

Article

Designing Resilient Subcenters in Urban Space: A Comparison of Architects' Creative Design Approaches and Artificial Intelligence-Based Design

Tomasz Kapecki ^{1,†} , Beata Gibała-Kapecka ^{2,†}  and Agnieszka Ozga ^{3,*,†} ¹ Faculty of Architecture, Krakow University of Technology, 31-155 Krakow, Poland; tomasz.kapecki@pk.edu.pl² Department of Interior Architecture Design, Faculty of Interior Design, Academy of Fine Arts in Krakow, 31-157 Krakow, Poland; bkapeccka@asp.krakow.pl³ Department of Mechanics and Vibroacoustics, Faculty of Mechanical Engineering and Robotics, AGH University of Krakow, 30-059 Krakow, Poland

* Correspondence: aozga@agh.edu.pl; Tel.: +48-12-617-36-70

† These authors contributed equally to this work.

Abstract

This paper presents a comparative study on the transdisciplinary design of resilient urban subcenters, examining the interplay between human-led and artificial intelligence (AI)-generated design approaches. By employing holistic design methods, we prepare and present revitalization projects for two areas of urban space. Our goal was to create a resilient urban subcenter that contributes to the development of a resident. The first revitalized site reflects the multicultural past of the city. The second project addresses the need to revitalize a subcenter reserved for residents. In the non-AI approach, holistic design is implemented across various universities, fields, and academic disciplines—the humanities, social sciences, engineering, and the arts. Transdisciplinary teams of sociologists, engineers, interior designers, architects, urban geographers, and acousticians transcend workshop limitations as well as cognitive boundaries, promoting the creation of new, unconventional knowledge. The AI-integrated approach employs artificial intelligence in a dual capacity: both as a generator of alternative design visions and as an analytical tool for assessing technological readiness. The findings contribute to the evolving discourse on sustainable urban development and the transformative potential of technology in transdisciplinary design practices.

Keywords: subcenters; resilient subcenters; resilient spaces; urban space design; megatrends; AI-generated design; sustainable development of urban areas



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1. Introduction

The contemporary world requires constant updates to megatrends and forecasts of global phenomena. Megatrends [1,2] occur in the social, economic, environmental, and technological spheres. They redefine and update the concept of sustainable development [3,4] through a holistic approach [5,6] to urban design. Whether we design entire resilient cities or focus on resilient subcenters, these global forces remain equally relevant and influential. They reframe the relationships between climate-resilient (or non-resilient) human and non-human environments [7] and technological transformations.

Urban resilience [8] refers to the ability of all components of an urban system to maintain or quickly return to the desired functions in the face of disruptions. Resilient

spaces are able to adapt to various changes and quickly transform systems that limit current or future adaptability.

In the holistic view [9,10], where all phenomena in the universe form integral systems, interdependencies between system components must be recognized. The holistic design process involves multilayered collaboration and an approach that takes into account the impact of the project on the construction of resilient places and resilient societies [11–13]. Holistic design, in our approach, is carried out in different universities and disciplines: humanities, social sciences [14], engineering [15], and interior design [16]. Experiments involving artists, sociologists, philosophers, and engineers are transdisciplinary. The key element of this idea is learning interdisciplinary verbal communication [17,18]. It is necessary to develop a shared professional language across industries to achieve the best results in designing or revitalizing public spaces in cities. There is also an internal imperative driven by creative and cognitive motivation and the need to reject stereotypes, which requires new methodological competencies. Transdisciplinary experiments in designing resilient urban spaces transcend workshop limitations and cognitive boundaries, facilitating the creation of unconventional knowledge. We go beyond the existing definitions and practices in urban space design.

Megatrends are gradually reshaping the design process by incorporating artificial intelligence into every stage of work, from defining the problem and developing concepts to visualizing projects, and ultimately gaining social acceptance for changes through AI-generated content on social media platforms. In response to evolving technological paradigms [19–21], we incorporate AI into our research [22–24] and educational methodology [25]. The integration of artificial intelligence into urban design has emerged as a transformative approach to enhancing urban resilience in the face of climate change, natural disasters, and socio-economic inequalities [26–28]. This article explores urban design by presenting the stages of artificial intelligence design and comparing human-generated proposals with those produced by generative AI systems [29]. While human designers rely on experience, contextual knowledge, and transdisciplinary collaboration, AI-driven approaches leverage data, algorithms, and pattern recognition to generate urban spaces rapidly and at scale.

In this context, the integration of artificial intelligence presents both opportunities and challenges for transdisciplinary design processes [30,31], as it fundamentally reshapes work while simultaneously raising complex questions about authorship.

