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31 [2023] 1 [65]

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ZNANSTVENI ČASOPIS ZA ARHITEKTURU I URBANIZAM

UNIVERSITY
OF ZAGREB
FACULTY OF
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SVEUČILIŠTE
U ZAGREBU
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Meanings | Značenja

PROSTOR *m* space, room; (*površina*) area; (*zona*) tract; (*prostranstvo*) extent, expanse; (*za kretanje/manevriranje*) elbow-room, playroom, leeway, scope; (*prostorije, smještaj*) premises, accomodation | **životni** ~ living space; **stambeni** ~ housing; **školski** ~ school space; **poslovni** ~ office space/premises; ~ **za noge** legroom; *prema raspoloživom* ~**u** on a space available basis; *fig* **pružati** ~**za** offer/give scope for; **posvetiti (pokloniti)** ~ (*u novinama*) devote (give) space to; **zbog pomanjkanja** ~**a** because of limited space; **radi uštede na** ~**u** to save space; **povreda zračnog** ~**a** violation of airspace, aerosp; **istraživanje** ~**a** space exploration

ŽELJKO BUJAS (1999.), *Veliki hrvatsko-engleski rječnik | Croatian-English dictionary,* Nakladni zavod Globus, Zagreb

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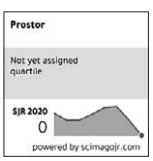

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Fig. 1 The Capriccio Genre: Giovanni Paolo Panini, Gallery of Views of Modern Rome, 1759, Louvre Museum, Paris

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A Theory towards a Built-in-Variety in Museum Design: The "Capriccio Museum"

Capriccio
neoclassical
museal spaces
museum typology
transhistorical

The paper presents an excerpt from the extensive research on various *museal spaces* throughout human history. By re-evaluating the imaginative procedures involved in conceiving those spaces, the research in its broadest scope asks: how do we map, rethink and revive the historically valuable assets of architectural thought without "museumising" them? The excerpt is initially dedicated to the neoclassical museum space based upon the notion of the *frame* that was already adopted by the painting genre *capriccio* to induce the spectator's mind into an architectural fantasy of juxtaposed real and fictitious buildings, archaeological ruins, urban and natural landscapes. In the neoclassical museum space, the *capriccio* "became alive" as an actual-size architectural fantasy that could be stepped into. Based upon multiple conceptual *frames*, the interconnected yet distinct architectural fragments illustrated the *neoclassical worldview* founded on inclusivity, synchronicity and bodily experience. This historical episode is further theorised into the *capriccio museum,* a new theoretical model that critically perceives multiple experience probabilities as distilled from the past and starts a process of conversion of that historical knowledge into transhistorical knowledge relevant for today.

INTRODUCTION

This paper presents a single excerpt from the otherwise extensive research on museal spaces throughout human history that are conceived by curious imaginative procedures.[1] It collects them from an interdisciplinary context and re-evaluates them in order to rethink and revive them as valuable assets of architectural thought.

The excerpt presented in this paper is dedicated to the *neoclassical museum space* and the *frame* that was already adopted by the painting genre *capriccio* as its imaginative procedure. The *capriccio* is a painterly representation of architectural fantasies of juxtaposed real and fictitious buildings, archaeological ruins, urban and natural landscapes. In the neoclassical museum space, by analogy to the painterly space, the *capriccio* "became alive" as an actual-size architectural fantasy that could be stepped into.

The textual part of this paper presents the historiographical facts about the use of *capriccio* as an imaginative procedure in art and architectural context and the way it is recognisable in the conceptualisation of "The Pio Clementino Museum of Ancient Art".

Learning from this historical episode, the *capriccio* is then revived as a theory that is emphatically dedicated to opening new ventures from the architectural vocabulary and meanings of the past. The historical referentiality discourse in the museum context is therefore deconstructed, resulting in the classification of the museum's fragments and their accompanying formal and experiential capacities as a new ground for the exploration of an incredible variety of architectural options.

The graphic part of the paper presents three kinds of "boards" – historical, associative and imaginative, illustrating a graphical method for a re-direction of this historical knowledge into speculative and design-wise procedure. The "historical" and "imaginative" boards put forward a catalogue of museum architectural fragments, placing one image next to another, starting with the real and the rational and transposing it towards the imaginative and fictitious and from past to present. The "associative" board mobilises a set of museums that are based on the idea of the whole as a complex model incorporating many real and imagined syntactic memories or fragments of the past and present. In that way, the *capriccio museum* as a new theoretical model shows its two-fold relevance: first, to re-read the existing museum production anew and to recognise the "built-in variety" in museum design transhistorically, in terms of formative ideas and techniques, and second, to contribute to a museum metaphor that has the power to dissolve the museums' established authority towards new architectural (and curatorial) freedoms to choose and select from a variety of spatial and experiential options.[2]

THE ARCHITECTURAL CAPRICCIO

> "The capriccio can be understood as a metaphor of the architectural mind and of the way it operates by association, analogy and permutation. It can also be the architectural project itself which combines analysis and synthesis, precedent and experiment, technical expertise and artistic poetry in a densely layered and intricate image. The capriccio corresponds truly to the expectation of architecture as an 'Ars Combinatoria' with an infinite palette of variations and associations." (Steil, 2016a)

Capriccio as a term is ascribed via a range of meanings across many art disciplines. Its original meaning was negative, similar to grotesque. Its positive meanings refer to the general onset of defiance and the artist's clear right to an unrestrained imagination. The term *capriccio*, as of the visual domain, first appeared in the writings of Vasari to describe ancient and modern artists who violate the rules of mimicking nature. It is recognised in the 16th-century painting based upon a game of analogies between the shapes and symbolism of objects, as in the example of Giuseppe Arcimboldo (Popiel, 2015; Anders, 2016). *Capriccio* officially departed from the faithful image of space in the 18th century as a

subgenre of landscape painting, representing an architectural fantasy composed of real and fictitious elements, i.e. buildings, archaeological ruins and urban and natural landscapes (Fig. 1). The composition was built by introducing fictitious architectural elements into otherwise realistic *vedute*, by placing familiar architectural objects in an unusual way, or by changing their usual scale by reducing or enlarging them. Sometimes, they were imagined in visions of the future as torn by the ravages of time. As Popiel (2015) notes, capricious paintings use the framework of landscape convention as an empty form, a template that can be filled with various elements and new semantics.

Capriccio also contributed to the artistic expression of the "spirit of the place" by accentuating a specific light or atmosphere and by emphasising certain features of the landscape that are otherwise unnoticeable in the documentary view. *Capriccio* aimed to represent (and shape) the viewers' feelings, those they take away from the cities, which are usually a reflection of the super-reality of emotions and do not coincide with the factual content of the scenery (Steil, 2016).

Architectural capriccio, including the *capriccio of ruins*, was a sub-genre of *capriccio* expectedly practised by architects or painters who had some notions of architecture (Mazzola, 2016). It was developed in parallel with the world's fascination by the Antiquity and the Grand Tour, the cultural pilgrimage for wealthy intellectuals towards the South – Italy. The Grand Tour enabled essential education for architects who were given a first-hand chance to witness the wondrous excavations and discoveries of the Ancient world's fragments.[3] Here, this cross-current of painting and architecture reached its high point. By using the very working methodology of taking notes and sketching in situ and then developing them into elaborate drawings and paintings in the workshops, *capriccio* was adopted as a compromise between archaeologically and historically correct precedents in the face of antique ruins and hypothetical and fictive models of the creative mind (Steil, 2016b). The documentary and the imaginary started to go hand in hand.

The personal voyage from the documentary to the imaginary, until the two became utterly indistinguishable, is evident in the oeuvre of Giovanni Battista Piranesi. His "Carceri d'Invenzione" (Imaginary Prisons), a new form of architectural fantasy that Piranesi himself called "capricious inventions", presented impossible architectural structures that assigned even more striking and extraordinary visual experience to the image of *capriccio* (Marchesano, 2010). In the images of Piranesi, cavities of space are filled with architectural fragments of pillars, buttresses, walls and arches, flights of stairs, portrait busts and tomb sculptures. The architectural fragment remains a basic building block of his compositions even in his later "Le Vedute di Roma" (Views of Rome) and the speculative reconstructions of "Le Antichità Romane" (Roman Antiquities) with the grandest of them all – the reconstruction of "Campo Marzio dell'Antica Roma" (Campus Martius of Ancient Rome). And while in each of Piranesi's works we see a highly personal response to the past in its fragmented state (Pinto, 2016), "Imaginary Prisons" (re-made over and over again throughout Piranesi's life) represents a real experimental space for architectural fantasy without any realistic limitations (Huyssen, 2006). "*Archaeological correctness was no longer an issue for Piranesi",* as Mallgrave (2005: 33) would say, "*artistic license and bravado were the call of the day*".

Capriccio was also used in architectural training for developing skills of visionariness through central aspects of the imaginary of ruins: that of erosion, natural decay and the return of architecture to nature. For example, Carl Friedrich Schinkel asked his students to first "build" a building in their drawings and then to start to mentally "decompose" it little by little until they had turned it into a romantic ruin. This procedure was used as a lesson for both architecture's transitory nature – its vulnerability and its resistance to transience – its dignity in the decay (Bogdanović, 1995: 44-45). But most of all, it was a lesson for architectural imagination to be enabled to look from within, from the interior essence of buildings that come to light, with their structures and substructures exposed, and the mixture of elements and forms they are composed of, such as the rooms, the itineraries, arches, vaults and domes. Joseph Gandy set up this visionary and analytical game earlier through his imaginary representation of John Soane's Bank of England as a ruin.

Therefore, *capriccio* in all its architectural manifestations, imposed on the viewer a new

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1 In his theory on practices of imagination, Michael K. Hays explains the dynamic process that takes place in architectural imagination, starting from our intuitions or sensory experiences and extending to our understanding. In order to bridge our intuitions into the understanding that is the sphere of concepts and categories, he introduces the need for a third agency – a mediator, the so-called imagination intermediary or an underlying imaginative procedure. (Hays, 2016; Fabrizi, Lucarelli, 2019; Klaske, Sioli, 2021)

2 This paper itself works as a *capriccio*.

3 The Grand Tour encompassed a thorough study of antique buildings on archaeological sites. The museal sites, i.e. the collections, especially the ones consisting of visual arts and antiquities, were also visited and studied.

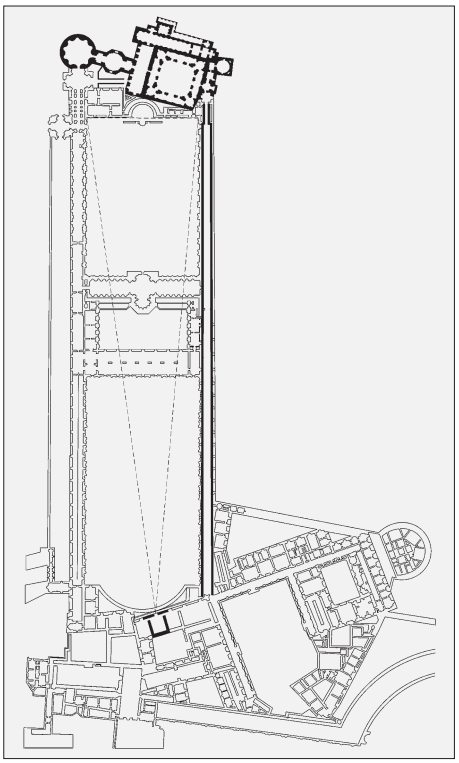


Fig. 2 Museal Fragments Sequence of Vatican Palace. The Belvedere Corridor connecting the "Stanza della Segnatura" (Studiolo; down) and "Cortile delle Statue" (The Courtyard of the Statues) of the Belvedere Villa (upper right), continued with "Museo Pio-Clementino" (Pio Clementino Museum; upper left)

frame of reference to induce his/her mind into an imaginative rearrangement of the real.

We can summarise that *capriccio* represents the architect's desire and intellectual satisfaction to create forms that do not have to be built as well as forms that cannot be built and whose imagined status is equally valuable. *Capriccio* implies working in parallel with the real and the fantastic/fictitious, thus maintaining the self-awareness that the imaginary expressions of the mind are never completely independent of the objective world of concrete real things. *Capriccio* represents the growing fascination with the classical past and introduces the formal logic of architectural composition. Even today, it can be used as a learning ground for the classical categories of architecture and, at the same time, for experimentations with strivings to escape the rigid classical doctrine (Popiel, 2015). That is why it often exhibits oddness in its invention, multiform special arrangement and irregular mixture of conventional and unexpected forms, affecting the viewer with juxtapositions and ambiguity of shapes and meanings (Dowling, 1977). *Capriccio* can be used to investigate architectural meaning by imaginatively placing one image next to another, one metaphor next to another, some belonging to the real world and some to the imagined world. The meanings of those images are transposed and combined, reinforcing or invalidating the original metaphors while new ones are being born.

Capriccio, apart from being an imaginary museum itself, a collection of characteristic architectural fragments from (analogue) cities, has concrete contributions in the context of real museums.

Until the 18th century, the museum was dedicated solely to the experienced viewer, the connoisseur. The display of *capriccio* paintings introduced an intellectual game for the connoisseurs of art and culture and a creative mechanism for socialisation in high intellectual circles. The "artificial", as they were called, or rather, the "fake" architectural compositions, the most famous of which are the paintings of Venice by Canaletto and of Rome by Panini, were self-consciously composed in order to provoke a serious effort on the part of the connoisseurs to recognise the rearrangement of reality: naming the significant architectural and artistic works, discussing the unknown locations to which they have been moved to, or the ways in which they have been changed or recomposed (Mayernik, 2016).

Another contribution of *capriccio* in the context of the architectural imagination of museums is the neoclassical museum. It is a fascinating genre of museum historical types, represented by the complex and primarily fictitious composition of architectural elements and archaeological finds, which, introduced the concept of a frame (of reference) into the museum design vocabulary for the first time.

The Architectural Capriccio and the Neoclassical in the Pio Clementino Museum of Ancient Art

The Pio Clementino Museum of Ancient Art, a fragment of today's Vatican Museums, is the first museum ever based on the premise that "the collection is a long-term cultural depository" accessible to the general public (Kirk, 2005: 69). The Pio Clementino Museum of Ancient Art is a rare historical example that, due to the availability of research sources, allows a thorough insight into the process of its conceptualisation.[4]

The Pio Clementino Museum of Ancient Art was established in 1771 and was architecturally conceptualised as a continual expansion of the "Cortile delle Statue" (Courtyard of the Statues) at the Belvedere Villa, famous under the name of the Octagon (Fig. 2). The first museum room added to its west was the "Salla delle Muse" (Hall of the Muses), designed by Michelangelo Simonetti as one of the first museum rooms dedicated to a complete group of ancient artefacts in 1776. It came into existence due to the important discovery of the Tivoli full-size statue group of seven Muses with Apollo Citharoedus.[5] It was believed that the statue group belonged to an ancient Greek-themed library or art gallery in an ancient villa dating from the period of Julius Caesar, when, in the words of Collins, elite patrons consolidated their status by absorbing and displaying Hellenic culture. This statue group was the backbone of the collec-

4 There is a significant gap in the artefactual history of museum prototypes between the 16th-century "diaeta" and the 18th-century established art galleries. The gallery, the cabinet and the salon all stated the new public purpose within their architectural programme but did not exemplify any new architectural invention, being usually positioned as a separate room or a sequence of rooms within the grand palaces. Architecturally, they can be tracked only through the paintings that depict the wealthy men with their collections (many of them presented as capriccio paintings). That is why Collins comments that historical museum spaces are inherently challenging to reconstruct and interpret because they are complex systems of physical structure and conceptual content that are never static, because of which original schemes (and the accompanying visual and archival documentation) are a real rarity (Collins, 2008-2009; Levine, 1990; Kirk, 2005; Mata, 2006).

The architectural capriccio used in the museum context is not just an Italian story. As the most famous capriccio in the history of museums, as well as the most capricious realisation, we can single out the house-museum by John Soane from 1824, on Lincoln's Inn Fields in London. A widower, losing hope that his two sons will inherit the architectural profession, finds solace in collecting and arrang-

tion, which over time was further expanded with twenty-eight busts of Greek intellectual heroes installed between the Muses. The Muses were clustered around their pastor Apollo, within their "natural environment" – the ancient Greek Temple of the Muses. The architecture was dissolved in an illusionistic manner to include fragmentary representations of Mount Parnassus and to transpose real space into the idealised vision of Arcadia. It was further furbished with thematic decorative schemes that involved fragments of authentic Greek mosaic floors. The first and most dominant paradigm underlying this spatial construct was the enhanced interest in Greek antiquity (Collins, 2008-2009).

Fig. 3 The Neoclassical Frame: August Ahlborn, after the lost original by Karl Friedrich Schinkel, View into the Heyday of Greece, 1836, Alte Nationalgalerie, Berlin

Johann Joachim Winckelmann is the one directly responsible for the shift from the Latin vision of antiquity towards perceiving Greek antiquity as superior, even miraculous. He was the first to articulate the differences between Greek and Roman art and the author of the "History of Ancient Art" (1764), which established the foundation of modern archaeology and art history. However, years before his theoretical work was finished, he worked as a papal antiquarian in Rome, participating in and writing about the current excavations. It is believed that although the Pio Clementino Museum of Ancient Art was founded in 1771, three years after his death, this museum project was actually his legacy. The way the "Salla delle Muse" tried to visualise and build a slice of Winckelmann's beloved Greece from the ground up is more an attempt to imagine an ideal Greek space and time than to recreate real Greek space and time. Moreover, this is what makes it truly neoclassical. What does "neoclassical" actually mean?

