distribution. The Ideate phase accounts for the highest number of reported applications within the analyzed architectural studies (15 occurrences). In most cases, GenAI tools are positioned during concept generation, formal experimentation, and early-stage exploration of alternative design directions. The Prototype phase represents the second most frequent context of use (7 occurrences). Here, generative systems are integrated into workflows aimed at translating preliminary ideas into more structured visualizations, spatial layouts, or preliminary configurations. The Define phase (4 occurrences) presents a moderate presence of GenAI integration. In these instances, generative systems are involved in refining conceptual directions or supporting the development of design proposals after initial research activities. By contrast, the Understand (n=2) and Observe (n=1) phases show only limited occurrences. Few studies report the use of generative systems during contextual research, data collection, or user-centered analysis stages. Finally, the Test phase appears marginally represented (n=1). Instances of GenAI use during evaluation or validation processes are rare compared to its presence in generative and developmental stages.

3.2 Technical configuration of GenAI tools in architectural studies

When The Generative AI tools identified in the architectural subset were classified according to the taxonomy proposed by Strobel et al. [6], which organizes systems across three meta-dimensions: System Design, System Access, and System Value.

- System Design

Across the dataset, only two input types defined by Strobel et al. [6] are present in the analyzed architectural studies: Image input (9 occurrences) and Text input (14 occurrences). No instances of video or sound input are reported. The predominant input modality is text and image. The presence of both text- and image-based inputs reflects the use of prompt-based generation as well as image-to-image workflows. Image inputs are frequently associated with sketch transformation or visual refinement, while text inputs are primarily linked to descriptive prompting. Outputs are predominantly image-based: Image output (15 occurrences) and 3D model output (1 occurrence). No video or sound outputs are recorded in the architectural subset. Image outputs include renderings, conceptual visualizations, façade explorations, and atmospheric

scenes. 3D outputs are present only once and typically associated with spatial configurations or preliminary volumetric models. The most frequent modality is One-to-one (with 11 recorded occurrences), where a single prompt produces multiple design alternatives. This configuration reinforces the exploratory function of GenAI tools within architectural ideation. By comparison: (i) Many-to-one appears 6 times; (ii) Many-to-many appears only 1 time; no instances of One-to-many configurations are identified. In terms of operation, most tools run as managed (cloud-based) systems (10 occurrences) rather than on-premise installations (6 occurrences), indicating dependence on external computational infrastructures.

- System Access

Interaction with GenAI tools is primarily prompt-based (11 occurrences). Fine-tuning rarely occurs at the model-training level. Instead, control over outputs is exercised through iterative prompt modification, parameter adjustment, or input variation. Most tools are classified as closed (7 occurrences) or semi-open systems (2 occurrences), with limited transparency regarding training data or internal architectures. Interfaces are typically web-based or integrated into design environments through APIs or plugins.

- System Value

Regarding value proposition, the following distribution is recorded: Generation recurs 15 times, Assistant 7 times, and Reimagination only once. Therefore, the overwhelming majority of tools are categorized under Generation, with some cases aligned with Assistant and one case aligned with Reimagination. Assistant appears regularly but less frequently, while Reimagination is marginal.

3.3 Combined distributions

After separately examining the distribution across design phases and the technical characteristics of the tools, the two dimensions were combined to identify how Generative AI configurations are positioned within the architectural design process.

- Phase × Value Proposition

Fig. 2 presents the heatmap displaying the distribution of Value Proposition (Generation, Assistant, Reimagination) across the six Design Thinking phases.

DESIGN PHASE	VALUE PROPOSITION: Generation	Assistant	Reimagination
Understand	2	1	0
Observe	1	1	0
Define	4	4	0
Ideate	14	7	1
Prototype	6	5	1
Test	1	1	0

Fig. 2. Heatmap of Phase/Value proposition

The heatmap shows that: Generation is most strongly concentrated in the Ideate phase (14 occurrences), followed by Prototype (n=6); in the Define phase, Generation and Assistant appear with equal frequency (n=4 each); Assistant is distributed across Ideate (n=7), Prototype (n=5), Define (n=4), and appears marginally in Understand, Observe, and Test (1 each); Reimagination appears only twice in the entire dataset, once in Ideate and once in Prototype; the Understand, Observe, and Test phases show

comparatively low frequencies across all value propositions. The distribution confirms that the highest density of occurrences across all value propositions is located in the Ideate phase.

- Phase × System Design

Fig. 3 presents the heatmap combining Design Thinking phases with the System Design dimensions (Input, Output, and Modality).