While human-led collaborative teams generate contextually grounded solutions through participatory methods, AI models can produce alternative design visions based on similar resilience criteria, offering comparative insight into creative possibilities. Simultaneously, AI serves as an analytical tool to assess the technological readiness of proposed interventions, mapping existing technologies, identifying implementation gaps, and evaluating the feasibility of translating visionary concepts into real-world applications. This dual approach allows for a comprehensive evaluation of both design innovation and practical viability in urban resilience planning.

This article presents the results of work on a city subcenter [32,33]. Our goal was to create a resilient urban subcenter that contributes to the development of a resident.

A subcenter is defined here as a part of a city or agglomeration that serves as an important hub. However, its importance is not necessarily defined by economic, service-related, or commercial activity. Rather, we define subcenters in the context of the current and future needs of diverse residents.

The space we design should support integration and counteract increasing societal polarization, loneliness, exclusion, and immersion in virtual reality. We also consider other megatrends shaping creative spaces, such as global population growth, intensifying

migration, aging populations in developed countries, increasing urbanization, increasing energy demand, and climate change.

This initiative contributes to the development goals of the city as outlined in the *This is where I want to live. Krakow 2030. Development Strategy* [34]. One of its operational goals is to ensure a widely accessible and high-quality public space and a high level of civic participation. Furthermore, it offers insight into proposed development concepts for selected urban areas, which reflect the vision of the city as seen through the eyes of its younger residents.

2. Methods

The transformation of the modern world is captured in key documents such as the 2030 Agenda for Sustainable Development [35], adopted in 2015 by 193 member states of the United Nations. It defines a global model for sustainable development focused on human living environments, including public spaces. One of its goals is to make cities and human settlements inclusive, safe, resilient, and sustainable. Another key document is the Davos Declaration [36]: Toward a High-Quality Baukultur for Europe, signed in 2018, which defines Baukultur as well-designed cities, villages, and buildings that create a healthy and culturally rich living environment for both human and non-human entities, respecting cultural aspects of protection, design, and construction. We also refer to the New European Bauhaus (NEB) initiative [37], launched in 2020 by the European Commission, which is an interdisciplinary project based on three core values: beauty, sustainability, and community. NEB promotes a sustainable lifestyle, combining design, ecology, social inclusion, affordability, and investment, focusing on four main thematic axes:

- Reconnection with nature;
- Reclaiming a sense of belonging;
- Prioritizing the places and people most in need;
- Transformation towards long-term, life-cycle-based visions.

Historically, public spaces—squares, markets, parks, buildings, and small architectural objects—have undergone flexible transformations in response to changing needs. However, they lack resilience and require further transformation. Urban planning and design, extensively studied through numerous case studies and community consultations [38–40], help shape local ideas.

The need to designate local subcenters within the city has been recognized through spatial planning initiatives and raised by both Krakow's municipal authorities and architects and urban planners. Creating new local subcenters in urbanized areas is a crucial element of local government policy, driven by the importance of these spaces in improving the quality of life of residents. The authors of this article, who organized the workshops, decided to support these efforts. The revitalization sites were selected by design teams: as city residents, they chose spaces that did not fulfill their social functions and sustainable development goals.

However, it is essential that our task when creating new projects involves confronting local needs with global phenomena, such as climate change. Transdisciplinary design experiments are conducted in three phases:

1. Analysis and goal formulation;
2. Design phase;
3. Validation and presentation of the project to urban authorities and residents.

The analysis phase lasts approximately fourteen days and includes consultations with industry experts. Research materials include several documents such as preliminary reports, geological analysis, public event summaries, and online surveys. Preliminary

studies help generate reports that align with current trends and development directions. At this stage, we see the application of artificial intelligence in assisting in the selection and analysis of available materials.

The design phase is more complex. In transdisciplinary projects, visionary planning often clashes with stereotypes and populist ideologies. Social and economic uncertainty, fragmented planning systems, and outdated urban infrastructure highlight the need for long-term planning and holistic visionary thought.

Our project draws on the “thought experiments” of Dixon [41], echoing Le Corbusier’s visionary planning tradition [42]. Visionary concepts can help shape strategic urban visions in public spaces, as indicated by Kitagawa and Vidmar [43]. The idea behind transdisciplinary workshops focused on the urban future is to demonstrate how diverse the urban living environment can be when designed with long-term scenarios in mind. Visionary planning is not an end in itself; it is a tool. In an increasingly uncertain world, we must encourage research on how foresight and vision can influence the city-region scale.