The term "neoclassical" means returning to the Classicism of Antiquity at the time when Italian Renaissance began to be perceived as offering architectural paradigms that were untrue to the Antique. Archaeology, comprehensive excavations and a huge number of publications dealing with antiquities led to an architecture that was more accurate to the spirit of Antiquity (Curl, 1999). Through this new knowledge, the way classical Antiquity was imagined and represented started to change in the 18th century, in a process that was neither unequivocal nor linear and fact-based. Mallgrave succeeds in giving us a peek into this neoclassical worldview by illustrating Winckelmann's architectural thought on the example of ancient gymnasiums utilised as a training ground for Greek artists. Greek artists used nude males as models and thus had nature as their source, he says, but the idealised beauty of Greek deities was not present in a single model. It consisted of and was assembled from the best parts of all present bodies. Additionally, physical perfection was not complete without expressing a "noble simplicity and quiet grandeur", or how physical appearance expressed the dignifying human condition (Mallgrave, 2005: 30). The plastic form was hence both formally and spiritually defined (Fig. 3). This oversimplified theoretical assumption is vital to understanding neoclassical architecture's true nature of historical relativism as opposed to the popular belief in neoclassical historical accuracy. It was surely eclectically based on historical forms, but there were neither dominant nor singular ones. It experimented with classical vocabulary but relativised and eroded classical architectural doctrine. It was archaeological, but it was as imaginative as it was documentary. As Ernst (1993: 483, 493) would say, the neoclassical meant seeking for "environment of flawless and timeless perfection", and "the neoclassical medium was "vision" meaning imagination".

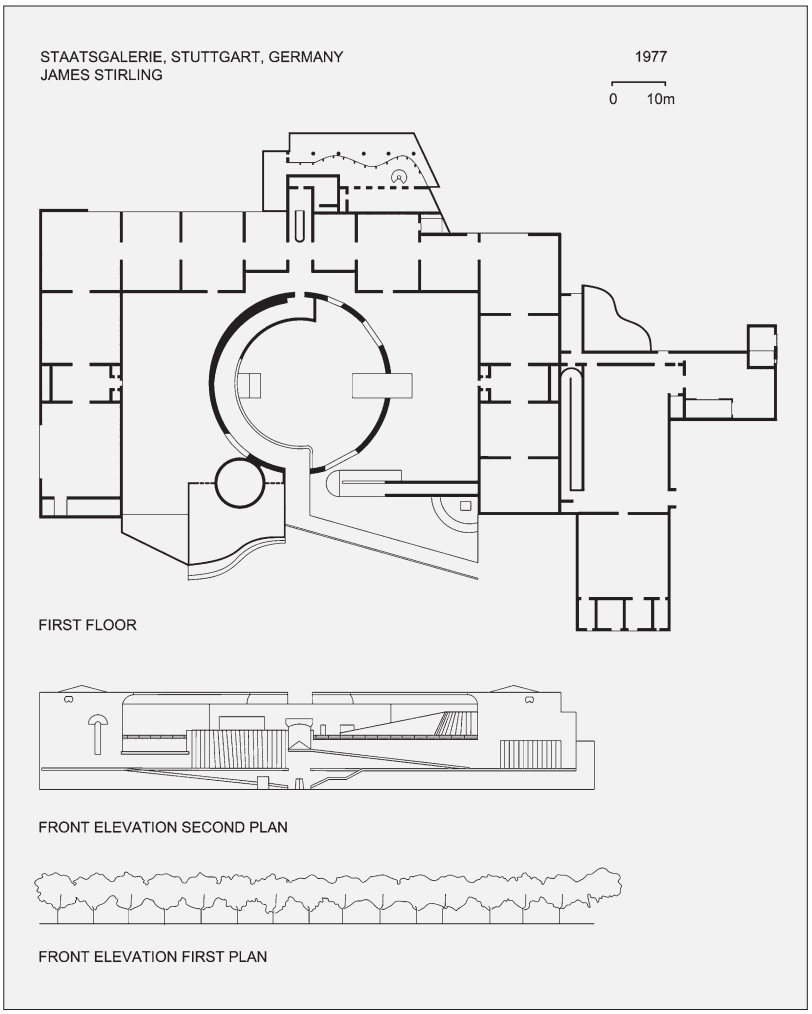
The actual knowledge of the architects about ancient Greek architecture was rather incompetent.[6] What the architects did was not a reconstruction of any kind in the modern

ing his collection of works of art and sculpture, which he planned to leave to the state as a public museum or academy of architecture. He built, expanded and adapted his gallery for 30 years, buying three houses in the neighbourhood and transforming the central building as a significant expression of his architectural worldview – a labyrinthine series of interconnected theatrical scenes lit from the zenith. Each scene in this series is a portal to a unique world. The room of pictures should be especially highlighted because in that room monumental panels have been introduced that open and reveal new settings of artworks.

There are also numerous research sources through which the process of its conceptualisation can be tracked (Lucacher, 1983; Ernst, 1993; Furjan, 1997, 2002, 2004; Psarra, 2009), but it presents a very eccentric structure, where the multiple narratives and the special effects as added on to the autonomous architectural apparatus make a self-referential system that hardly speaks for anything else than itself.

5 Apollo bearing cithara or lyre.

6 As Collins explains, Greece was inaccessible until the 1740s, when the Turks allowed sporadic visits to some of the cities and important sites, and even after the resulting publications, it took at least a generation to assimilate and put into practice the new knowledge.



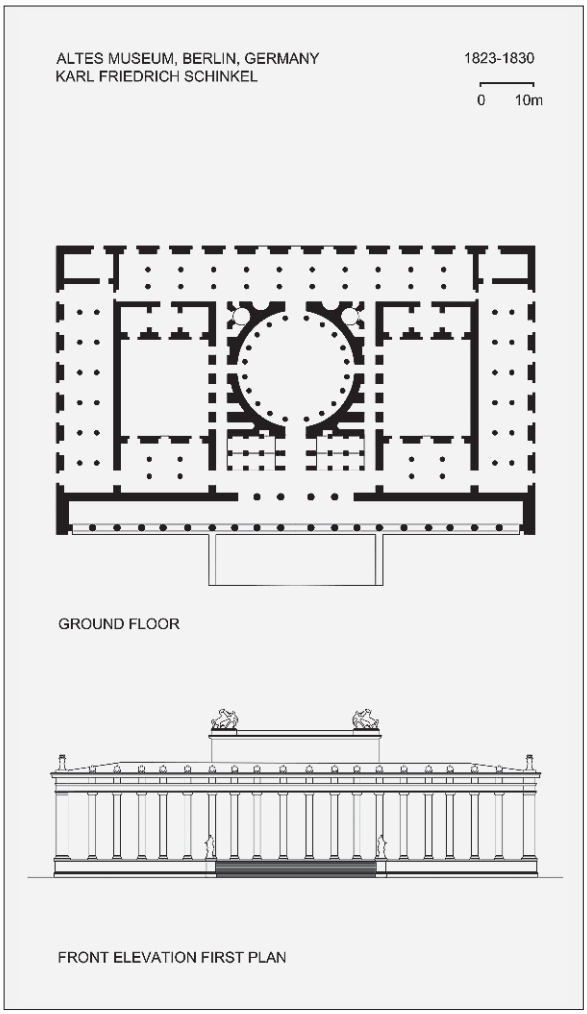


FIG. 4 STAATSGALERIE IN STUTTGART, GERMANY BY JAMES STIRLING: ARCHITECTURAL FLOOR PLAN AND ELEVATIONS

FIG. 5 ALTES MUSEUM IN BERLIN, GERMANY BY KARL FRIEDRICH SCHINKEL: ARCHITECTURAL FLOOR PLAN AND ELEVATION

sense but a creative combination of Roman models, baroque training and a few young archaeological findings. The Hellenistic setting for the Tivoli sculpture group for the "Salla delle Muse" was therefore built as "tentative Greek shoots onto a sturdy Roman stock. Whereas the plan, vaulting and fenestration derive from Imperial bath complexes, a useful model for arranging varied interior spaces, the room's sixteen monolithic columns evoke the post-and-lintel structure that was becoming identified with ancient Greece" (Collins, 2008-2009: 43).

The Museum was compiled of collated real and imaginary citations that could not be interpreted by separate citations but by the new whole. It expanded west, and with each museum addition, a new frame (of reference) was introduced.

"As is clear in views from about 1790, the cool, cross-vaulted western atrium invoked Egypt, with its tomblike architecture, pharaonic sentinels, paired granite sphinxes, and smaller Egyptian statues, including some from Tivoli. The adjoining Rotunda recalled ancient Rome, with its obvious resemblance to the Pantheon and its colossal statues of Roman gods and deified emperors. The bright and colorful Hall of the Muses, by contrast, evokes ancient Greece and reflects an important early moment in Europe's absorption of Hellenic style." (Collins, 2008-2009: 41)

The realisation of the Pio Clementino Museum of Ancient Art is a starting point of an unfolding architectural historical fantasy, a *capriccio* of unique buildings, archaeological remains and other elements in highly fictional combinations. It introduced the notion of the frame in the museum context vocabulary as one of the most important concepts in the architectural imagination of museums. Architecturally, the neo-classical pattern of compiled architectural fragments signified the fragment of the Hall of the Muses to work as a frame to ancient Greece, the fragment of the Rotunda to work as a frame to ancient

Rome, and more. These frames were meant to transpose spectators into an ideal space and time. The museum started to work as a singular imaginative *mise en scćne* that offered multiple spatial experiences.[7]

Deconstructing Historical Referentiality in Museum Context – The Museum as a Fragment instead of the Museum as a Whole

> "The root issue is not one of fact but of theory. It is conceptual." (Marx, 1992: 209)

The architectural *capriccio* has historical imagination as its frame of reference and is emphatically dedicated to opening new ventures from architectural vocabulary and meanings of the past. It represents a highly erudite approach to architectural design and is knowledgeable of and therefore playful with conventional formal elements and their experiential, intellectual and even political meanings.

The museum as a building type, more frequently than other building types, exhibits conceptual interest based on historical referentiality, or in the ways the new museums formally reinvent old ones. The way Stuttgart Neue Staatsgalerie (1984) by James Stirling (Fig. 4) reinvented Altes Museum (1830) by Karl Friedrich Schinkel (Fig. 5) became "an architectural emblem of the new historical culture" of museum design (Lampugnani et al., 2001: 12). Anthony Vidler (1989) singled it out as representative of a history that lost its face, i.e. its façade, conceptualised as a modern re-interpretation of Schinkel's museum inner parts, the stoa, the central rotunda, the sequence of rooms en suite – enfilade and the central stairs.

The historical referentiality as conceptual interest, even when neutralising the historical pastiche as in the example of Stuttgart Neue Staatsgalerie, carries the risk of being operationalised as dangerously arbitrary architectural sampling. In the architectural literature on museum design, these approaches are recognised as the *museum-citation type* (Marotta, 2010) and further theorised as *figurative (iconographic) versus typological recreations* (Montaner et al., 1987). Incredibly lucid, although seemingly oversimplified, is the typological categorisation (with historical reference) of the *museum with traditional enfilades* (Lampugnani et al., 2001: 20).

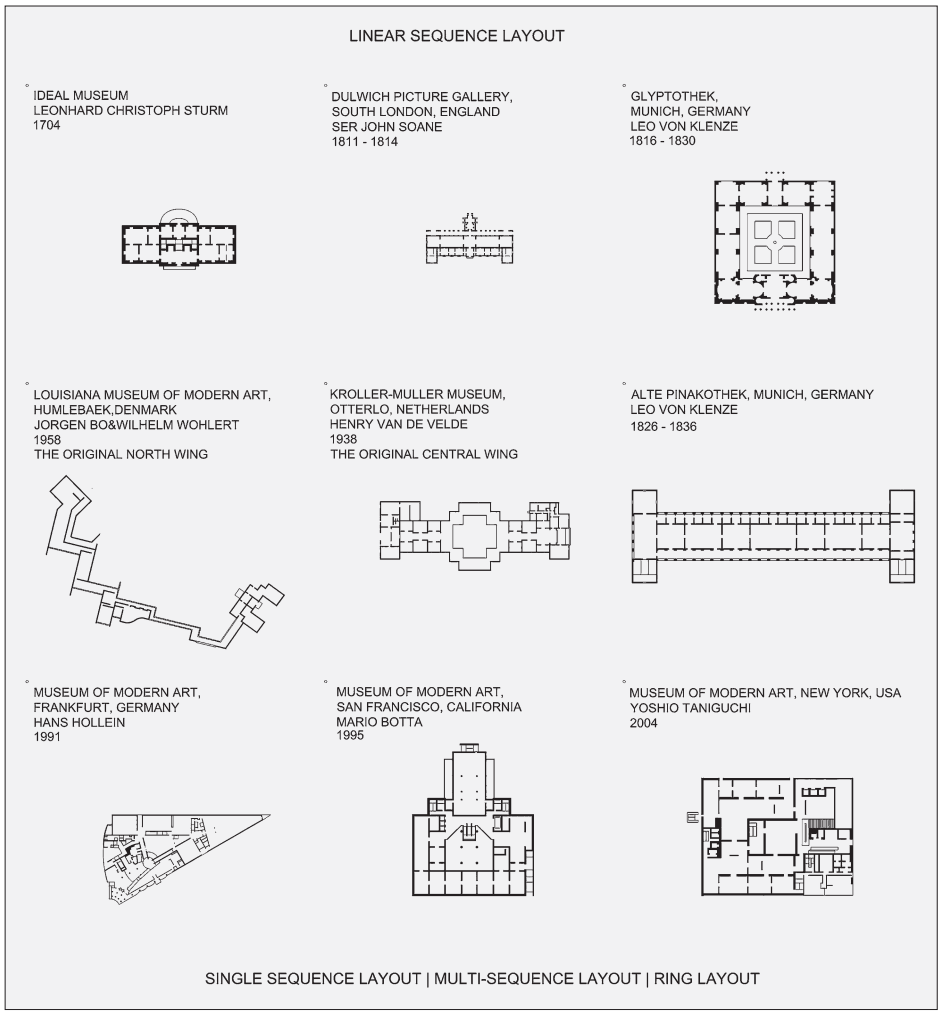


Fig. 6 Linear Sequence Layout Museums: Single Sequence Layout, Multi-sequence Layout, Ring Layout

This simplest architectural prototype, recognised by Space Syntax[8] as the *linear sequence layout* (Fig. 6), is represented with the highest percentage of the entire production of museum buildings (Batakoja, 2015). The *museum with traditional enfilades* reminds us of yet another vital aspect that is missing in the historical referentiality discourse – by recreating famous museum models, we partake in the maintenance of the political programmes, the dogmatic positions and even the clichés of existing museums. The *museum with traditional enfilades*, or the *linear sequence layout* in a broader context, conceptually maintains the authoritative pedagogical manners and the systematising procedures reflecting the taxonomic reasoning of the 19th century. Then why do architects keep recreating it?

7 The author of this paper personally believes that there is a significant and neglected link between the history of theatre and museum architecture. The scenography of museum space, not in decoratively symbolic terms but in spatial and effectual terms, is also a legitimate museum content. That content is presented to the viewer through a frame of reference, like a portal to particular set of beliefs or ideas.

8 There is a specialised sector of Space Syntax – spatial measurements methodology that is dedicated to museum buildings. Bill Hillier and Kali Tzortzi started it with their paper "Space Syntax: The Language of Museum Space" from 2006 (Hillier & Tzortzi, 2006).