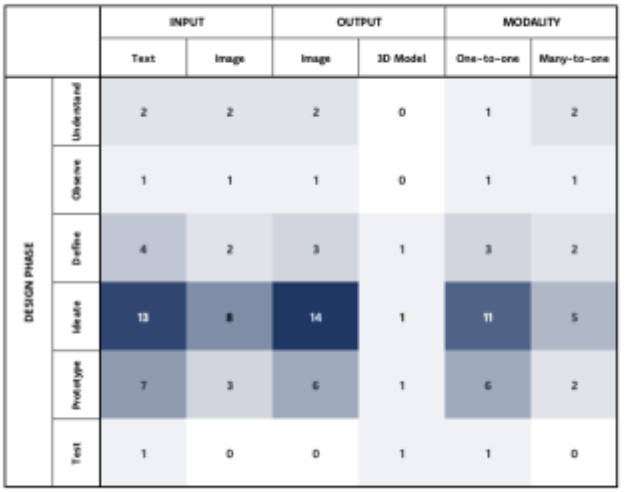

Fig. 3. Heatmap of Phase/System design

The combined distribution shows that Text and Image inputs and Image output are particularly concentrated in the Ideate and Prototype phases. In Ideate, Image input appears 8 times and Image output 14 times; Text input is also strongly represented in Ideate (13 occurrences); 3D model output appears mainly in Ideate (n=1) and Prototype (n=1), with no occurrences in early phases; One-to-one modality is most concentrated in Ideate (11 occurrences), followed by Prototype (6) and Define (3); Many-to-one appears mainly in Ideate (n=5), sporadically in Understand, Observe, Define and Prototype, while is absent in Test.

Together, the two heatmaps provide a structured visualization of how GenAI configurations and design phases intersect within the analyzed architectural studies.

4. Discussion: a new ontology of architectural practice

The structured mapping presented in the previous section provides the basis for a deeper reflection on how Generative AI (GenAI) is currently positioned within architectural design processes and what this positioning implies for architectural creativity and professional practice. As discussed in the Introduction, architectural design has been widely described as a co-evolutionary process in which problem and solution spaces develop iteratively and reciprocally [2; 3]. Within this theoretical framework, creativity emerges through alternating cycles of divergence, evaluation, and reframing. The empirical results reported above show a consistent concentration of GenAI tools within the Ideate and Prototype phases, together with a strong predominance of the Generation value proposition and One-to-one modality. Conversely, the analytical phases (Understand and Observe) and the evaluative phase (Test) seem to remain marginally represented. This uneven distribution reflects not only current technological maturity but also deeper epistemological and operational constraints. The *Understand* phase relies on contextual interpretation, stakeholder negotiation, regulatory frameworks, and other forms of situated judgment that are difficult to formalize within prompt-based or pattern-recognition systems. While AI can support data aggregation or simulation, reframing the problem space requires interpretative synthesis rather than combinatorial generation. Likewise, the limited presence of GenAI in the *Test* phase relates to issues of responsibility and validation: architectural testing involves structural, environmental, economic, and legal compliance, where accountability remains human-centered. As generative systems are optimized for probabilistic plausibility rather than performance verification, they integrate more easily in divergent phases than in convergent ones requiring precision and regulatory conformity. In contrast, the dominance of generative systems
in the Ideate phase indicates that present applications of GenAI primarily intensify the exploratory dimension of creativity. In terms of Boden's distinction between exploratory and transformational creativity [4; 5], the