The workshop participants formed teams according to the following principle: 2 students studying art, 2 students studying architecture, 1 student studying urban spatial geography, 2 students studying social sciences, and 1 student studying acoustic engineering. Social science students played a dual role: in addition to defining the needs and deficiencies of a given space, their task was also to facilitate communication between individual team members. Our research was oriented and directed not so much at individual students but rather at teamwork, within which individual students recognized their competency and practical capabilities and, consequently, professional skills. Two competencies were priorities: the ability to collaborate for the benefit of both the group and oneself, and the outcome. In contrast, in other universities around the world, students’ final achievements are not considered most important. From the perspective of the interdisciplinary New Space project, it is significant that each discipline has different, or visibly differentiated, requirements for the characteristics and competencies of its best student. In teamwork, this diversity is a fundamental value, based on which each student gains spectacular experience and knowledge about their psychological and even physical predispositions, and importantly, in an accelerated time frame. This diversity of competencies makes future creators of new socio-spatial concepts effective. In our case, we emphasize interdisciplinary educational methods, believing that they should be continuously selected, verified, transformed, and adapted to social development and needs. We maintain that the characteristics and predispositions of the students should be discovered and developed through the application of original teaching methods and forms. The following structured methodology was used to develop revitalization proposals:

1. Introductory lecture;
2. Topic discussion and review of local research reports;
3. Team formation;
4. Initial artistic and research work;
5. Presentation of each team’s project concept;
6. Expert collaboration;
7. Public presentation of project outcomes;
8. Group discussion;
9. Summary;
10. Preparation of a public exhibition of work results;
11. Competency self-assessment of project participants.

Students were assisted by Ph.D. candidates and academic staff throughout the workshops. These interdisciplinary teams aim to accelerate students’ educational development, guarantee faster professional maturity, and therefore foster a more conscious professional

entry into the labor market. The forming of the participants' creative attitudes in the project is a priority for their subsequent activity in achieving their life and professional goals. The compendium of experience resulting from the transdisciplinary project is multidimensional, starting with consultations with stakeholders to cooperation in the creation of public spaces and places. Students are able to implement the experience and knowledge they have gained in various professional projects and a variety of life events. As their experience is universal, the aim is that they should be able to find answers and solutions to different types of problem that interest them at the time. Computer skills involving the use of AI in design are not yet widespread. Each new project edition requires academic teachers to provide additional student training on the currently available AI-assisted design capabilities. Artificial intelligence in the design process automates and accelerates creative work by enabling the following:

- Removal or modernization of design elements: AI models can analyze existing images [44] or designs and implement changes specified by the designer, such as replacing an outdated building facade.
- Presentation of spaces in different seasons: Generative image models [45,46] can simulate the appearance of the same location with added snow, blooming flowers, or autumn foliage.
- Perspective modification: AI can generate views from different angles or viewpoints [46,47].
- 3D modeling: Although AI does not yet fully replace professional tools such as Revit or SketchUp, there are emerging solutions capable of automatically generating 3D models [48,49] from photographs or textual descriptions.
- Creation of promotional videos: AI can generate animations [50], scene transitions, and even complete short films that showcase architectural spaces created from a design concept and descriptive input.

3. Results

We present two urban revitalization proposals. Our goal was to create resilient subcenters that foster residents. The selected sites reflect contrasting characteristics, each with its own problems. The first project involves revitalizing the urban space of the old town, representing the multicultural past of the city. While tourist-friendly, it is often unfriendly to residents. The second project focuses on revitalizing a residential area with no touristic function.

3.1. Wolnica Square, a 14th-Century Historic Square, Design Without the Use of AI

The outcome of the first team is the revitalization of a 14th-century historic square. Its name, Wolnica Square (Polish: Plac Wolnica), comes from the Latin *forum liberum*, meaning "right of free trade". It was once a major stop on the salt trade route to Wieliczka and Bochnia. Today, it occasionally hosts cultural events, festivals, and fairs. In the vicinity there are theaters and monumental churches with excellent acoustics, often used for international concerts. Jewish Culture Festivals evoke memories of wartime losses. However, the history of the square has become a barrier to its functional development as a social subcenter. The design team aimed to create a space in which the local community could integrate and develop. They comprehensively assessed residents' needs, as well as the functionality and social aspects of the area. They proposed a concept of an urban stage understood as an environment that engages citizens in various activities. The design limits car traffic and transforms parts of the square into green spaces. In the center, a multipurpose pavilion shaped as umbrellas was proposed. It was designed to allow simultaneous but noninterfering activities, offering weather protection and multifunctional use. The pavilion echoes traditional market stalls, restoring the historical context of the square. The color

scheme and spatial design reference Polish folklore, with geometric forms inspired by floral patterns deeply rooted in folk culture. The irregular layout supports integration by creating new social functions. Natural light reflections help define zones for different uses. The space is designed to be inclusive for users of all ages and genders, focusing on a minimalist core concept (Figure 1).



Figure 1. Wolnica Square, Shades of Identity, 2023. Authors: Oliwia Dybczyk, Katarzyna Grzesiak, Weronika Mojecka, and Anna Panasiewicz (Academy of Fine Arts); Marek Szymala (Institute of Geography and Spatial Management, Jagiellonian University); Tomasz Turzański and Witold Żemėlko (Institute of Sociology, JU); and Bartłomiej Jarocho (Faculty of Mechanical Engineering and Robotics, AGH University).