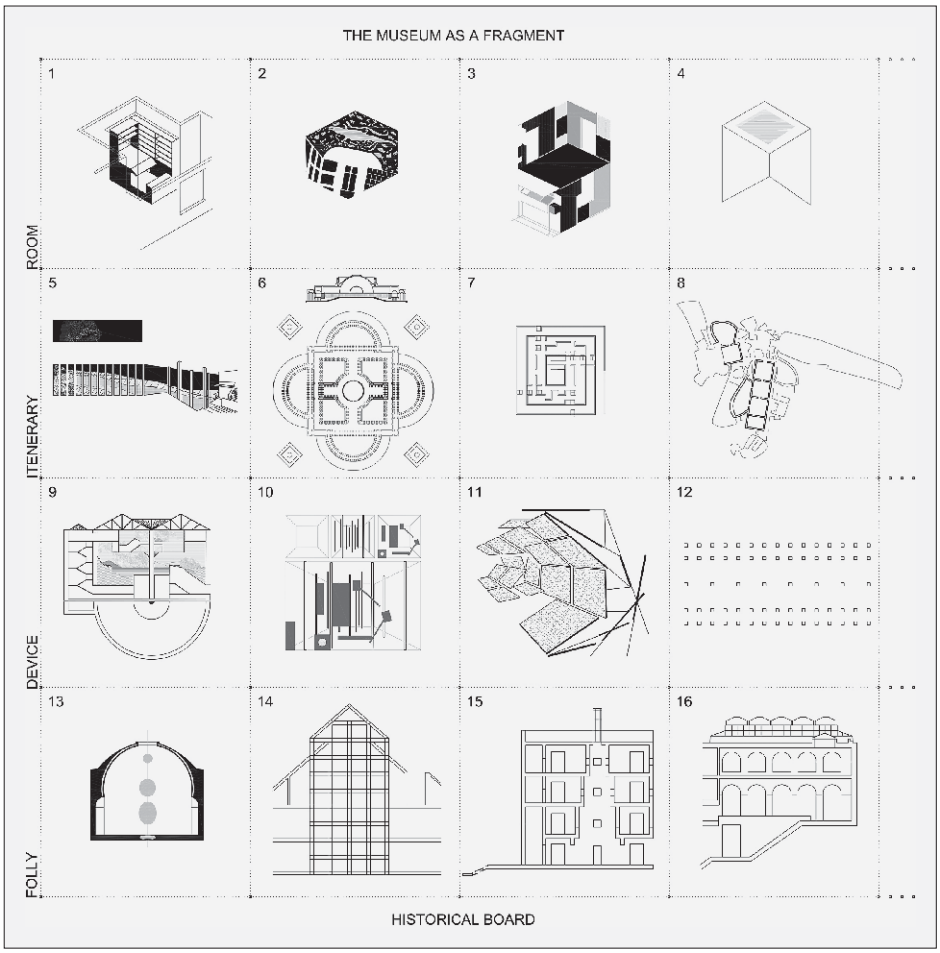


FIG. 7 HISTORICAL BOARD – THE MUSEUM AS A FRAGMENT: ROOM, ITINERARY, DEVICE, FOLLY

1. DRAWING OF STUDIOLO AS PRESENTED IN RENAISSANCE PAINTINGS OF SAINT JEROME IN HIS STUDY
2. CABINET OF CURIOSITIES (WUNDERKAMMER) AS REMEMBERED FROM THE ENGRAVING FROM FERRANTE IMPERATO'S DELL'HISTORIA NATURALE *(NAPLES 1599)*
3. DRAWING OF THE MIRRORED AXONOMETRY OF THE ABSTRACT CABINET (KABINETT DER ABSTRAKTEN) BY EL LISSITZKY (1928)
4. SKETCH OF THE BLUE PLANET SKY ROOM BY JAMES TURRELL INSTALLED IN THE 21ST CENTURY MUSEUM OF CONTEMPORARY ART IN KANAZAWA (2004)
5. DRAWING OF ARCHITECTURAL FRAGMENT IMPOSING THE VALUE OF AESTHETIC PLEASURE AS INSEPARABLE FROM THE EXPERIENCE OF NATURE
6. THE CONCEPT OF *MARCHÉ* IN THE PROJECT FOR A MUSEUM AT THE CENTRE OF WHICH IS A TEMPLE OF FAME CONTAINING THE STATUES OF GREAT MAN (1785) BY ÉTIENNE-LOUIS BOULLÉE
7. SKETCH OF THE IDEA BEHIND THE MUSEUM OF UNLIMITED GROWTH BY LE CORBUSIER (1939)
8. THE WRAPPED ENFILADE IN THE GUGGENHEIM MUSEUM IN BILBAO BY FRANK O'GEHRY (1997)
9. PANORAMA BUILDING SECTION ACCORDING TO THE LEICESTER SQUARE PANORAMA BY ROBERT BAKER (1793)
10. DECONSTRUCTING THE SPACE EMANATED BY THE LEGER UND TRAGER (1924) EXHIBITION SYSTEM BY FREDERICK KIESLER
11. THE EXPANDED FIELD OF VISION DIAGRAM (1930) BY HERBERT BAYER, REINTERPRETED IN CHARLES AND RAY EAMES' MULTI-SCREEN CONSTRUCTION WITHIN THE IBM PAVILION AT THE NEW YORK WORLD'S FAIR (1965)
12. CEDRIC PRICE'S PROTOTYPE FOR THE STRUCTURAL SYSTEM OF THE FUN PALACE (1961-1964) OR WHAT IS LEFT OF ARCHITECTURE
13. ROTUNDA – THE IDEAL GEOMETRY OF THE SPHERE AND THE RENDERING OF LIGHT EFFECTS
14. THE HOUSE ARCHETYPE LEVITATING IN THE CENTER OF THE GERMAN ARCHITECTURE MUSEUM IN FRANKFURT (1984) BY OSWALD MATHIAS UNGERS
15. THE ENTRANCE TOWER IN THE BONNEFANTEN MUSEUM (1995) IN MAASTRICHT, BY ALDO ROSSI
16. THE "CUBE OF BRICKS" INTERIOR BY RAFAEL MONEO IN HIS EXTENSION OF THE PRADA MUSEUM (2006)

If we take a "little" step back in time on the historical trajectory, we will see that the museum encompassed a variety of ideas, images and institutions (Findlen, 1989) or, as Ernst Wolfgang (1993: 492) would say, museums were "not simply an institutional frame but an encompassing epistemological obsession". Architecture, the space for practising that encompassing epistemological obsession, was just a single layer, not a dominant one, of that stratified and very dynamic field of ideas, images and institutions occupying the Renaissance individual and collective mind. A variety of architectural fragments from temples, palaces and villas, like "rotunda", "cabinet/studiolo", "gallery", "chateau/grotto", "passage", spatially confined the ever-expanding paradigms of spiritual philosophies, study and collecting practices. This modest inventory of existing types and models was later supplemented by an extensive inventory of ancient words signifying various imagined architectural spaces as fractured from some Platonic whole, like the Alexandrian Musaeum – "exedra", "oecus", "xystus", "peripatoi", etc.[9] We can confidently state that architectural fragment, both real and imagined, is inherent to architectural imagination of the museum as a building type.[10] Thus, the fragment can be understood as a kind of zero-point museum, where every experience is still possible, and none of it is institutionalised (dogmatised) yet.

That is why this duality between "the museum as an architectural fragment" and "the museum as an inviolable whole" can be a starting point, a preliminary stage for collecting the sources required for a different approach towards historical referentiality as conceptual interest. Because by analysing and thinking of the museum as a whole, we are naturally recreating the existing formal repertoire of museums, and by analysing and thinking of the museum as scattered fragments, we are thinking of human modalities, historical fragments enabled within the original framework. By analysing and thinking of the museum as a whole, we are partaking in the continuation of all dogmatic positions, even political programmes of existing museums, and by analysing and thinking of the museums' historical fragments, we are aspir-

ing towards their conceptual thematic and experiential receptiveness through the autonomy of architectural form. By analysing and thinking of the museum as a whole, we are limiting our architectural thought to its institutionalised and institutional history after the 19th century. In contrast, by analysing and thinking of the museum as a fragment, a more extensive alternative history is opened, including various museal spaces for private collections, picture-viewing devices, avant-garde experiments in the field of exhibitions, multimedia, galleries and museums, and other complex conceptual structures that intrinsically underlie the museum architecture.

For example, by thinking of **the museum as a room**, we can think of the spiritual solitude of the *studiolo* or the aesthetics of the incredible juxtapositions of curiosities and wonders in the *wunderkammer*. We can also remember the *Kabinett der Abstrakten* (1928) within the Landesmuseum in Hannover by El Lissitsky, the reconstructed *Mur de l'atelier d'André Breton* (2000) in the Pompidou Centre in Paris, or the room of *Blue Planet Sky* (2004), the open-air sculpture installed by James Turrell in the 21st Century Museum of Contemporary Art in Kanazawa. As different as they are, they are all little "boxes" of distinct experiences based upon the formative ideas of "*domesticity*" and "*space specificity*". Domesticity refers to the scale of privacy and the immediacy of the event. The space specificity means that museum space is not conceived as a neutral, timeless space; instead, museum space is treated as an experiential platform for the spectator, and it is through this dynamic interrelation between the spectator and the environment that the meaning is presumably created.

Considering **the museum as an itinerary**, we can think of the mysterious *symbiosis between nature and architecture* and how selected architectural fragments impose the value of aesthetic pleasure as inseparable from the experience of nature. We can think of the *Academy* (387 BC) by Plato and his peripatetic dialogues[11] among the olive trees.

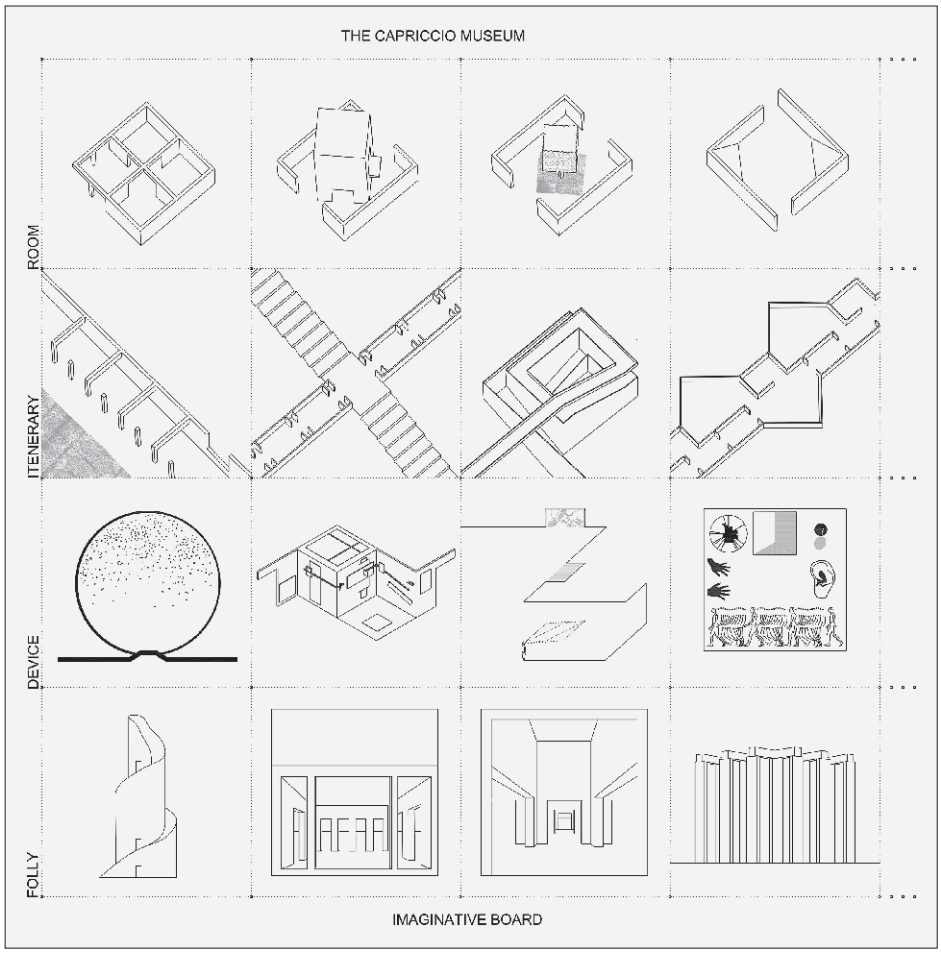


Fig. 8 Imaginative Board – The Capriccio Museum: Evolving ideas and images from the already existing typological themes in the historical board

We can think of the "Beaux-Arts" broader concept of *marché,* which controls the action of moving and viewing through built form by using the layout's principal axis and the way it is monumentally realised in the famous *Project for a Museum at the Centre of Which is a Temple of Fame Containing the Statues of Great Man* (1785) by Étienne-Louis Boullée. Moreover, we can think of all the previously mentioned *museums with traditional enfilades* that are synonymous with a *single sequence layout* and exist throughout history, starting from the *Grand Gallery of the Louvre* (1793) in Paris to the inventive *Museum of Unlimited Growth by Le Corbusier* (1939) and the sculptural *Guggenheim museum in Bilbao* by Frank O'Gehry (1997).

As different as they are, they are all linear structures (galleries, courtyards, loggias, pavilions, towers, passages) that support prolonged (across the dimension of time) experiences based upon the formative ideas of "*sequencing",* "*permeability*" and "*staging*". Sequence is a method of composition in which elements are juxtaposed in a meaningful series. Permeability refers to the character of the

9 See more about the construction of the museum as a new building type based upon the Alexandrian Musaeum in: Lee, 1997.

10 These fractured fragments began to finally synthesise as early as by 1750s when the Italian Academies started to launch design competition tasks to invent the museum as a new building type, a new whole. This research is aware of the "Monumental Public Edifice for the Exhibition of Busts of Famous Men", a programme launched in 1758 as part of "Concorso Clementino" of the "Accademia di San Luca" in Rome won by Robert Mylne, and the "Galleria Pubblica" programme launched in 1763 as part of "Concorso of the Accademia di Parma" won by George Dance, Jr. (Kirk, 2005: 69).

11 From the word *peripatetikos* meaning the act of walking.

continuity of the axis, treated as a vector in expanse. Staging means setting conditions across the linear structure, of which the most common are the ceremonial and festive processions[12] of the traditional enfilades. There are, however, various other means to direct the museum itinerary differently, with its beginning, mid- and end points, by the rhythm of events, walking and stopping areas, secondary axis intersections, sudden or gradual transitions between the elements, etc.

By thinking of **the museum as a device**, we are thinking of the imprint of the technological age on our perception, from the invention of the *Panorama* and *Diorama buildings* (18th century) as architectural machines for seeing wondering sensations to all of the interactive spaces and spatial systems the architects and artists invented throughout the 20th century.[13] Consider, for example, Frederick Kiesler's *Leger und Trager* (1924) exhibition system, the Eames' *architectural multimedia structures* (1950s) or the *high-tech architectural containers* never achieved but ever dreamed of, as Cedric Price's *Fun Palace* (1960s).[14]

All of them invite us to see what lies before our eyes, inured by habit, in a new light, to break with visuality as perspective automatism and explore the possibilities of the new multisensory interactive environment. The formative idea of *interactivity* refers to the participative body, when the spectator[15] is respected as an active participant with all of his/her senses and hence becomes the design's key intention, encouraged to build his own relationship with the space of display and the displayed content.

By thinking of **the museum as a folly**, we are thinking about a museum's capacity to house curious architectural objects whose purpose is not clearly determined but are of higher aesthetic and philosophical order. We can recognise the concept of folly, starting with the *temples of the muses* (rotundas), the *grottoes* and the small-scale *chateaus* in the *gardens*. It gradually started to inhabit the interior museum spaces as a "*cube within a cube*" (house within a house) concept. We can illustrate this with the house archetype levitating in the centre of the *German Architecture Museum* in Frankfurt[16] (1984) by Oswald Mathias Ungers as memory inserted into the body of architecture. We further recognise the museum as a folly concept in the *Bonnefanten Museum*[17] (1995) in Maastricht, by Aldo Rossi, in the two "towers" with different characters that mark the beginning and the end of the exhibition.

At last, the multiple spatial ambiences in the "cube of bricks" by Rafael Moneo in his extension of the *Prada Museum* (2006) challenge the perception of whether they are completely imagined or meticulously reconstructed as new, therefore, representing the folly-repertoire of architectural fragments.

The rooms, itineraries, devices and follies are the elements, i.e. the fragments every museum is composed of. Each of them is based upon distinct formative ideas and therefore work as a frame for a unique spatial experience (Figs. 7 and 8). If we explore what those elements are and what spatial experiences accompany them, we can explore an incredible variety of spatial and experiential options of forms and meanings. We can reassemble them in different formations and compile from them the *capriccio museum* as always new.

How can we use this imaginary *capriccio museum* to conceptualise a possible "built-in variety"[18] in museum design, to imagine a contemporary analogue to the neoclassical museum space?

THE ARCHITECTURAL CAPRICCIO AS A METHOD TOWARDS A BUILT-IN-VARIETY MUSEUM TYPE

The museum is first broken down into its historical parts, thematically classified (room, itinerary, device, folly) after rigorous research, but briefly illustrated in this paper (Figs. 7 and 8). Many architectural interpretations of the same fragment are possible, starting with the real and the rational and moving towards the imaginative and fictitious, from the past to the present. In this catalogue of museums' architectural frag-

12 Think for example of the Vatican Museums and their role in expressing papal triumphalism through the procession held for ordinary people or the wedding procession of Napoleon I and Marie-Louise of Austria taking place in the Grand Gallery of the Louvre.

13 Read more about the avant-garde spatial experiments and the reorganisation of the human sensorium in: Batakoja and Śerman, 2021.

14 It is remembered as a project by Cedric Price as the single architect of the team, otherwise composed of the director Joan Littlewood, the structural engineer Frank Newby and the systems consultant Gordon Pask.

15 Therefore the "viewer" becomes "spectator".

16 And, in dialectical position, with the glass cube with a tree in the backyard.

17 Bonnefanten Museum means "Museum of Good Children" and refers to the name of the monastery that housed the museum in the period 1951-1978.

18 The term "built-in variety" is introduced in the paper by Geraint Franklin dedicated to the architectural practice of David and Mary Medd in the area of primary schools. It refers to the re-thinking of the spatial relationships between pupil groups and learning activities that resulted in many interconnected contrasting spaces. They coined that term to distinguish their kind of flexibility as essentially different from the flexibility of the "open plan" of US origin, where a single neutral, unenclosed space can be infinitely subdivided in order to accommodate multiple classes. This can also be applied in the context of museum space (Franklin, 2012).