analyzed cases show a clear reinforcement of the former; by producing multiple alternatives from prompts, most frequently through image-based configurations, GenAI systems significantly expand the accessible solution space. Divergence becomes therefore 'computationally amplified', enabling designers to navigate a breadth of formal possibilities that would otherwise require extensive sequential iteration. However, the limited presence of generative systems in the Understand and Define phases suggests that computational tools rarely participate in reframing the problem space itself. While they amplify variation within established conceptual boundaries, they seldom contribute to transforming those boundaries. Transformational creativity, in Boden's sense, thus remains predominantly human-driven in the mapped cases. As evidenced by the heatmaps discussed in the Results section, the prevalence of one-to-one systems introduces a condition that we could define as 'computational multiplicity' into architectural practice. Where exploration once unfolded through incremental sketching, modeling, or parametric adjustment, generative systems now produce extensive sets of alternatives almost instantaneously. This shift does not eliminate the architect's role but redistributes it. If the production of alternatives becomes partially externalized to computational systems, the architect's activity increasingly centers on evaluation, selection, contextual adaptation, and integration. Indeed, the asymmetry revealed in the mapping, with strong roots in the generative phases and weak integration in research and validation, seems to suggest that while machines expand the space of possible forms, the responsibility for coherence, feasibility, and contextual alignment remains primarily human. Rather than indicating displacement, the findings thus point toward a reconfiguration of creative work: from direct form production to the orchestration and critical mediation of computational outputs. The predominance of image-based inputs and outputs, also highlighted in the analysis, underscores the strong visual orientation of current GenAI applications in architecture. Generative systems are mainly used at the representational level, producing renderings, façades, atmospheric scenes, and speculative configurations. This visual emphasis introduces a structural tension. Since many generative models are trained on large-scale image datasets, their outputs reflect statistical regularities embedded within those datasets. Here, the risk is not simply automation, but potential aesthetic convergence and stylistic homogenization. As a consequence, the architect's role extends beyond selection toward critical interpretation. Professional competence involves distinguishing between novelty and recombination, between contextual specificity and dataset-derived generality. In this respect, the findings resonate with the theoretical concerns outlined in the Introduction regarding authorship and intentionality in computational design environments. Additionally, the unbalanced integration of GenAI across the design phases has further implications when reconsidered within the co-evolutionary model referenced earlier [2; 3]. If generative systems are primarily embedded in divergence-oriented stages, their influence is concentrated on the solution space rather than the problem space. Architects continue to define constraints, interpret contextual conditions, and validate outcomes, while computational systems expand the range of possible formal responses. In this way, the feedback loop between generation and evaluation becomes denser and faster, but the framing of architectural questions and the responsibility for decisions remain anchored in human judgment. Therefore, the co-evolutionary structure of design is not dismantled, but its rhythm is modified: the divergent phase of the design process is computationally accelerated, while the convergent phase remains dependent on human evaluation.

4.1 Toward a reframed architectural identity

When considered together, all these tendencies suggest an emerging transformation in architectural identity, as anticipated in the theoretical framing of this study. First, the architect increasingly operates as a curator of computational alternatives, navigating abundance rather than scarcity. Second, given the dominance of image-based workflows, the architect assumes the role of critical interpreter of visual outputs, capable of recognizing biases, contextual limitations, and aesthetic patterns embedded in generative systems. Third, because GenAI remains concentrated in generative stages, the architect's role as integrator across analytical, technical, and evaluative phases becomes structurally reinforced. Thus, rather than dissolving architectural authorship, Generative AI redistributes creative functions within a 'computationally mediated' design workflow. Beyond its operational implications, the integration of

Generative AI in architecture raises deeper theoretical questions concerning the ontology of architectural practice itself. As noted in the Introduction, architecture has historically been grounded in intentionality: the

architect formulates constraints, synthesizes conditions, and produces spatial propositions that mediate between imagination and material reality. In this framework, authorship has been closely tied to the act of giving form under responsibility. The empirical findings of this study suggest that GenAI systems currently assume a predominantly generative role within architectural workflows: they expand formal possibilities through probabilistic recombination yet remain marginal in problem framing and evaluative validation. Additionally, it is important to keep in mind that since generative systems operate through statistical inference across large datasets, their outputs are inherently shaped by prior distributions of forms, styles, and spatial patterns. Architectural production, therefore, increasingly unfolds within a field of computationally mediated precedents.

In this context, the architect's role may evolve from originator of form toward critical mediator of inherited pattern systems. In this sense, rather than a singular act of creation, architectural authorship may become a distributed condition, emerging from the interaction between human intentionality and computational multiplicity. Yet this distribution does not dissolve professional responsibility; on the contrary, it intensifies the ethical and epistemic burden of selection. If GenAI accelerates and expands the divergence of design solutions, the architect remains responsible for their convergence into a coherent architectural proposition. If the system recombines historical patterns, the architect reintroduces contextual specificity. And if the model produces probabilistic novelty, the architect determines meaningful innovation. From this perspective, the findings seem to show a reframing rather than a diminution of architect's role, in which creativity shifts from production-centered activity toward judgment-centered capacity. The critical ability to frame problems, interpret outputs, and assume accountability for built consequences remains irreducibly human within the architectural domain. Thus, the integration of Generative AI does not signal the disappearance of architectural authorship, but simply its redefinition within a hybrid epistemic ecology in which creativity is distributed, yet responsibility remains concentrated.