3.2. Hanging Gardens of Podwawelski

The second transdisciplinary team selected a part of the city for revitalization that serves multiple and diverse functions (Figure 2). This is a residential estate built between 1967 and 1973 on former gardens and farmland. The estate consists mainly of low four- and five-floor apartment blocks arranged in a pavilion layout, with playgrounds and recreational areas. Within this space there are schools, kindergartens, shops, service points, as well as a cultural center and sports facilities. The estate is well connected in terms of transportation. The design team identified the need to reclaim parking spaces for green areas [51]. Their goals included conserving water and energy resources using green technologies [52], thus supporting biodiversity and minimizing the negative effects of climate change [53]. The team was inspired by Henri Lefebvre's spatial triad concept [54], the notion of identity of place [55,56], and Ray Oldenburg's concept of the third place [57].

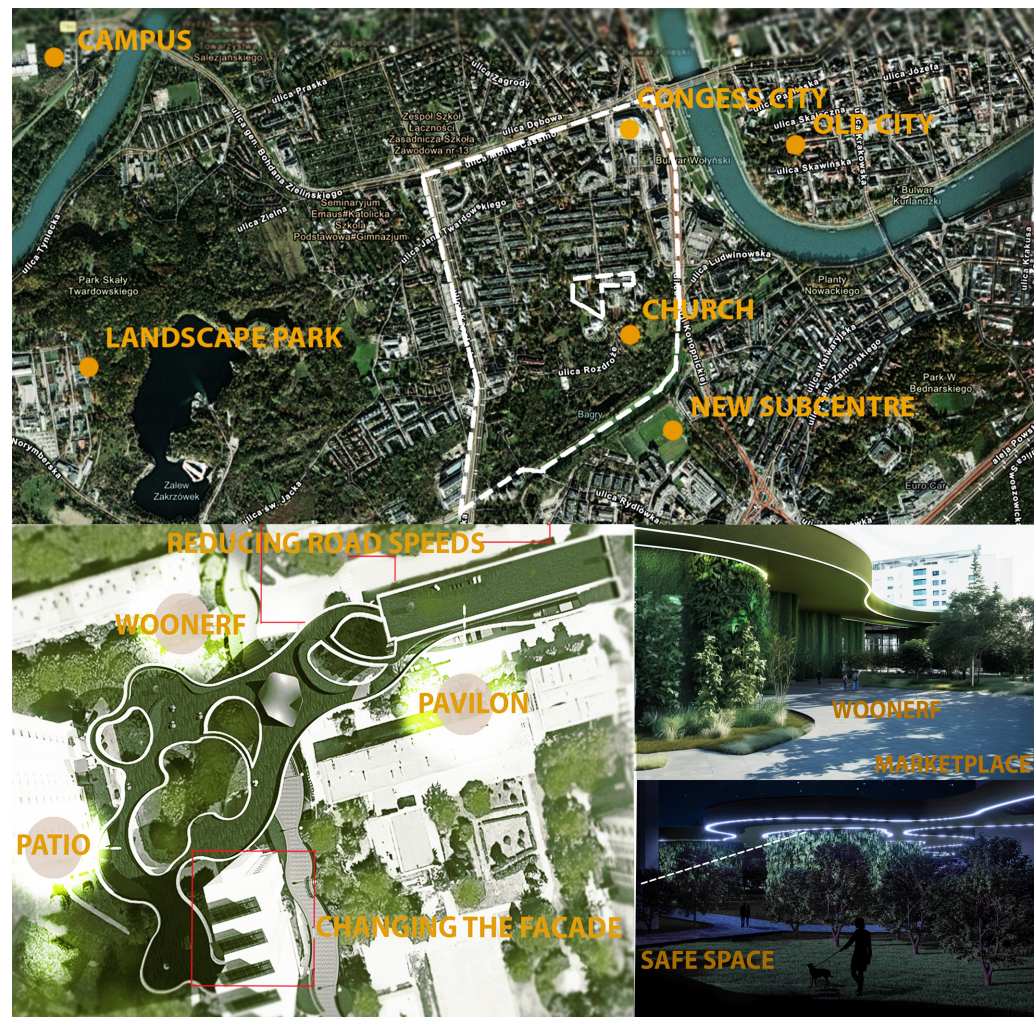


Figure 2. Project: Hanging Gardens of Podwawelskie, 2023. Authors: Karol Buchman (WIMiR AGH), Klaudia Drabczyk (WAW ASP), Julia Dudek (IGiP UJ), Paulina Kawecka (WAW ASP), Anna Kropyvnytska (IGiP UJ), Anastasiya Matsiuk (WAW ASP), Kaja Stempin (IS UJ), Hubert Szotek (IS UJ).