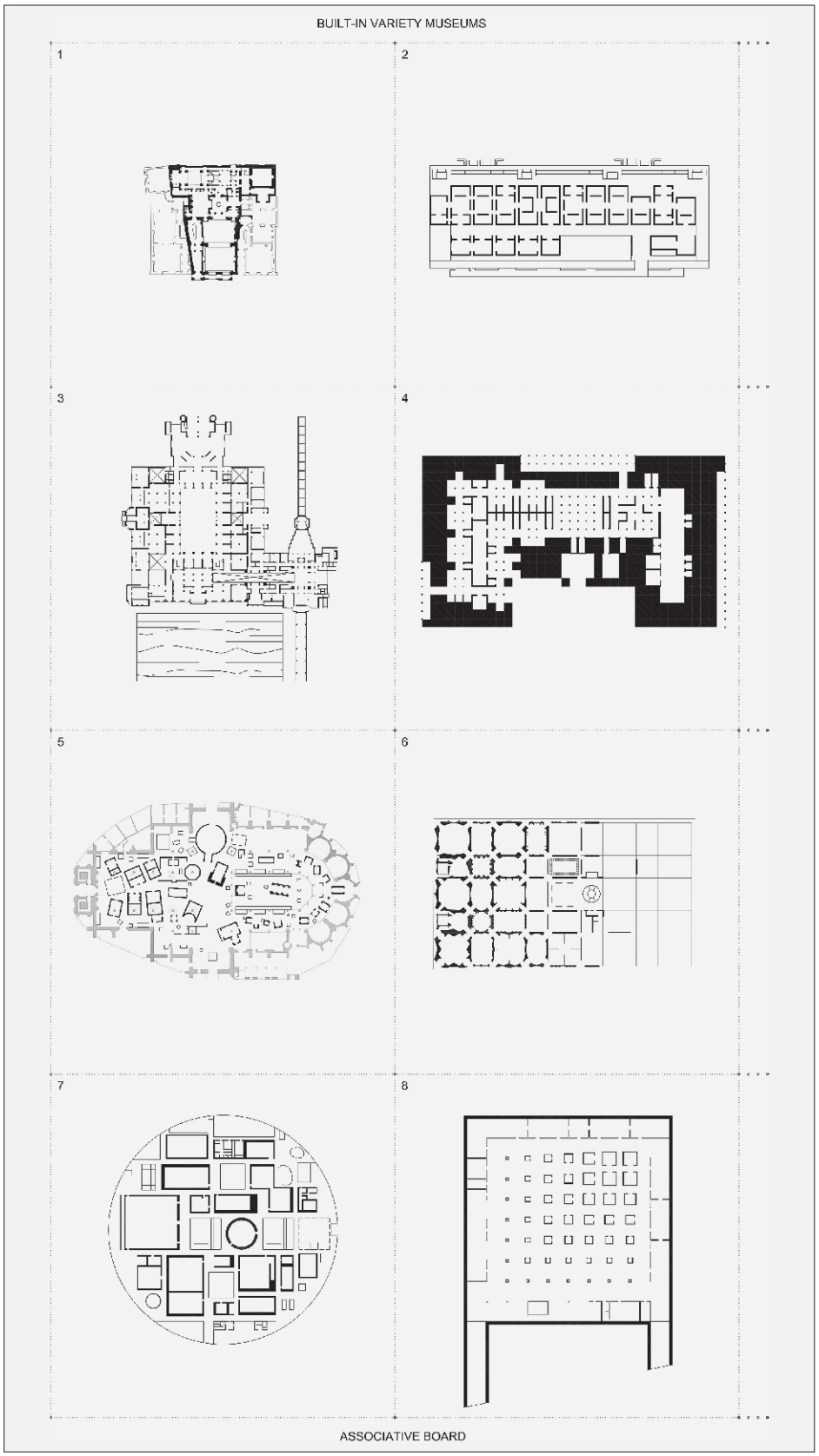


Fig. 9 Associative Board – Built-in variety Museums: Reading the existing museums and museum projects anew

1 The House – Museum (1824) in London by John Soan
2 The Fifth Floor Plan of the Pompidou Center (1977) in Paris by Richard Rogers, Su Rogers, Renzo Piano, along with Gianfranco Franchini
3 Gemeentemuseum Den Haag (1935) by Hendrik Petrus Berlage
4 Temporary Museum (1981) by O.M. Ungers et al., according to rear publication in: Koolhaas & Obrist, 2009
5 Imago Luxemburgi (1990) by Leon Krier
6 "Art in Context: Rethinking Museum typology" Graduation Research Project by Katarzyna Nowak (OBSCURA) from Rotterdam Academy of Architecture and Urban Design, Netherlands, tutored by Ludo Grootman, winner of Archiprix 2015 and awarded European Architectural Medal for the Best Diploma Project (EAM BDP) 2015
7 The 21st Century Museum of Contemporary Art (2004) in Kanazawa by SANAA
8 Contemporary Art Museum LiMAC (2006) in Lima, Peru by Productora

ments, by placing one image next to another, their original meanings combine or transpose, invalidating original metaphors and giving birth to new ones.

The "built-in variety" museum design, as a whole, is about finding a new articulation of space, inclusive of the dissimilar and holding the synchronous co-existence of heterogeneous architectural fragments as its key characteristic (Fig. 9). In order to do that, it experiments with the stratification of grids and figures and their elasticity in order to incorporate or compile many architectural fragments. It tests complex patterns of routing to master over a patchwork of unique spaces that unfold gradually or abruptly one in relation to the other. The resulting dense network of spatial possibilities evacuates the visitor into a multiplicity of intellectual and bodily experiences within a single museum space.

The *capriccio* museum, as a metaphor for the "built-in variety" in museum design, dissolves the museum's established authority towards a new architectural (and curatorial) variety of options to choose and select from.

CONCLUSIONS

Apart from being a fascinating historical pair, the neoclassical museum space and *capriccio* as its underlying imaginative procedure, impose theoretical and practical challenges for today's achitectural thought.

This paper demonstrates the validity of architectural *capriccio* as a theory of creating a new approach to historical referentiality as a conceptual interest, i.e. to find new ways the history of museums as building type could be used design-wise. It also practices the power of architectural *capriccio* to become an inspiring visual strategy through a graphical method that is tailored to transpose historical knowledge into speculative and design-wise procedure.

Capriccio in the museum context may be a centuries-old idea, but it is once again relevant. With its inclusivity of dissimilar and synchronous co-existence of heterogeneous architectural fragments, the "built-in variety" museum as its contemporary analogue, democratises the museum experience in the way in which it offers a variety of spatial and experiential options for spectators and curators to choose from. It strengthens the role of architecture in directing the museum experience. It also points towards the (unpleasant) fact that many of the sought-after architectural novelties can be discovered "behind us".

[Proofread by Mira Bekjar and Nadica Stamboldjioska]

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Figs. 2, 4-9 Author's drawings

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Author's biography

Meri Batakoja, Ph.D., works as Associate Professor at the Institute for Architectural Design at the Faculty of Architecture, Ss. Cyril and Methodius University in Skopje. Her broad research interest is the field of public space and public buildings, with the focus on interdisciplinary border areas of architectural thought. Personally, she is strongly interested in the phenomenon of museums, modernity and the avant-gardes of the 20th century. She has worked as a researcher on multiple national and international projects. She has published four books as an editor and over twenty articles as an author.

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Fig. 1 Complex of healthcare institutions on Zeleni brijeg (1927)

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Institute of Epidemiology and Bacteriology on Zeleni Brijeg, Zagreb by Architect Vasily Mikhailovich Androsov

Androsov, Vasily Mikhailovich
complex of healthcare institutions on Zeleni brijeg (Green Hill) in Zagreb
Štampar, Andrija
the Rockefeller Foundation

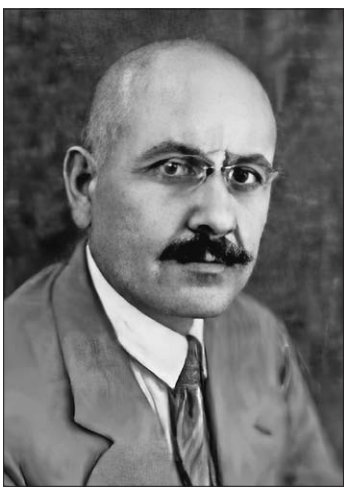
The complex of medical institutions of the 1920s on Zeleni brijeg (Green Hill) in Zagreb was built as a kind of a stronghold of the pioneering programme of new institutional forms of primary health care, as conceived by Andrija Štampar and his associates. The Institute of Epidemiology, which was originally supposed to be built according to Drago Ibler›s project (1922), but it was later rejected. The construction of the Institute began in the autumn of 1924, according to the plans by Vasily Mikhailovich Androsov, one of the Russian architects employed in the Architectural Department of the Ministry of Construction in Belgrade, probably after a closed competition, hastened by the threat that substantial funds allocated by the Ministry of Public Health, the Hygiene Section of the League of Nations, and above all the Rockefeller Foundation, would be lost. An Androsov design also replaced another avant-garde design of Croatian and Yugoslav modernism: due to direct intervention by King Alexander Karađorđević, Androsov's design for the Palace of the Main Post Office in Belgrade, in the spirit of academic mannerism, was chosen and built instead of Josip Pičman's design that had taken the first prize in the relevant competition. Hence the title of this article, which draws attention to the creator of a block of buildings of medical institutions, the interesting history of which can now be discussed on the basis of more information.

COMPLEX OF HEALTHCARE INSTITUTIONS ON ZELENI BRIJEG (GREEN HILL)

Zagreb architecture of the 1920s features an exceptionally wide range of stylistic stances. On the one hand there is the tried and tested tradition, and on the other, cosmopolitan tendencies that were mediated no longer only through the prism of the Viennese school (Viktor Kovačić, who trained under Otto Wagner, Hugo Ehrlich with Karl König, and Zlatko Neumann who studied with Adolf Loos, Antun Ulrich with Josef Hoffmann) but also through the experience that local architects had acquired all over Europe (Drago Ibler, Zdenko Strižić, Josip Pičman under Hans Poelzig in Berlin, Mladen Vidaković, Zvonimir Kavurić in Prague, Juraj Neidhardt and Ernest Weissmann at Le Corbusier's, Ivan Zemljak at Jacobus Johannes Ouda). One of the points at which it is possible to understand vividly the huge discrepancy between the frequently prescient aspirations in terms of design and programme and the realistically practical capacities of the Zagreb milieu is Zeleni brijeg above Gupčeva zvijezda, on which at that time a huge multi-functional complex of healthcare institutions was built, dominating the surrounding area to this today.

The construction was preceded by a competition for the design of the National Royal Institute of Epidemiology, the first prize being taken by a design by Drago Ibler (1922; Fig. 3), which was notoriously turned down. Concurrently in Belgrade, a building of the same purpose was being built and officially opened.

Fig. 2 Architect Vasily Mikhailovich Androsov (1873-1944)



Perhaps the nature of its stereotyped academic architecture indirectly tells us why Ibler's design could not have been accepted at that time. After the failure of the competition, a building was erected in Zagreb according to new drawings, created two years later. The architect was Vasily Mikhailovich Androsov, one of the Russian architects employed in the Architectural Department of the Ministry of Construction in Belgrade.[1]

Ibler's elliptical oval on Zeleni Brijeg, derived from a well-considered urban planning and design logic, was to be the *expressionist crown of the city*, says Željka Čorak, who adds: "The Institute of Epidemiology at last puts us in full expression. Taut's imaginary architectures, Poelzig's Salzburg Festspielhaus have calmed down in a vision of the rolling hillocks of Zagreb" (Čorak, 2000: 43-48).

After the competition design by Ibler was rejected it was decided – obviously under the pressure of time and the threat that the resources allocated would be withdrawn – that inside the architectural department of the Ministry of Construction, probably in a closed competition, a design would be made directly and then foisted on Zeleni brijeg. We can suppose that the planning guidelines for the design of the whole block were thoroughly studied. In other words, the premises of the competition for the Palace of Public Health, built to a design by Juraj Denzler and Mladen Kauzlarić, were determined pursuant to an entry they had sent to the "general Yugoslav competition" announced early in March 1925.[2]

As a rule, previous interpretations have not considered the existing building of the Institute of Epidemiology and Bacterilogy at Rockefellerova 2, which was delivered to the client at the same time as the Palace of Public

1 The authorship of the projects is revealed by the original designs that are still kept in the Croatian State Archives and not previously discussed in scholarly literature. It is my pleasant duty to thank two colleagues in Belgrade, Professors Aleksandar Kadijevic and Milenko Pekić who at the blink of an eye sent me all the relevant literature about Vasily Mikhailovic Androsov and confirmed the attribution that I have put forward here for the first time.

2 At the Technical College, as early as May 1, there was a public presentation of 15 entries that had been submitted (Kisić, 2014: 19-20; Bjažić Klarin, 2020: kat. 005). The panel of judges consisting of Andrija Štampar, Mirko Feric, Ćiril Metod Ivekovic, Emil Prašek and Marko Vidakovic did not award the first prize. The Denzler-Kauzlarić work took the second prize. Denzler and Kauzlarić were peers, both born in 1896. However, Denzler probably had a more salient role in this design. It is interesting that the beginnings of his professional career were related to the architecture of healthcare institutions. His first job after graduating from Construction College in 1915 was in the building firm belonging to E. Eisner and A. Ehrlich in which he worked until 1917, as construction technician in the building of the army hospital in Nagykanizsa (Jakšic, 2007).

3 Tamara Bjažić Klarin provided a sober critical assessment of the design programme itself: "In spite of their social, healthcare and educational character, their advanced

Health. Although subordinate in terms of space and architecture to the Palace, the building is an equally important element in the mirror image composition of the whole block.[3] Androsov's design, there can be no doubt, was produced at the same time the competition for the "Palace of Public Health" was announced, for the same client, and administered by the same commission, according to a single programme and, it seems, a single spatial and architectural concept. Because the Institute and Štampar's School of National Health were supposed to work closely together, the construction was planned for 1924 at the latest, the assumption being that the buildings should be next to each other on Zeleni brijeg, adjacent to the Hospital for Infectious Diseases, today's Dr Fran Mihaljević Clinic for Infectious Diseases.

The building of the Institute of Epidemiology and Bacteriology at Rockefellerova 2 was erected in the 1924-1927 period. In 1926 the two institutes were officially combined – during the course of construction, then. A bit later, on September 4, 1926, Zagreb saw the foundation of the united establishment of the Hygiene Institute and the School of Public Health, in which these two previously independent institutes were incorporated. The contractor for the buildings on Zeleni brijeg was the Construction Department in Zagreb. In parallel with the construction, a commission headed by the supervising engineer Lavoslav Sicer decided on the changes to be made to the design (Kisić, 2014).[4]

Finally, on October 3, 1927, the opening ceremony was held, with a large number of guests from both Yugoslavia and abroad, as well as huge media coverage. The Hygiene Institute moved into "the White" and the School of Public Health into "the Yellow Building" on Zeleni brijeg.

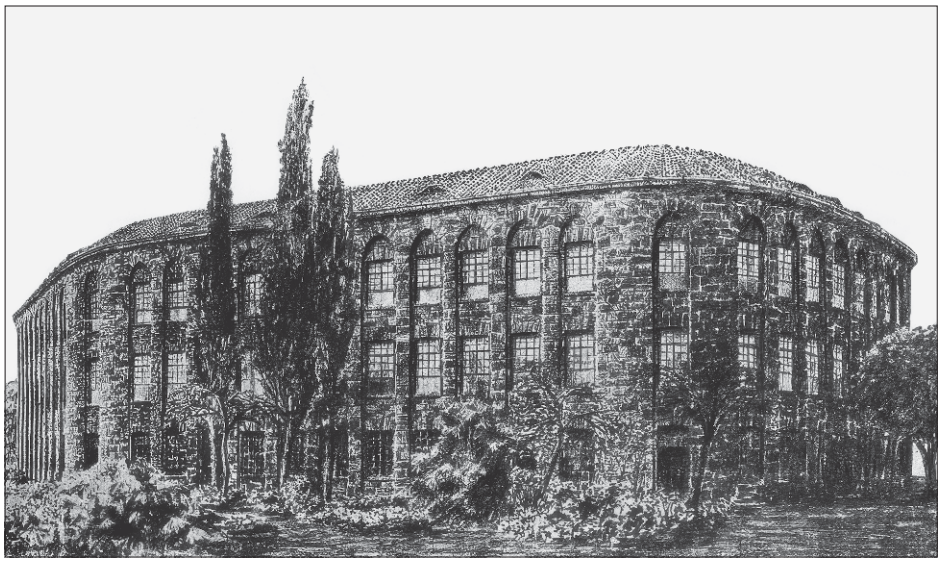


Fig. 3 Drago Ibler's design from 1922 for the facade of the Institute of Bacteriology on Zeleni brijeg

Vasily Mikhailovich Androsov – Architect of the Institute of Epidemiology in Zagreb

Born in Odessa on June 6, 1873, after the October Revolution in 1918, Androsov emigrated to Yugoslavia and died in Belgrade on September 13, 1944, little before he would have had to face the dilemma that met almost 350 Russian architects and structural engineers about where to go at the end of the war; in the event, almost two thirds of them opted for the West, leaving Yugoslavia they had previously worked in (Kadijević, 2017: 358-371; Kadijević, 2018: 308-319).