5. Conclusion

This study investigated how Generative Artificial Intelligence is currently integrated within architectural design processes and how such integration may be reshaping the architect's creative and professional role. By isolating 16 architectural articles and analyzing them through the combined frameworks of Strobel et al.'s [6] taxonomy and the Hasso Plattner Design Thinking model [7], the research provided a structured mapping of where and how GenAI tools are positioned in contemporary practice. The findings reveal a consistent configuration: Generative AI is predominantly concentrated in the Ideate and Prototype phases, largely configured as a Generation-oriented system, and mainly operating through image-based, one-to-one modalities. Early analytical stages (Understand and Observe) and evaluative stages (Test) remain marginally represented. This inconsistent distribution suggests that GenAI currently amplifies divergence and alternative production, while problem framing, contextual interpretation, and final validation remain primarily human-driven. From a theoretical perspective, the results indicate a redistribution rather than a replacement of architectural creativity. Under conditions of computational multiplicity, generative systems expand the solution space, while architects increasingly assume roles of critical mediation, selection, and contextual integration. Creativity, therefore, shifts from the exclusive production of form toward the orchestration and evaluation of probabilistically generated possibilities. In this configuration, architectural authorship becomes distributed, yet professional responsibility remains concentrated.

Several limitations should be acknowledged. First, the study is based on a narrative reinterpretation of a subset of previously collected case studies and does not include new empirical data. Second, the analysis relies on reported applications within academic and experimental contexts, which may not fully represent broader professional practice. Third, the classification process, while structured through established frameworks, involves interpretative decisions that may influence category assignment. However, by grounding theoretical reflection in empirical mapping, this study may still contribute to an ongoing discourse on the transformation of architectural identity in the age of generative technologies. Future research may expand the dataset to include longitudinal studies and professional case documentation,

enabling comparison between experimental and commercial adoption patterns. Further investigation could also examine the integration of GenAI within analytical and evaluative phases, as well as explore long-term

implications for architectural education, regulatory frameworks, and ethical responsibility. As generative technologies continue to evolve, understanding their long-term epistemological and professional impact on architecture remains an open and critical field of inquiry.

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N	Paper	Year	Input	Modality	Output	Fine-tuning	Value Proposition	Tool	Understand	Observe	Define Point of View	Ideate	Prototype	Test

1	[8]	24	a) Text, Image b) Text, Image	a) One-to-one b) Many-to-one	a) Text b) Image	a) Prompt b) Data	a) Generation, Assistant b) Generation, Assistant	a) ChatGPT b) Stable Diffusion	X	X	X	X	X	
2	[9]	24	Text	One-to-one	Image	Data	Generation, Assistant	Stable Diffusion				X		
3	[10]	24	Text, Image	Many-to-one	Image	Prompt	Generation	Midjourney				X		
4	[11]	24	Image	One-to-one	Image	Prompt	Generation	Stable Diffusion				X		
5	[12]	24	Text, Image	Many-to-one	Image	Prompt	Generation	Custom				X		
6	[13]	24	Text	One-to-one	Image	None	Generation, Assistant	Midjourney			X	X		
7	[14]	24	Text, Image	Many-to-one	Image	Prompt	Generation	Stable Diffusion	X					
8	[15]	23	Text, Image	One-to-one	Image	None	Reimagination, Assistant	Stable Diffusion				X	X	
9	[16]	24	a) Text, Image b) Text, Image	a) Many-to-one b) Many-to-many	a) Image b) Text, Image	a) Prompt b) Prompt	a) Generation, Assistant b) Generation, Assistant	a) Stable Diffusion b) ChatGPT			X	X	X	
10	[17]	24	Text	One-to-one	Image	Prompt	Generation, Assistant	Stable Diffusion				X	X	
11	[18]	24	Text	One-to-one	3D Model	Data	Generation, Assistant	Custom			X	X	X	X
12	[19]	24	a) Text b) Text c) Text	a) One-to-one b) One-to-one c) One-to-one	a) Image b) Image c) Image	a) Prompt b) Prompt c) Prompt	a) Generation b) Generation c) Generation	a) Dall-e b) Stable Diffusion c) Midjourney				X	X	
13	[20]	24	Text	One-to-one	Image	Prompt	Generation	Midjourney				X	X	
14	[21]	24	Text	One-to-one	Image	Prompt, Data	Generation	Dall-e				X		
15	[22]	23	Text, Image	Many-to-one	Image	Prompt, Data	Generation	Stable Diffusion				X		
16	[23]	23	Image	One-to-one	Image	None	Generation	Custom				X		

Appendix A. Included papers