The spatial plan combined commercial, service, recreational, and social functions. The project proposed the installation of a twelve-meter walkway above ground level (at the height of the tree canopy), set among greenery. The zone would be powered by green energy from photovoltaic panels. This space was intended to become a subcenter of activity and neighborhood integration. The project included numerous initiatives to increase plant and insect biodiversity, such as planting trees, shrubs, and climbing plants. Vegetation would help eliminate heat islands and improve the microclimate of the street. The plan also included solutions for rainwater retention, installing tanks beneath the surface of the area to store rainwater. Care was taken to create a habitat for non-human beings.

3.3. Security and Eco-Friendly Lighting

Both teams prioritized safety by using drones for environmental inspection, that is, detecting threats and responding to incidents. Additionally, drones can be used for monitoring the area to protect property and support search-and-rescue operations. The drone software was based on artificial intelligence algorithms.

The authors of both projects also included in their solutions the current problem of artificial light pollution of the urban landscape [58,59]. In order not to interfere with the natural diurnal rhythm of residents, plants, and animals, they designed and used lighting

fixtures with appropriately shaped shades, which result in the reduction of upward and sideways light emission, and pointed to the choice of lighting with appropriate color temperature (CRI 70 LED lighting). The comprehensive design measures taken to also reduce artificial light pollution are expected to ultimately contribute to improving the quality of life of residents [60], protecting the environment [61], and preserving the natural heritage.

3.4. A Design Approach with Artificial Intelligence

The selection of specific AI models was based on authors' experience in performance AI in architectural and urban design applications. The textual prompts used to generate design concepts were developed using the Qwen3 language model [62]. The model was selected following comparative testing with other state-of-the-art language models available in mid-2025, including GPT-4o, Claude 3.5 Sonnet, and Gemini 1.5 Pro. These models were evaluated based on their ability to interpret architectural criteria, such as resilience concepts, integration of residents, and sustainability principles, and transform them into detailed prompts suitable for image generation systems. For visualization, two generative AI platforms were selected to provide complementary perspectives on the same design concept: Krea AI [63] and MidJourney [64]. Krea AI was chosen for its real-time generation visualization and control over design variables, e.g., perspective, lighting, and materials. As of 2025, Krea has introduced enhanced tools for architectural prototyping, including scene adjustment and context-aware generation, making it suitable for exploratory design. MidJourney was selected for its exceptional ability to produce high-fidelity, aesthetically rich, and contextually coherent architectural visualizations from textual prompts. In its 2025 iterations, MidJourney has significantly improved spatial consistency, urban scene understanding, and architectural plausibility. Its strength lies in generating evocative, presentation-ready imagery that supports interdisciplinary communication in the project team. In the following, we present the prompts generated by the Qwen3 IA models based on the description in Sections 3.4.1 and 3.4.2. The visualizations for Wolnica Square (Figures 3 and 4) were generated using Krea AI and MidJourney, respectively, with each interpreting the same design concept independently. Similarly, the visualizations for the Hanging Gardens of Podwawelskie (Figures 5 and 6) were created using Krea AI and MidJourney, independently interpreting the shared design concept. The images serve as illustrative representations of the proposed ecologically regenerative subcenter, highlighting different stylistic interpretations of the shared vision. Both prompts are cited in full.

3.4.1. Wolnica Square

The following prompts were generated by the Qwen3 IA model [62]: *“Design a resilient, climate-adaptive urban subcenter for Wolnica Square in Krakow, Poland, centered around a modular, multi-use pavilion inspired by the form and function of open umbrellas. The structure should provide year-round weather protection—shielding against rain, snow, and intense sunlight—while enabling simultaneous, non-interfering activities such as markets, cultural gatherings, educational workshops, and quiet social interaction. Drawing from the historical legacy of medieval market stalls that once occupied the square, the pavilion reinterprets traditional typologies through contemporary sustainable design. Its form integrates biomimetic principles: each ‘umbrella’ module functions as a self-supporting unit with adaptive canopies that respond to environmental conditions (e.g., light, wind, precipitation) via kinetic or smart materials. The architectural language is rooted in Polish folk culture: use a vibrant yet harmonious color palette derived from regional textiles and incorporate laser cut metal or wood patterns inspired by traditional folk paper cut-outs and floral motifs. These geometric patterns should serve dual purposes: providing aesthetic identity and modulating daylight, creating dynamic light reflections that naturally define functional zones within the space”*.



Figure 3. Visualization of the subcenter generated with Krea AI based on the Qwen3-generated prompt.



Figure 4. Visualization of the green subcenter generated with MidJourney AI based on the Qwen3-generated prompt.