In his application to work in the Ministry of Construction in 1920, when he signed himself as Архитектор Художник or architect-artist, Androsov introduced himself: "I graduated in architecture in 1897 in the Imperial Academy of Architecture [Императорская Академия Художеств, Архитектурный отдел] in Petrograd. I have been employed as architect in our Ministry of Education fifteen years [sic!], and have for fifteen years been a member of the committee of architects of the Holy Synod." (Borovnjak, 2014). He worked, then, in the biggest design studio in the country, which with its very substantial building projects "had a direct impact on the architectural and urbanistic development of the Kingdom as a whole, from the development of central cities of the provinces *[banovine],* to smaller settlements all around the country, a special place belonging to newly arriving Russian designers" (Toševa, 1999: 171-181; Toševa, 2012, 2018).

programmes, their innovations in construction and technology, for these buildings too, built in the northern part of the city, rich in greenery, an outdated typology inappropriate to the content was proposed - freestanding buildings, with one or two internal courtyards, with monumentally designed facades, centrally located entrances, with grand staircases and so on. An essential step forward was taken with the employment of a layout consisting of only one section, so that all the rooms had cross ventilation via the corridors." (Bjažić Klarin, 2020). The author quotes Miroslav Krleža who said that "a much more appropriate pavilion typology was out of the question for the Institute of Epidemiology for financial reasons" (Krleža, 1924: 170-173).

4 The author is here mistaken in correlating the Commission Report of Members of the Ministry of Construction and the Ministry of Public Health (which refers to alterations to the Androsov design) with the Denzler-Kauzlarić design for the Palace of Public Health. The spirit of the many alterations to the design for the Epidemiological Institute corresponds to the statements made by Marko Vidaković, one of the panel of judges in the competition of 1924. Vidaković highlights his contribution to the improvement of the drawings of the Palace, especially the design for the main entrance. According to Marko Vidaković: *Referat o mojim životnim radovima*, Zagreb, September 1, 1971 (typescript, Library of HMA-HAZU). For more about Marko Vidaković see: Damjanović, 2013: 340-363.

Fig. 4 Vasily Androsov: the Palace of the Main Post Office in Belgrade

As one of the creators of the national style in interwar architecture in Serbia, he made over eighty designs for church buildings all around the Kingdom, building as many as sixty of them (Kadijević, 1994: 244-254; Kadijević, 1995: 75-79).[5]

Although it was written several times that designs "of public purpose" were exceptions in his oeuvre, in an annual assessments by his superiors it says that "together with church buildings, he also did schools, hospitals and other structures with excellent results".[6] And indeed, from 1920 to 1923, he did designs for the Real High School in Podgorica, and for the Ministry of Public Health he designed the Tropical Medicine Institute and the Malarial Diseases Hospital in Skoplje, as well as the Central Institute for the Control of Infectious Diseases in Novi Sad (Borovnjak, 2014). In 1924 he produced a design for a high school in Priština which, in terms of decorative elements of the façade (cornices, triglyphs, metopes), shows the same repertoire we meet on the facades of Zagreb's Epidemiological Institute.

In his design for the Institute of Epidemiology in Zagreb, Vasily Mikhailovich Androsov took the place left by the rejected entry of Ibler; in the same way, instead of the prize-winning Pičman design for the Palace of the Main Post Office – 1930, in Takovska ulica in Belgrade – after a closed competition in the Architecture Department of the Ministry of Construction – Androsov's design, in the spirit of dry academic mannerism, was in the end chosen and actually built (Fig. 4).[7]

Building of the Institute of Bacteriology and Epidemiology

The edifice is placed on a plinth course formed from three courses of massive blocks of finely dressed Bizovac sandstone, with a slight battering, over a moulded base. A solid base, often in rustication, is a characteristic of many Androsov's designs for Orthodox churches and parish houses. The ground floor, to the full height of the basement storey, is made visually distinct from the upper two floors by a simply moulded cornice that runs the whole way around. It is matched by a salient roof cornice articulated with empty metopes and triglyphs.

The central part of the northern façade is highlighted with a ramp in front of the main (and only) portal. The approach is handled on a slight elevation with two symmetrical arms that curve to east and west, while in the centre, there are steps that link the landscaped grounds with the approach and the main entrance. The portal is flanked by columns that rise over stepped stone bases and conclude with simple Tuscan capitals. A balcony is placed over an ascetically formed architrave (Fig. 5).

Androsov wanted to create the effect of corner avants-corps at the two ends of the façade with bands of stylised rustication. Contributing to this effect was the form of the broad segmental arch windows. The grille of bars in the transoms was designed to interplay with the joints of stone cladding.

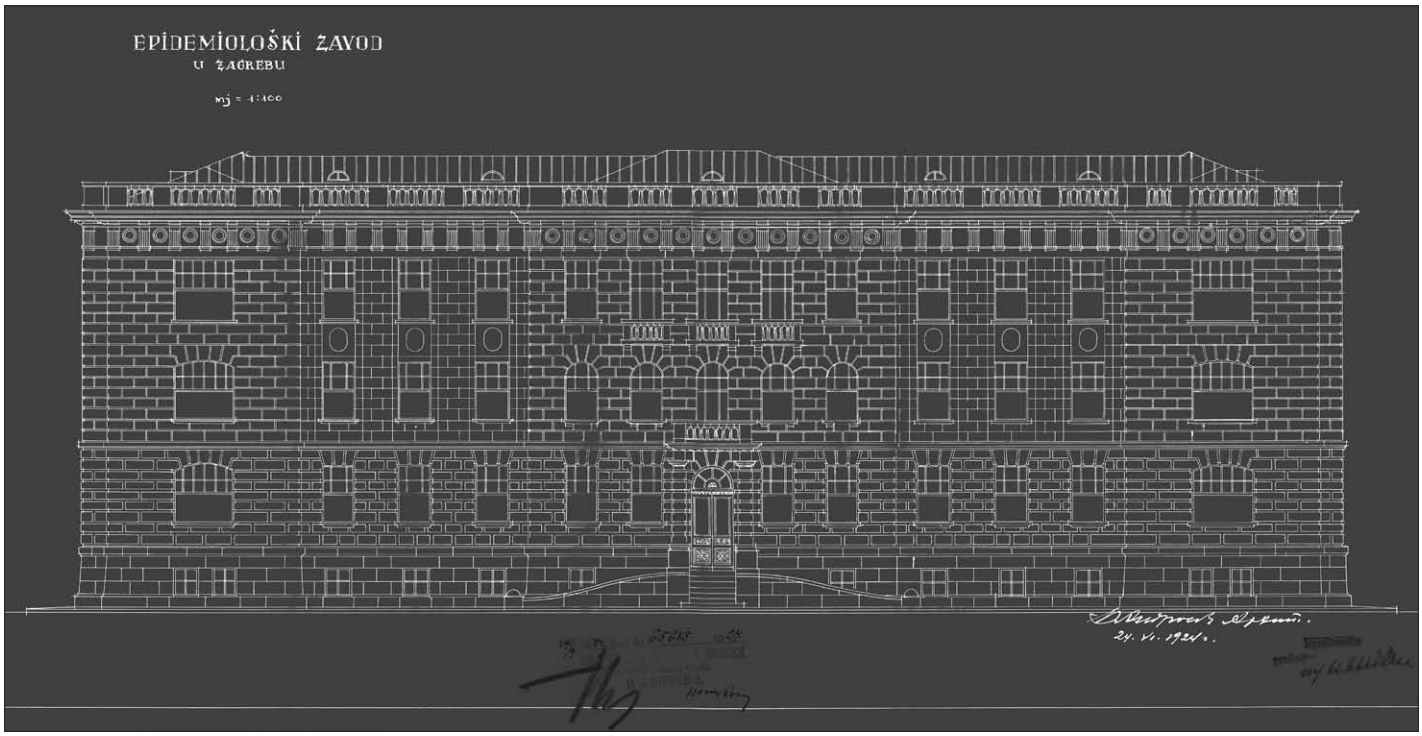
The character of the finishing cornice was meant to have been determined with a five-bar rhythm. Oculi were provided for in the metopes of the first, third and fifth bar. The triglyphs and metopes would be emphasised in the roof railing with balusters, and the low smooth metal roof would highlight them even more.

There was meant to be particular interest in the rhythmical articulation of the lateral facades with the powerful upward thrust on the strong base of the whole building, the importance of which was heightened by the batter. The original drawings show that Androsov paid particular attention to the various kinds

5 Đurđija Borovnjak is preparing a monograph about Androsov that will present and assess the whole of his huge oeuvre of architecture.

6 Thus the architect Petar Popović, mentioning a hospital in his report of 1924 was almost certainly thinking of Zagreb's Institute of Epidemiology.

7 Just before the closing of the competition at the end of 1930, "the plans were submitted to the Late Blessed Knight King Alexander I the Unifier for examination, and on that occasion his definitive instructions were received with respect to the architectural handling of the façade, for the whole of the square around the National Assembly to acquire a certain harmonization. (*Politika*, Belgrade, March 17, 1935 – after: Mutnjaković, 1997: 46). In the Ministry of Construction it was determined that afterwards a closed competition for the making of new plans for all facades should be held while Pičman's approach to the ground plan was to be retained. See Mihajlov–Mišić (2008): 239-264; Drljević (2009): 277-296.

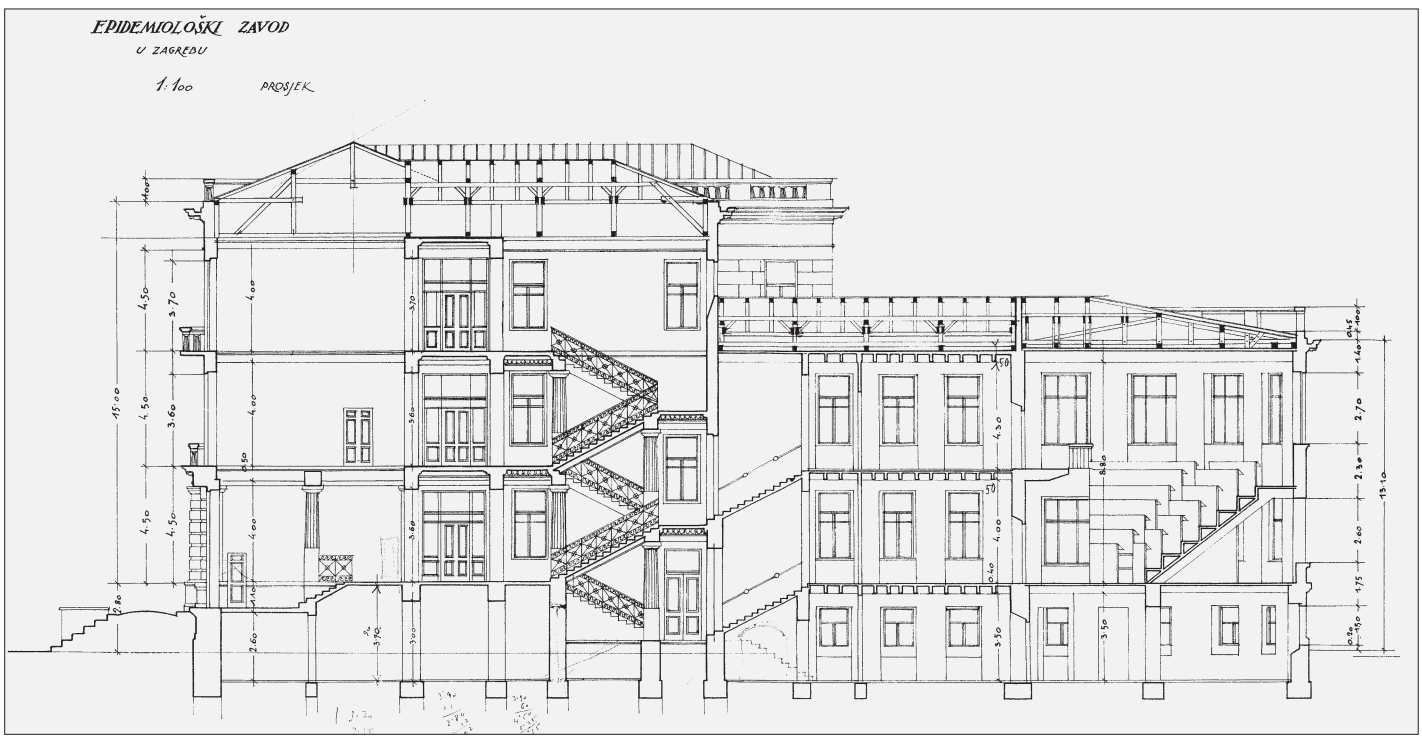


of masonry bonds, characteristic of a number of his designs (particularly in the Main Post Office Palace in Belgrade).

The design follows the layout usual for hospitals of the time. Still, although this is a building with a U-shaped plan, with two short wings at the side, in this particular case, in the axis of the central portal the approach to which is by the main staircase, it is actually an E-shaped ground plan that is formed, with a wide semicircular auditorium at the end of the central crossbar (Fig. 7).

Fig. 5 Vasily Androsov: Institute of Epidemiology and Bacteriology, plan of the main facade, 1924

Fig. 6 Vasily Androsov: Institute of Epidemiology and Bacteriology, cross section, 1924



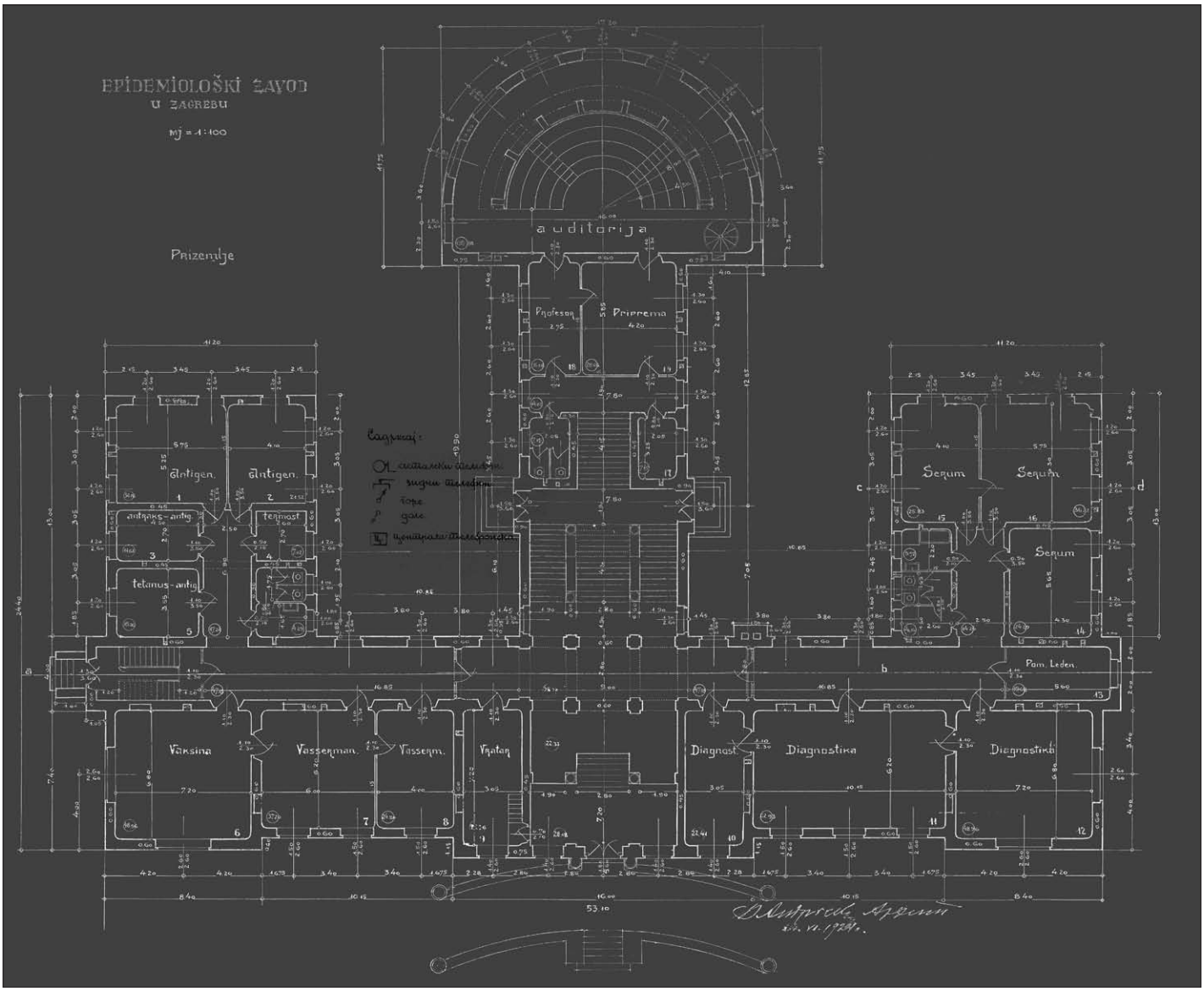


FIG. 7 VASILY ANDROSOV: THE BACTERIOLOGICAL AND THE EPIDEMIOLOGICAL INSTITUTE, GROUND FLOOR PLAN, 1924

As with several other designs for the public institutions of the twenties and thirties, the dominant element in the core of the building is the showpiece staircase, picked out plastically, here designed as if it were a distinct unit, in a separate elongated wing. With the intricacy of the flights and landings with which the staircase ascends at comfortable height or descends to the corridors, or that lead to the smaller rooms at the sides at several different levels, the staircase seems practically oversized (Fig. 6). We can interpret it as a variant – in a somewhat lowered stylistic register – of the equally plastically emphasised monumental triple-flight staircase in the adjacent building of the Hygiene Institute, built according to the design of Juraj Denzler and Mladen Kauzlarić, which was

8 For facts and figure about the competition for the construction of the School of Public Health, see Bjažic Klarin (2020): cat. 005. There is a somewhat different chronology in Kisić, 2014: 19-20, but that the competition was conducted as early as 1924 is stated by Marko Vidaković (n. 9), who says that 24 plans were received.