“The irregular, nonhierarchical layout encourages organic movement and spontaneous social integration across age, gender, and ability. Prioritize universal accessibility with tactile pathways, inclusive seating, sensory zones, and multilingual signage. Integrate green infrastructure, including permeable surfaces, bioswales, and vertical plantings, to manage stormwater and improve urban microclimate resilience. Power the pavilion with embedded renewable energy systems (e.g., solar-integrated canopy surfaces, piezoelectric flooring) and include digital connectivity for community participation (interactive displays, Wi-Fi access points). The core design philosophy remains

minimalist and low maintenance, using locally sourced, durable materials to ensure long-term sustainability and community ownership. Ultimately, the subcenter should act as a living urban room—one that honors historical memory, fosters social equity, and adapts to future environmental and societal challenges.”

3.4.2. Hanging Gardens of Podwawelskie

The following prompts were generated by the Qwen3 IA model [62]: *“Reimagine urban space in a dense European city by transforming underused parking areas into a multi-layered, ecologically regenerative green subcenter, rooted in climate resilience, biodiversity restoration, and community belonging. The design should embody Henri Lefebvre’s spatial triad—perceived, conceived, and lived space—while activating Ray Oldenburg’s ‘third place’ principles: informal, inclusive, and socially nourishing.”*



Figure 5. Visualization of the subcenter generated with Krea AI based on the Qwen3-generated prompt.

“Emphasize the evolution of place identity through participatory design, cultural memory, and ecological reciprocity. Elevate urban experience with a 12 m high elevated walkway, threading through the tree canopy like a living ribbon. Constructed from cross-laminated timber and recycled steel, this aerial promenade connects buildings, parks, and public functions, offering panoramic views, shade, and immersive contact with nature. Integrate photovoltaic glass panels into railings and overhead canopies to generate renewable energy on-site, powering lighting, water pumps, and community amenities. Replace asphalt with a stratified green landscape: plant native trees, pollinator-friendly shrubs, and climbing vegetation to support insect and bird habitats. Use vertical greening systems and green walls to maximize ecological yield in limited space. Designate bird boxes, as integrated architectural features. Prioritize plant species that thrive in urban microclimates and contribute to carbon sequestration, air purification, and noise reduction. Combat urban heat islands through strategic transpiration cooling and albedo modulation. Install subsurface rainwater retention tanks beneath permeable pavements to capture stormwater for irrigation and greywater use. Incorporate bioswales, dry wells, and misting systems that activate during heatwaves, enhancing thermal comfort. Use smart sensors to monitor soil moisture, temperature, and biodiversity activity, feeding data into a public dashboard visible on-site. Layer the ground and mid-level zones with mixed-use micro-programming: small-scale commerce (kiosks, cafés), service hubs (repair stations, tool libraries), recreational nooks (play areas, yoga decks), and social gathering spaces (amphitheaters, communal tables). Ensure universal accessibility via ramps, tactile guidance, and inclusive seating. Use natural light, acoustic buffers, and vegetated thresholds to differentiate zones without barriers. The overall aesthetic should balance technological sophistication with organic texture—sleek solar elements harmonize with wilder greenery, creating a dynamic tension between innovation and wildness. The space must feel like a living organism: adaptive, self-sustaining, and co-created by humans and more-than-human inhabitants alike. Visualize this as a new model of post-car urbanism—a verdant, energy-positive, socially vibrant heart for the neighborhood.”

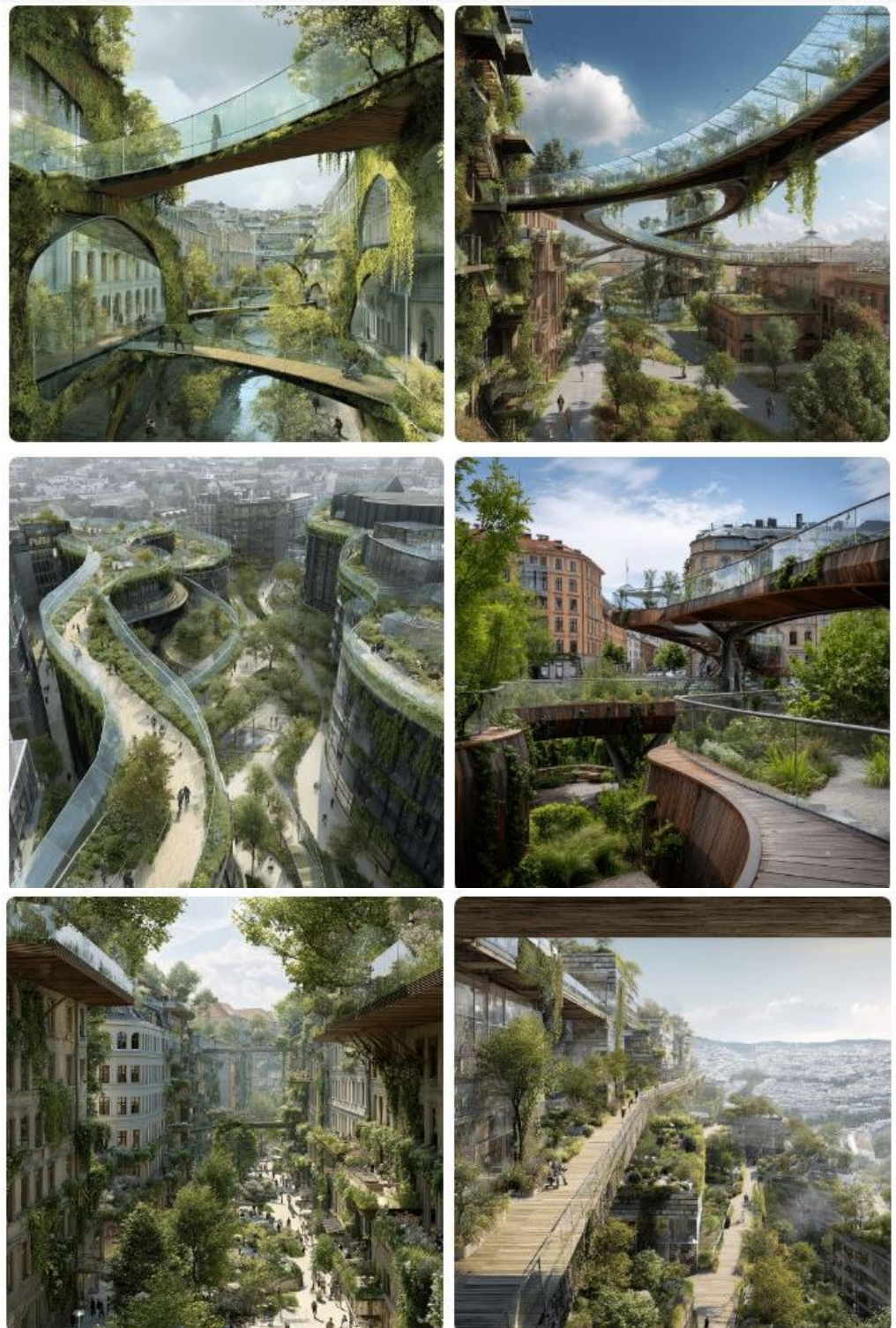


Figure 6. Visualization of the subcenter generated with MidJourney AI based on the Qwen3-generated prompt.

3.5. Validation of Design Team Proposals

During the four-day design workshops, it was possible to develop concepts and draw up a design proposal. However, evaluation of the projects based on a public exhibition of the outcomes is necessary. The evaluation of the spatial transformations revealed both the strengths and weaknesses of the projects. In both cases, spatial resilience was well defined, though not always holistically. The revitalization of the historical center of the city fulfilled its social goal of integration and incorporated technologies adapted to climate change.

However, the project did not consider the impact of excess water [65,66] during heavy rainfall, such as redirecting it to a nearby river and/or retaining and using the stored water to irrigate vegetation during heat waves or using cool water to reduce the temperature of large-scale building elements, thus improving thermal comfort in designed spaces. The risk of flooding [67,68] was also overlooked.

However, the project emphasized the need to use or develop equipment and materials capable of storing and/or dispersing excess heat. Heating and/or cooling open urban spaces calls for a re-evaluation of surface materials used, especially in those parts of the city that form part of its cultural heritage.

In contrast, the Hanging Gardens project did not adequately address the needs of people with certain disabilities [69–71], such as mobility impairments. In the next phase of work, the projects were modified accordingly.

3.6. Validation of AI-Generated Designs

Unlike traditional architectural renderings, which are crafted by human designers, AI-generated visualizations emerge from data-driven processes, and these projects are reproductive in nature (that is, they lack creative characteristics). The consistency with the project and the assumptions, as well as realism and contextual fidelity [22], remain at a low level. The depicted locations, though clearly defined in the prompts, are the result of algorithmic hallucination representations of actual spaces. Visual quality and aesthetics achieve a high standard, but their abstract nature and detachment from reality make them unsuitable for supporting social dialogue or engaging residents in the process of change.

It should be noted that the technological solutions are contained only in the prompts and have no impact on the visualizations themselves.

The authors are aware that AI tools will improve significantly with subsequent software versions.

4. Discussion

Problems such as pandemics, climate change, and other global megatrends are increasingly prompting reflection on cities as resilient spaces. In the existing literature, urban (or city) resilience is defined and analyzed in four key dimensions: economic, environmental, social, and infrastructural [8,72]. Within this paradigm, various tools [73,74] have been developed to support local governments in diagnosing urban vulnerabilities, identifying existing resources, and formulating concrete actions to improve resilience. Despite its comprehensiveness, this approach focuses primarily on risk management, hazard reduction, and strengthening existing urban systems in response to both predictable and unpredictable shocks.