9 Named after the German microbiologist who, together with dermatologist Albert Neisser, developed the serological text showing antibodies in the blood of patients infected with bacterium *Treponema pallidum*. The battle against syphilis, active or endemic, was at the top of Štampar's list of priorities. In Bosnia, endemic syphilis was rooted out as late as at the end of WWII. This is syphilis transmitted by non-sexual contact among people or via objects, such as crockery and cutlery. Most often the affected are children living in unhygienic conditions.

10 In an assessment of Vidakovic's role one should perhaps take into consideration the incidental remark of Tamara Bjazic Klarin who mentions the dispute that broke out when it was suggested that Vidakovic, who was a member of panel of judges, should be contractor for the school "although this was nevertheless abandoned" (Bjažic Klarin, 2020: 66/n. 23).

also deployed in the axis of the main entrance to the building.[8]

In contrast with the neo-Historicist façades and with the inner nucleus with its grand staircase, the interior is conceived very functionally. In all the floors of the main section of the building (basement, raised ground floor, first and second storey) spaces are distributed in a similar way along a long corridor that stretches all along the interior.

The programme was functionally elaborated with great precision. The layout of the interior spaces clearly shows the intention of Štampar's programme. The School of Public Health with the Institute of Epidemiology, an important component of it, was founded primarily for studying and teaching the people, improving poor hygienic habits (resulting in tuberculosis, malaria, diphtheria, trachoma, endemic syphilis) and the adoption of a modern understanding of sickness and health.

The Institute originally had a bacteriological/epidemiological, a chemical and a parasitological department, with units for biological products, the production of vaccinations against smallpox, for social medicine, sanitation technology, promotion of good hygiene and Pasteur Institute.

In the basement, together with the usual infrastructural items, there were quarters for healthy and infected animals. Particularly interestingly, in the basement of the auditorium there was supposed to have been a museum, accessed by a spiral staircase from the ground floor of the auditorium (Fig. 8).

In the rooms of the main section in the ground floor, right next to the entrance and the small porter's lodge, there were two rooms dedicated to the Wassermann reaction, a complement fixation test used in the diagnosis of syphilis.[9] The left-hand eastern side wing was reserved for departments for anthrax and tetanus, and the right or western wing for a department for serum production,

The eastern side wing on the first floor was meant for the holding of "courses", the western one for the department that dealt with sera. The central place of the main section of the second floor was occupied by a library. On the left, there were chemistry and physics labs, in the side wing "a room for bacteriological and hygienic practical exercises". Off to the right rooms of the bacteriology department, with a serology laboratory, were located.

Although the outside of the building has nothing to suggest the complexity of the functions for which it was built, inside – if we ignore the not particularly elegant staircase however grand it might be – there is a genuinely modern healthcare institution. This holds good above all for the corridors. The lateral wings are separated by double doors in light partitions of trellised wooden frames, with glass going up to the ceiling, through which percolates a fine diffuse light. All the rooms – laboratories, production rooms, surgeries – reflect awareness of the importance of sunlight, the necessity of hygiene and a sterile environment.

The historical context in which the institution of today's Immunology Institute was created is revealed to us more by the forms of the furniture designed in the spirit of the discreet, just nascent, Art Deco than by the exterior of the architecture itself and the conspicuous monumentality of the central staircase. In some places the furniture is used across the partition walls of adjacent rooms, which tells that it was really made for the particular needs of the laboratory, and not as a mere standard element (Fig. 9).

If we rely on the Vidaković's handwritten texts, we can assume he had an important role in changes of interior design, particularly concerning the elaboration of details and artisanal works of interior furnishing, with lovely partitions of wood and glass, with handsome functional furniture, all produced by Vidaković Brothers Factory ("the First Yugoslav Factory of Shutters, Roller Blinds, Wooden and Steel Covers").[10]

Androsov's design for the building of the Institute of Epidemiology underwent thoroughgoing preliminaries. Drawings are dated June 24, 1924. The construction contract was signed on September 19, 1924. Works started without delay, in order not to lose the funding from the Ministry of Public Health, the Hygiene Section of the League of Nations and, above all, of the Rockefeller Foundation.

An important role must have been played in the programming of the whole complex by Berislav Borčić, a hygienist and specialist in social medicine, the first director of the Institute and later, like Štampar, an official in the World Health Organisation, whose signature is on a number of documents related to the construction.

Alterations, particularly in the framework of the tempo of building that had been enjoined, tended in the direction of the economy of the building. The most important package of changes was adopted on March 9, 1925, when the works were already in full swing. The changes affected all aspects of the original design. All the expressive elements of the design for the façade were cut. For example, the cladding of the upper parts of the façade in stone, a *forte* of the Androsov design, was dispensed with; the moulding of the roof cornices was simplified; the balustrade meant to run along the roof line was abandoned; instead of in stone, the triglyphs

Fig. 8 The auditorium, actual state

Fig. 9 Furniture in the laboratories between the two world wars and in 2022

FIG. 10 VIEW OF THE BUILDINGS OF THE CROATIAN INSTITUTE FOR PUBLIC HEALTH AT ROCKEFELLEROVA 2 AND 4

and metopes on the frieze beneath the main cornice were at the end rendered in stucco; instead of in stone, the steps had to be made of reinforced concrete "clad in artificial stone [e.g. as on all the buildings of the medicine faculty]"as well as the "columns in the staircase" and so on.

Since the architect is no longer mentioned in a single one of the many extant documents, it would seem that he was divorced from the works. That was also the case with the Palace of Public Health (Fig. 10). It was then common for those who administered competitions to look for ideas, pay royalties to the designer, and then work out the detailed design themselves. The practice is tellingly illustrated by the scandal caused in the competition for the State Trades School and the City Extension School in Zagreb by Josip Seissel and Josip Pičman (the latter having learned his lesson from the Main Post Office in Belgrade), when they submitted an entry outside the competition with a letter of protest which said, among other things: "the Vice-Royal Government and the City Authority with this announcement look to the entrants just for ideas, i.e., for intellectual work, and exclude a priori the entrants from any chance that he who created them will be the person to implement them... Should this plan by reason of its quality be destined for building, we reserve all the author's rights, for the implementation of this plan out of principle [relinquishing any financial reimbursment]". (Mutnjaković, 1997: 52)

Although from a stylistic point of view it is more conservative than the design of the leaders of Croatian Modernism, Denzler and Kauzlarić, this somewhat anachronistic work of Vasily Androsov for the Palace of Public Health, distinctive for its practically uncommon "high mannerist academicism", did make a certain impact on Croatian Modernism.

The basic traits of the design are defined by the harmonious composition of the functional division of interior spaces and the calm axio-symmetrical articulation of the façade with which the ambition was to achieve a monumental effect, just as with the grand interior staircase. A similar ground plan conception, "strictly central and academic", with communications in the axis of the centreline of the building, to which circulation is channelled directly and linearly from the very entrance is to be seen in Denzler's designs for the Council Chamber at Sušak (1928) and in the building of Municipal Enterprises of 1932/33. This kind of an approach, in Denzler's version, but also as a consequence of the premise of organising the internal space of the Institute of Epidemiology, - it can be assumed – might have had an effect on the articulation of the floor plan of Vrkljan's Veterinary Faculty (1937), also based on the idea of a central entrance axis, along which were strung the main building, atrium spaces and the complex of theoretical and experimental institutes, with an anatomy lecture hall shaped like an amphitheatre in the eastern annexe right at the end of the axis (Barišić Marenić, 2004: 167-178).[11]

11 N. Jakšić (2007: 201) senses the influence of Denzler's floor plan on the Palace of Public Health and in Ostrogović's new Zagreb Town Hall of 1956.

12 An excellent introduction to the width and global scale of the Rockefeller Foundation programme is given by Dugac, 2005. The foundation got involved with important financial donations as well as direct programming of a number of projects, firstly in Prague, 1921; then London 1922; Warsaw, 1923; Zagreb and Belgrade, 1924; Budapest and Toronto, 1925; Rome 1930; and Tokyo 1933. More: Prausnitz, 1933: 121-140, 169; Chen, 1989; Dugac, 2010: 193-232.

13 At the invitation of the Rockefeller Foundation, he continued his career abroad. Usually mentioned is his contribution to the advancement of public health in China (he had three long stays there from 1932 to 1936, but it seems that his influence in that country should be considered together with the remarks of Macfayden (2014). Štampar's experiences were also used in the organization of the Greek health system. He taught at a number of universities in the USA.

14 Perhaps it should be added that Štampar's views in the 1920s coincided with the philosophy of the Rockefeller Foundation, which was in essence guided by the then very vociferous objectives of eugenics, a new and popular science about the improvement of the race. Štampar, who in the 1920s was the head of the Department for Public, Racial and Social Hygiene in the Ministry of Public Health in Belgrade, in this respect held a position opposite to that of a number of influential Croatian medical people. He proposed for example that "no one may marry unless they bring a certificate from a state physician that they are healthy and capable of marriage", that "marriage may not be contracted by a person who is mentally retarded, mentally sick, epileptic or is sick of open tuberculosis", that "a person with a sexually transmitted disease may not marry until they bring a certificate from two registered physicians that they have recovered and that the disease is not hereditary", etc. Some of his foreign friends mentioned, like the German eugenicist and hygienist Grotjahn, had

The Context of the Construction of the Block of Healthcare Institutions on Zeleni Brijeg

The parts of the Institute of Epidemiology with ancillary structures around it were gradually handed over during February 1927. Finally, on October 3, 1927, the opening ceremony of the Palace of Public Health was held. Present at the opening were prominent world hygienists like Professor Selskar M. Gunn, trustee of the Rockefeller Foundation for Europe, as well as Thorvald Madsen, Alfred Grotjahn and Léon Bernard, all close friends of Štampar. The complex was opened by Stjepan Radić, a celebrated Croatian politician (then in opposition but until February that year minister of education), who several times and in glowing terms referred to Štampar's principles in the rehabilitation of the countryside.

At that time Croatia, like a major part of prewar Yugoslavia, was a country that lived by rudimentary agriculture, as appallingly revealed by the book *How People Live* (1936, 1939) by Rudolf Bicanić. Štampar had launched what was probably the most important modernisation project of the twentieth century in Croatia, and Yugoslavia, a vision set off by contemporary world views about what was preventive medicine.

The construction of the complex on Zeleni brijeg in Zagreb was the first fruit of the vigorous collaboration with the Rockefeller Foundation that was started in the year 1924.[12] As historian of the Croatian medical heritage and of public health Željko Dugac states that that was the time when all over Europe, the USA, South America and Asia the Rockefeller Foundation was putting up healthcare establishments in which physicians were acquiring advanced insights into medicine. It built centres for medical research, laboratories and other institutions necessary for the amelioration of conditions in health and hygiene, for the dissemination of preventive medicine and health education.

The Foundation set aside huge resources for the building of the School of Public Health in Zagreb (Fig. 11) as well as for a network of institutions such as healthcare stations, establishments for the protection of infants and little children, school polyclinics, dispensaries for TB, outpatient departments for STDs, institutes and stations for malaria, surgeries for trachoma, institutes for social medicine, epidemiology institutes, bacteriology laboratories and so on. In an almost inconceivably short time, about 250 public health facilities were built in the country.

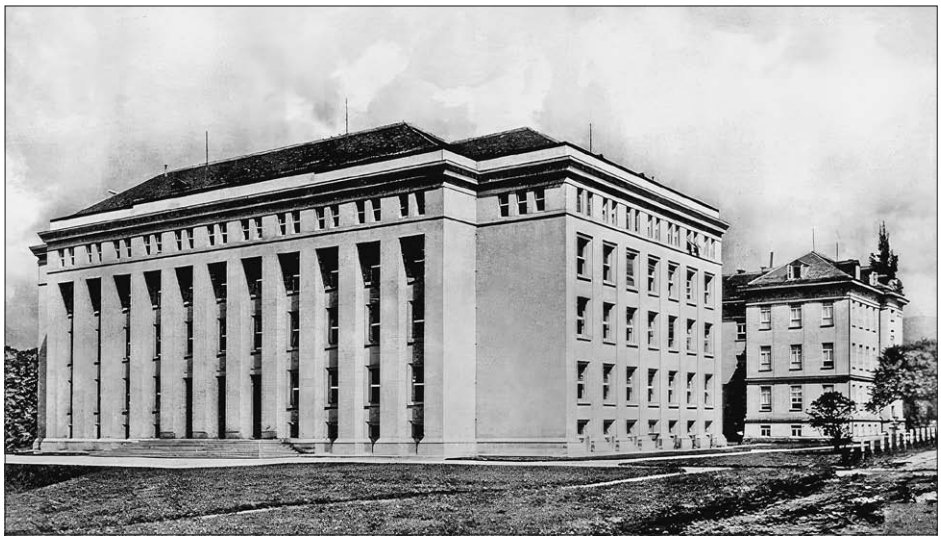


Fig. 11 Juraj Denzler and Mladen Kauzlarić: The Andrija Štampar School of Public Health in Zagreb, 1924-1927

Štampar was able to undertake all this as head of the Ministry of Public Health (appointed in 1919), conducting a thoroughgoing reform of health care, premising his work on social medical principles of the organisation of the healthcare services, thinking up a completely new institutional form of primary care, appropriate to the needs of the given milieu. In parallel, there was the training of professional medical personnel; students and young physicians, nurses and sanitary technicians were given scholarships, many of them for personal and professional development abroad.

It is particularly important to point out that the Rockefeller Foundation enabled Štampar's socialist understanding of health care and employees of the School of Public Health in general to distance themselves from the influence of political parties, that is, of the regime of the time, which was very significant during the dictatorship of King Alexander. It is not surprising that in 1931 Štampar was forced into retirement, "incapable of his office", after he had refused to join the cabinet.[13]

Experts of the health organisation of the League of Nations, as well as those from the Rockefeller Foundation, says Dugac, praised the innovative work between the two world wars. The case of a rural and undeveloped country that had managed to improve its public health significantly in a short span of time became a general model in peer countries.[14] Systematic courses for rural people

very broadly worked out ideas about national regeneration, with projects that the philanthropic Rockefeller Foundation was amply financing up to 1940. Štampar's eugenic episode, however should be understood in the context of the eugenics of the time, especially against the background of his gradual detachment from such viewpoints, and calibrated, as has been astutely done in Kuhar (2015). Incidentally, it may be mentioned that in the last few years there has been a broad critical discussion of the role of several American philanthropic foundations in the eugenics project. See for example Weintraub, 2012; Page, 2002: 265-287. The Rockefeller Foundation has recently launched an internal investigation (The Anti-Eugenics Project *Dismantling Eugenics*) to uncover more details about its involvement in the movement. https://www.devex.com/news/devex-newswire-ford-rockefeller-and-a-history-of-eugenics-101763

obtained a special and original status among schools and hygiene institutes in Europe. The auditorium of the building at Rockefeller 2 was constantly at work.

CONCLUSION

One of the propositions of this article is that Androsov's design was created at the same time the competition for the Palace of Public Health was announced – for the same client and probably according to the same programme. The Epidemiological Institute and the School of Public Health were meant to work closely together and the construction was planned – by 1924 at the latest – on the premise that the buildings should be side by side, in a mirror-image composition of the block as a whole (together with the Infectious Diseases Hospital). It can be supposed then that during the designing of the edifice of the Institute of Epidemiology the planning guidelines for the formation of the whole block were studied attentively, that is, the premises of the competition by which the approach for the Public Health building was supposed to be acquired. The design of Juraj Denzler and Mladen Kauzlarić for the construction of the Palace, however superior to the mannerist academicism of Androsov's drawings for the Institute, follows the harmonious composition of functional division of interior spaces in its own way, with communications in the axis of the centreline of the building, with an overblown grand staircase, influencing, however, similar approaches in Denzler's oeuvre, as well as the articulation of the ground plan of Vrkljan's Veterinary Faculty complex (1937), or perhaps the new Zagreb City Hall of Ostrogović (1956). In this sense, the architectural design of Vasily Mikhailovich Androsov, Serbian architect of Russian origins, has an importance of its own for the understanding of Croatian Modernism.