However, this paper has a different character and purpose. It does not aim to assess or catalog urban resilience within established analytical models. Instead, we initiate a discussion on the design of resilient subcenters as a conceptual and holistic process. Our approach goes beyond the logic of reactive crisis management by proposing an early design-driven intervention in which resilience is constructed not only through system management but primarily through the shaping of spatial structure. In this sense, resilience is not merely a system attribute but an outcome of transdisciplinary design. We introduce artificial intelligence as a novel integrative framework in the design process, which enables more adaptive, responsive, and future-oriented behavior.

Urban space revitalization projects are developed by students under the supervision of researchers and experts. Public discussions include representatives of the City Hall Department of Strategy, Planning, and Investment Monitoring, media representatives,

practitioners, and local residents. Feedback agreed upon by the project team is incorporated into the design.

Workshops that did not use AI were held in November 2023. The work on employing artificial intelligence in the design of resilient spaces took place eighteen months later.

The workshops encourage students to think unconventionally and to experiment in the field of urban space design:

- Transdisciplinary teams composed of sociologists, engineers, interior designers, architects, urban geographers, and acousticians necessitate a holistic approach to urban planning.
- For participating researchers, it is also essential to develop critical thinking [75–77] among students and the ability to question stereotypes related to shaping the living space of humans and other beings.
- A holistic perspective on design is also made possible by the fact that researchers represent Generation X and Generation Y, while students belong to Generation Z and Generation Zalpha [78,79]. The instructors gained their professional experience before the advent of the Internet and artificial intelligence algorithms and are deeply grounded in the physical world. They work in hybrid models and rarely operate in virtual reality. The students, on the other hand, are members of a hybrid society: part of their lives unfolds in the real world and part in virtual space. The designed spaces should therefore be attractive to all generations and co-existing beings.

The impact of AI in all the presented projects and movies is visible in several aspects:

- As a generator of conceptual images, facilitating conversations with potential investors;
- As an injection of diversity, accelerating the creation process by generating 3D shapes;
- As a significant element in the speed of the iterative architecture process, for example, to work through different versions of the facade.

The authors of this article's use of AI in design is distributed across various models, starting from defining expectations through 2D or 3D visualization (Figure 7) to presenting ideas in the form of promotional videos, see Figure 8. The most useful technological solutions proposed by the Qwen3 model to define a resilient subcenter include solar integrated canopy surfaces [80], piezoelectric flooring [81], and the integration of photovoltaic glass panels [82] into railings and overhead canopies to generate renewable energy on site, used to power lighting and operate water drainage pumps. The language models also defined the design through the core philosophy of being minimalist [83] and low-maintenance, using locally sourced durable materials to ensure long-term sustainability.



Figure 7. Conceptual images of Wolnica Square generated with MidJourney.



Figure 8. Visualization of the subcenter generated with Krea Movie AI. The video presents an alternative concept to the Wolnica Square shown in Figure 1.

5. Conclusions

Several megatrends have been identified that the creation of subcenters seeks to address. These include the crisis of human relationships, loneliness, mental health crisis, burnout society, fluid identity, and social isolation. Friendly, safe, and climate-resilient spaces create the opportunity to develop residents capable of confronting the negative and irreversible effects of current and future transformations. We present the results of the seventeenth edition of the workshops.

The design projects developed by architects demonstrate how transdisciplinary urban design can support the achievement of multiple Sustainable Development Goals [84–86] through the integration of key policy frameworks, such as the Davos Declaration [87,88], the New European Bauhaus (NEB) initiative [89], and the 2030 Agenda for Sustainable Development, particularly Sustainable Development Goal 11.7, which calls for universal access to safe, inclusive, and accessible green and public spaces through multifunctional urban programs that combine commercial, service, recreational, and social functions. Beyond the frameworks mentioned above, there is a growing number of initiatives—from the Urban Agenda for the EU [90,91] to the 15 min city [92,93] and the Circular Cities Declaration [94,95]—which together create a rich ecosystem of policies supporting the innovative shaping of public utility spaces. The projects presented in this article not only align with these frameworks but can also serve as inspiration for transformational changes, opening possibilities for their financing, scaling, and monitoring within existing programs.

The integration of AI into transdisciplinary design processes opens new methodological pathways for urban resilience planning, particularly in enabling rapid prototyping and participatory visualization. The comparative framework we present—between human-led and AI-generated design—can serve as a foundation for future studies on creativity, authorship, and decision-making in hybrid design environments.

Our project, New Space, has the potential to have a real impact on improving the quality of life of residents and may positively influence the implementation of the city's

development strategy. We believe that artificial intelligence will automate the work of designers and will soon become indispensable in the holistic design of urban spaces.

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