[Translated by Graham McMaster]

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Archive sources

1. Higijenski zavod sa školom narodnog zdravlja [Hygiene Institute and School of Public Health] (HR-HDA-517) with a total of three boxes of documents, among which are documents from 1927 about the construction of the Epidemiological Institute in Zagreb. Box 2.
2. HR-HDA-135. Inspektorat Ministarstva narodnog zdravlja kraljevine SHS u Zagrebu [Ministry of Construction of the Kingdom of the SCS, Construction Department in Zagreb] (1920-1929); in box (documents 19218/24 and 20086/24), box 24 (6581/25), box 32 (21043/25), box 46 (2285/25), box 71 (25557/26), box 84 (5238/27) and 88 (6979/27).
3. HR-HDA-130. Ministarstvo građevina Kraljevine SHS. Građevinska direkcija u Zagrebu [Ministry of Construction of the Kingdom of the SCS, Construction Directorate in Zagreb] (1920-1929); in box 53 there is documentation about the building of the Epidemiological Institute (1924-1927) with drawings for the construction and other pertinent documentation (bills of quantities, bids from building firm, contracts with contractors) and material related to the building of the byre of the Epidemiological Institute in Zagreb (box 54).
4. HR HDA 517. Higijenski zavod sa Školom narodnog zdravlja [Hygiene Institute and School of Public Health].*

* I would like to thank colleagues from the Croatian State Archives, above all the chief, Diana Mikšić and the archivist Ivana Marinovic for being so promptly willing to show this material to us.

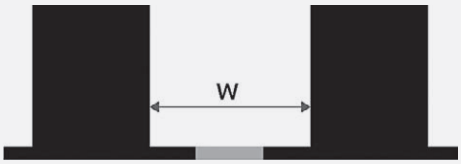
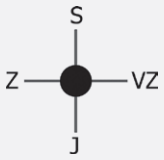
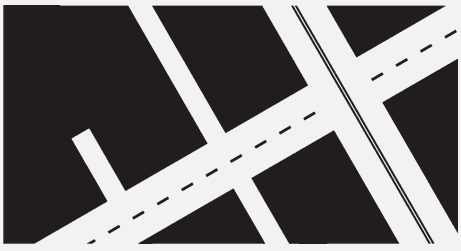
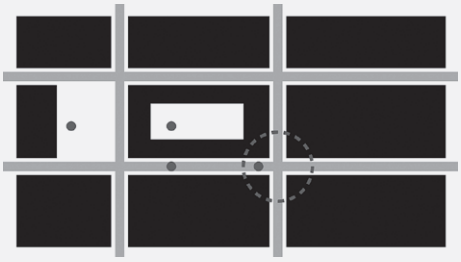
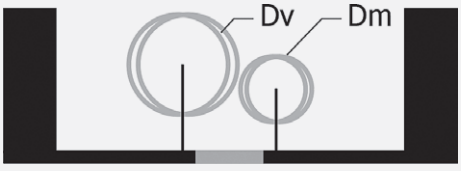
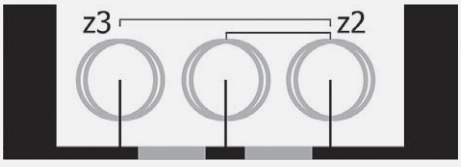
Illustration sources

Fig. 1, 5-7, 9a, 11	Hrvatski državni arhiv (Croatian State Archives), Marulić square 21, Zagreb
Fig. 2	Author's archive
Fig. 3	Zagreb, Museum of Arts and Crafts -020610/1
Fig. 4	Post *Museum*, Belgrade
Fig. 8, 9b, 10	Photo: P. Mofardin, Institute of Art History

Author's biography

Josip (Joško) Belamarić, Ph.D., is head of the Institute of Art History in Split. Between 1991 and 2009 he served as the director of the Regional Conservation Institute of Dalmatia. He has published a number of books and studies on the urban history of art, architecture and urbanism of early modern Dalmatia. He has directed conservation works in Dalmatia and also edited a number of exhibitions. Bibliography link: https://www.ipu.hr/article/en/9/josip-belamaric-phd

Table I Modelling domains and categorisation of variable classes

Domain	Category	Scheme	Description	Class
Built environment – morphology	Street canyon height/width ratio		The height of the buildings (h) and the width of the street (w) form the street canyon ratio H/W. Street canyons are classified in three classes.	model 20/50, H/W 0.4 model 20/30, H/W 0.6 model 20/20, H/W 1
	Orientation of the street grid		The main street, and the development of which the school building is a part, can be divided into two predominant orientations.	Wind direction perpendicular to the street grid Wind direction parallel to the direction of the street grid
The Open space	Typology of the thoroughfare		PM particulate pollutants for three categories of traffic routes	Main road, collector road, local road
	Position within the street grid		The position within the street grid is defined a ccording to the windward or leeward side, the side, the proximity to the intersection and the location at the edge or within the domain unit.	Windward or leeward Proximity and distance to the junction Position at the edge or inside the unit
Street greenery	Type of tree canopy and planting method	 	Street greenery is modelled in high and low planting modes. High and low trees are distinguished, as well as two- and three-row tree plantations.	High crown trees/1d Low crown trees/2d High crown trees/two-lane Low crown trees/two-lane

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Dispersion of Traffic Pollutants in the Built Environment

STREET CANYON
STREET GREENERY
TRAFFIC POLLUTANTS
URBAN DESIGN
URBAN MORPHOLOGY

Environmental modelling software can be useful for evaluating design interventions and formulating strategies to achieve a specific purpose, such as providing outdoor thermal comfort. It is less commonly used in predicting the dispersion of street pollutants. The aim of this research is to test selected morphological patterns with respect to their influence on wind conditions and the transport of traffic pollutants, and to verify the results against previous studies. The objective of the research is to evaluate relations between building typology in interactions with urban atmosphere. The method utilises a wind tunnel simulation with a static line source of emissions. Experiment results show that the exposed urban morphology models display an impact on flow conditions and consequently on the dispersion of traffic pollutants. At the same time, the results highlight the importance of urban aerodynamic perspective, particularly of urban spaces that can be expected to be subject to higher traffic pollutants in terms of urban air pollution.

Introduction

Design interventions with computer modelling are increasingly recognised as one of the possible urban design solutions that can improve air quality at street level. These solutions can concern either landscaping features, such as trees, shrubs or green walls and roofs, or the form of the urban fabric itself, which refers to the morphological image of the city. The relationship between the height/width (H/W) ratio of the street profile and the transport characteristics of traffic pollutants is complex. Fluid dynamics studies (Zhong, Cai and Bloss, 2016; Abhijith et al., 2017a) explain the poorer air quality in narrow street profiles by the reduced self-cleaning capacity of the urban street canyon (UC), or the dispersion of traffic-derived pollutants above the roof level. The main mechanism in the reduced self-cleaning capacity is the vorticity factor, which is split in UC with a higher H/W ratio of the street canyon profile and is therefore less effective in mixing street air with air from the general urban background, the largest difference would therefore be expected at the pedestrian level (Chen et al., 2015). To tackle the problem of poor air quality in street canyons and near thoroughfares, some authors have addressed the issue of pollutant dispersion (Carvalho, Vilhena and Moreira, 2007; Gromke and Ruck, 2007; Abhijith et al., 2017a), and the issue of airiness and wind corridors in the city (Buccolieri et al., 2011; Ng and Chau, 2014; Huang et al., 2016) with wind tunnel simulations.

Removing and limiting traffic from cities is the most effective strategy to reduce traffic emissions, but for the purposes of this research we focus on other design-based options aimed at decreasing pollutant concentrations at street level. Rough surfaces halt air velocities, and some have begun to explore the impact of built environment density (Buccolieri et al., 2011; Shen et al., 2017), rooftop morphology (Hang et al., 2009; Huang et al., 2016), and street greenery (Sabatino et al., 2008; Hang et al., 2009; Abhijith et al., 2017a) on the dispersion process of traffic pollutants. Others have tested the variability of building morphology in simulations (Kurppa et al., 2018) and found that varying the height of buildings along the street improves ventilation, resulting in 7-9% lower average pollutant concentrations of traffic origin at the pedestrian level, the height where concentrations of traffic pollutants ($PM_{2.5}$, ultrafine particulate matter – UFP, nitrogen oxides) are proven to be the highest (Vardoulakis, Gonzalez-Flesca and Fisher, 2002). The dependence of street-level airborne particulate removal processes on meteorological conditions has been investigated by Chen et al. (2015), highlighting that relative humidity and wind speed have the greatest impact, while temperature has the smallest one. The influence of solar radiance on urban surfaces is complex and there is still much uncertainty about interactions between airflows and pollutant transport in the UC, although different heating scenarios undoubtedly influence airflows. Other studies (Crank et al., 2018; MeshkinKiya and Paolini, 2021) indicate that in the actual conditions of an urban street canyon, the effect of solar radiation on airflow is weaker than the effects of building agglomeration or airflow direction, but this effect only becomes noticeable in low wind conditions. In the summer, this process is accelerated by up to 0.7% due to warmer temperatures (Jeanjean et al., 2017).

Considering the processes of dispersion and deposition of pollutants in the urban environment therefore helps us to design spaces where the most vulnerable are protected from the highest concentrations of pollutants. It is only through these two processes that pollutants are removed from the atmosphere. The first requires good air flow, which depends on convection and surface roughness or wind barriers. Wind barriers in urban areas can be either built barriers or landscaping features, especially taller vegetation with dense canopies. The aerodynamic effects of spatial building blocks in the urban environment are more effective than the deposition process in removing pollutants from the atmosphere when it comes to particulate matter, according to the authors of previous

studies (Vos et al., 2013; Jeanjean et al., 2017; Santiago, Martilli and Martin, 2017; Buccolieri et al., 2018). In the wind environment, green infrastructure is one of the most important building blocks in the study of air flows, but its role depends on the geometric characteristics of the street and interaction with the surrounding morphology (Buccolieri et al., 2011; Gromke and Ruck, 2007). Some plants act as porous bodies, influencing local dispersion patterns and helping to deposit and remove airborne pollutants (Abhijith et al., 2017; Salmond et al., 2016). However, the importance of green infrastructure in urban areas for air quality is not unambiguous, since it reduces wind speeds and the rate of air exchange, and it removes certain types of pollutants through the process of deposition on leaf surfaces as well (Santiago et al., 2017). It is therefore important to evaluate each green element within the context of its urban environment to determine their potential.

Materials and Methods

The study of UC on wind conditions and the transport of traffic pollutants was carried out in two steps. In the first phase, a preliminary selection of selected urban environments was done with the use of geomorphological data by the Surveying and Mapping Authority of the Republic of Slovenia (MOP, 2020). Different housing typologies were selected based on various spatial criteria, such as morphological design, period of development, distance from the city centre, variety of buildings, variety of external open space layout, spatial fit, shape, size, street network or connectivity, climatic comfort, and so on.

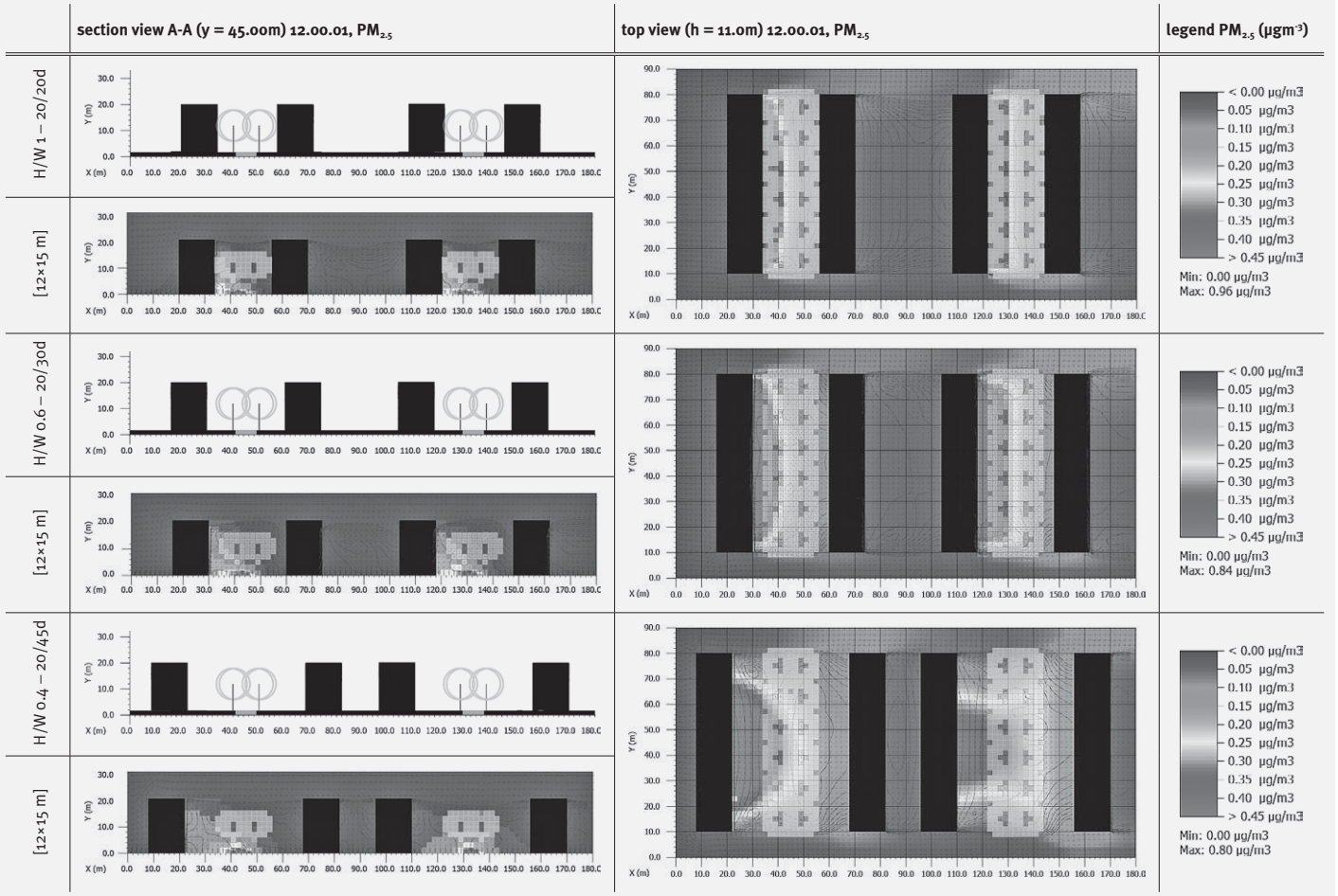
In the second phase the ENVI-met V5 software tool was used, and air quality conditions were modelled to compare spatial scenarios of urban environments. Furthermore, the input values were tested against the comparable models by the authors (Salmond et al., 2013; Abhijith et al., 2017b; Crank et al., 2018). The overarching research hypothesis of the modelling exercise is that the urban morphology and urban greenery can affect urban air quality at street level. Whether through changes to the traffic regime or spatial layout within a building, it can have a perceptible impact on indoor air quality.

The model domain included sources of CO_2, and PM_{10} and $PM_{2.5}$ pollutants. The diurnal variation of traffic emissions of particulate matter and NO and NO_2 are subject to daily changes in the number of vehicles, or depend on the daily distribution of vehicles. In other words, it is defined by traffic peak periods, with a typical increase in morning and afternoon commuting periods, which is defined as the morning and afternoon peak periods. In the research presented in this paper, two traffic distribution models were used to represent the traffic distribution typical for the city of Ljubljana (Koblar, 2016), where the daily distribution is geographically independent and represents a typical distribution for different categories of thoroughfare in the city. To further characterise the role of urban open space on the dynamics of airflows and dispersion of particulate pollutants, individual building blocks are used as models (Table I). This helps to understand how local air quality changes under different spatial scenarios by considering pollutants of transport origin. In this context, the research was focused on how this process affects the local ambient values of pollutants of transport origin in the atmosphere. The most common spatial building blocks that can be found in urban morphologies are selected: the form of individual buildings (Bruse and Fleer, 1998; Santamouris, 2006; Hang et al., 2009), the shape of roofs (Huang et al., 2016), vegetation types (Wania et al., 2012; Baldauf, 2017; Kończak et al., 2021), while complex urban patterns (Hang et al., 2009) are not considered in modelling.

The simulated wind tunnel conditions matched those used by the authors (Gromke and Ruck, 2007; Buccolieri et al., 2011; Jeanjean et al., 2017). The settling velocity of traffic pollutant particles was kept constant, the wind speed was standardised, and the processes of particle resuspension and wet deposition were neglected for the purpose of the simulations. This research presents quantitative analyses of UC, and the possible relations between the effects of detailed street morphology and the corresponding street greenery on street ventilation and pollutant dispersion.

The morphological properties of the building blocks (Table I) include: the H/W ratio of UC (from 0.4 to 1), the asymmetry of UC, height of buildings with upper storey height up to P+3 (from 0 to 10.5 m), the direction of the prevailing wind in relation to the orientation of the street grid (parallel and perpendicular), the typology of the thoroughfare (main road, collector road and local road), the position within the street grid in relation to the building block (inside or outside), the layout of street greenery (the type of tree canopy, shrubs and planting). The choice of spatial building blocks elements, the H/W ratio of UC and the characteristics of street greenery are based on related studies of wind tunnel computer models (Ahmad, Khare and Chaudhry, 2005; Ng and Chau, 2014). The selected morphological criteria represent a scale of a medium dense urban area with a built-up factor between 30 and 35% and a utilisation factor between 1.2 and 1.4.

Table II Street greenery – two-part avenue in relation to the height and width of the street canyon



Street typologies correspond to different traffic capacities, emissions and influence the transport of pollutants. The geographical orientation of streets is considered because of its influence on natural ventilation and surface temperatures. The last category provides information on the impact of the surrounding area on each individual street. The trees selected represent any deciduous tree species of 15 metres in height with a dense, circular canopy. The dry biomass weight is 100,00 gm^{-2} and is simulated for the month of June when canopy density is at its highest.

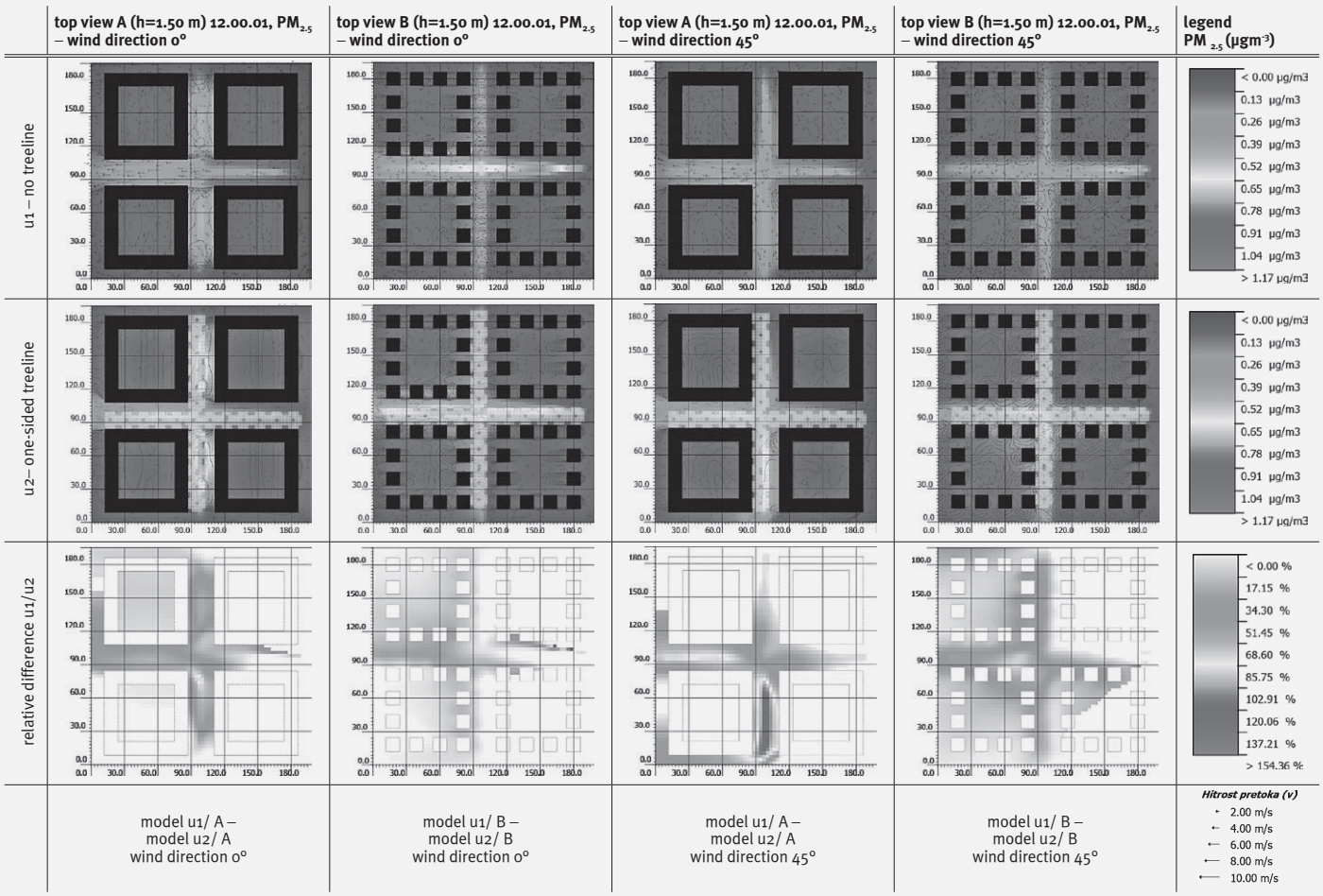
Model Evaluation of Typical Spatial Building Blocks

The data obtained from the analyses are consistent with the findings of other authors in the literature review (Carvalho, Vilhena and Moreira, 2007; Gromke and Ruck, 2007; Abhijith et al., 2017a), and identify different ways and options to influence the transport of pollutants in the open urban space of the street and air quality at the pedestrian level. The built environment, morphology and street greenery have an effect on wind flow patterns, and accelerate or decelerate the transport of particulate pollutants in space. A partial finding suggests that reduced air exchange may be due to the presence of street greenery in the UC, especially at the level below the tree canopy. The implications are not straightforward, as this does not consider the efficiency of particle deposition or the multiplicative effects of the relationship between morphology and vegetation infrastructure on local airflows and turbulence. An individual scheme in space should be considered in terms of its scale and analysed on a case-by-case basis, assessing meteorology, building morphology and vegetation interactions.

In the wind tunnel, the wind speed was constant and in the direction perpendicular to the direction of the street (from left to right), with the exception of a case presented in Table III, where the wind direction is presented in a deflection. The source of $PM_{2.5}$ pollutants is constant in both models on the axis of the thoroughfare in the middle of the street canyon. All situational illustrations are made at a height of 1.5 m or at pedestrian height.

Table II shows the street greenery models, tree canopy types and planting methods. All models are positioned in open space with the same input mass of pollutants of linear origin. All trees are deciduous trees with a spherical canopy. Low trees (5 m), medium trees (15 m) and tall trees (20 m) with a spreading canopy and a linear shrub planting of 2 m are presented. It is evident from the illustration that mature tree plantations stop the movement of particles at pedestrian height (1.5 m) better in the setback than in the case where they are planted close to the source (axis of the thoroughfare). Low trees with a thinner canopy stopped the transport of particles to a lesser extent than trees with a larger canopy, where the difference is 61%. The model with linear shrub planting proved to be the most effective in stopping the trans-

Table III Built environment – Orientation of the street network



port of particles further downwind at pedestrian height. The higher pollutant retention rate of shrubs can be explained by their smaller distance from the pollutant source than the distant tree canopy. In a comparable study (Gromke, Jamarkattel and Ruck, 2016), the authors found that in the presence of a continuous hedgerow, the concentration of traffic emissions at the pedestrian level decreases by up to 60%. A 30% decrease in the concentration of particulates can be discerned at a distance of 10 m from the edge of the roadway. It should be noted that in all models the direction of flows is oriented perpendicular to the street array.

The results coincide with the findings of authors (Blocken and Carmeliet, 2004; Morakinyo, Lam and Hao, 2016; Tong et al., 2016; Jeanjean et al., 2017; Santiago, Martilli and Martin, 2017), which found up to 25% increased pollutant concentrations in front of tall shrubs behaving as a solid barrier in space, and reduced concentrations behind the barrier where the wind slowed down and then the effect was no longer detectable, due to reduced particle dispersion. In our model, we observed elevated particle concentrations even 2-3 m behind the vegetation barrier, which can be attributed to the porosity of the shrubs for wind currents, which slows down the dispersion of particles and stops the transport, but not within a negligible distance. We hypothesise that the ability to stop transport and the ability to deposit particulate pollutants on leaf surfaces, depends on the type of vegetation barrier and the density of greenery. At the pedestrian level, an average 7% reduction in traffic emissions was found in the off-street canyon area in Leicester (Buccolieri et al., 2018). In all models considered, it can be observed that at a distance of 20 m from the line source of emissions, pollutant concentrations are reduced by more than 50% downwind. At a downwind distance of 35 m, pollutant concentrations access ambient levels, reaching 50 m.

Table III shows the built environment models used to test the orientation of the street grid, and UC in relation to the prevailing wind direction. Floor plan A represents the street layout of an atrium building block at a height of P+4. Floor plan B represents the street layout of a row of single or semi-detached dwellings at a height of P+2. As shown in model u1/ floor plan A, the street canyon has 50% higher pollutant levels perpendicular to the wind direction. As expected, there is a higher wind speed in the downwind direction along the street and a better dispersion of particulate matter at 1.5 m height.

In the case of model u1/floor plan B of the individual building fabric, the values are reversed, and the particulate concentration is 66% lower, as there is more turbulence in the direction of the street perpendicular to the wind direction, which helps the air exchange with the surroundings. At the same time, less wind flow can be seen along the street with lower flow velocity on the street in the direction of the wind. In the case of a 45° wind direction, the picture is different, with 34% lower maximum concentrations (83-54 µgm^{-3}),

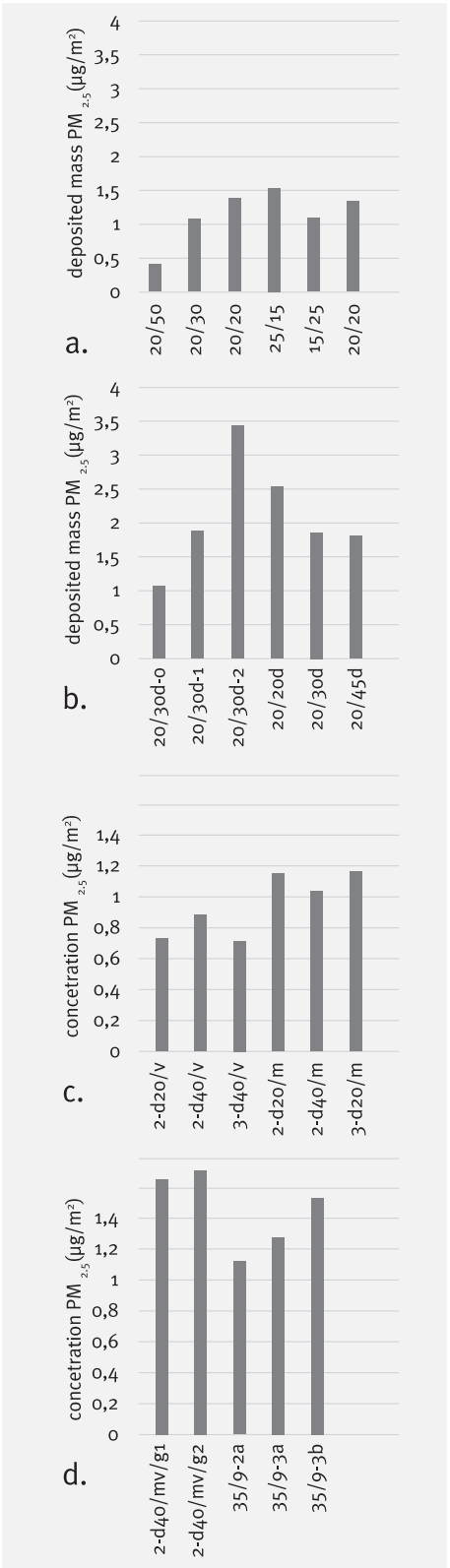


Fig. 1 Results of the built environment and street greenery modelling scenarios: a.-d.

the two variations of the morphology of floor plan A and B are more similar, and the highest concentrations in both floor plans occur at the intersection of the two streets. The results are consistent with the findings of authors (Wania et al., 2012); Garbero, Salizzoni and Soulhac, 2010), who note the important influence of intersections on the ventilation and dispersion of pollutants, where larger eddies and vertical air exchange can occur.

In the model u2 (Table III), where single-unit tree-lined avenues with contiguous canopy is illustrated in both street orientations, the concentrations of pollutants of traffic origin are higher, ranging from 20 to 50%, at a height of 1.5 m. From the figure in the third row, it can be seen that the differences in the model with and without the boardwalk are highest in the case of the atrium block, which forms the street canyon, while the differences on floor plan B are less marked. The difference in pollutant concentrations in the inner atria, the closed and semi-closed atrium cases of floor plan A and B, is smaller, ‹10%. In the case of model u2 with the tree block, the reduced pollutant concentration at 45° offset is less pronounced than in the case of model u1 without the tree block. From the above, it can be concluded that the characteristics of the street morphology, including street width and H/W ratio, side openings and intersections, are closely related to the air flow patterns and pollutant dispersion in UC. Side street openings and intersections have a significant influence on air flows in UC, and the effects are particularly pronounced in the uniform and dense distribution of morphological voids (side street openings). Regardless of the wind direction, the wind conditions inside the atriums of enclosed building blocks are stable. The air quality inside them remains unperturbed in all simulations, which means that traffic pollutants are generally not easily transported into the built environment.

Initial results showed the dependence and magnitude of street greenery and wind barriers on different variables. The most relevant dependent variable is the horizontal pattern of pollutant concentration in the downwind direction, as well as the distance to the maximum concentration and the effectiveness of pollutant dispersion with respect to the individual building blocks in the urban area.

The difference between low and high vegetation in the street canyon can be observed in relation to the street development. High vegetation can be an effective measure in open space where air circulation is not relevant. In open space, low vegetation is more effective in trapping PM pollutants of traffic origin at heights of up to 2 m. In the scenario of a street space with perimeter walls, the ability for advection is limited and consequently the capacity for dispersion of traffic pollutants is reduced. In such an area, high green cover is a negative phenomenon in the context of traffic-derived pollutants at street level when they are of greater concern than the ambient concentration of pollution outside of the UC.

The results of the total deposited $PM_{2.5}$ mass and $PM_{2.5}$ concentrations for the built environment and street greenery modelling scenarios are shown in the figure 1. The results also include the data for spatial configurations not specifically highlighted in the Table II). Thus, point a. of Figure 1 (a.-d.) shows the analyses of three street canyon models without greenery (without tree or shrub planting) in the H/W ratios 20/20, 20/30, 20/50 and 15/25, 25/15 and 20/20. With higher H/W ratios, there is a clear gradual decrease in the total mass deposited. A slightly higher proportion is evident with the asymmetry of the UC in the 25/15 ratio. Point b. shows three different H/W ratios in the UC, which are also presented in the table (Table II), at different distances from the thoroughfare with three planting systems along the thoroughfare. In this case, a higher proportion of the total deposited mass is seen with a higher UC enclosure. All values of the deposited mass for the UC types with a tree canopy are increased. Section c. shows the proportions for UC with different street greenery systems in open space. We find slightly higher total $PM_{2.5}$ concentrations across the model domain for lower canopy tree species. Treetops with higher canopies in open space had less effect than in the narrow street profile of the UK, where they impeded airflow and exchange with the surrounding area. Similarly, in point d., where examples of UC with shrubs are shown, the differences in concentration are smaller. $PM_{2.5}$ concentration fractions were higher for higher hedgerows, and for all models, more effective $PM_{2.5}$ retention is evident for cases with lower green barriers located closer to the source of traffic emissions.

The results of the numerical modelling of the three classes of street tree in the canyon show clear differences in the distribution of $PM_{2.5}$ elements. In the case with the planting of a boardwalk, it can be noted that the windage is lower and thus the effect of particulate retention in the canyon is evident. This effect is greater when the tree canopy is denser, with a larger canopy and trees with dense canopies that block airflow close to the ground. There are minor differences between the cases of different stand spacing and the arrangement of the street greenery building blocks. From the point of view of removing particulate matter from the atmosphere, the

system without street greenery is most appropriate in the case of a narrow street canyon. This has a positive effect on the overall concentration and retention of pollutants along the street only at a ratio of 0.5 H/W.

Discussion

Because the vertical air exchange with the surrounding area is crucial for the dispersion and dilution of traffic pollutants at street level, it is necessary to provide fewer barriers, including street greenery, in places where air flow is impeded. The latter is true for street canyons with a narrow profile or a very high H/W ratio, in places with dense peripheral development, or in places where the wind speed is either very weak, or the prevailing direction cannot be measured and a higher degree of turbulence is generated. In these places, the following applies to better dilute traffic pollutants:

– The canopy of trees and shrubs should be permeable or not contiguous, as a too dense canopy diverts flow past it. The total volume of the canopy should not fill the space of the street canyon.

– However, greater spacing between trees ensures better ventilation of the lower parts of the UC, as the eddies created by wind at roof height are better able to penetrate towards the ground.

– Street greenery elements should be located as close as possible to the source of traffic emissions, adjacent to traffic areas, which applies to the location of planting and the height of the canopy volume.

In the scenario of a street space with a medium or low H/W ratio, or in places with less frequent peripheral buildings, it is also possible to accommodate taller street greenery elements that reach or exceed the height of the wreath of the peripheral buildings, the canopy of trees and shrubs may be less permeable, and they may be contiguous. The H/W ratio of the street profile and the ratio of the full empty space in the city is one of the most basic characteristics of the urban morphological image and is closely related to the ventilation of the street and the dispersion of pollutants from traffic sources, as reported by similar studies (Buccolieri et al., 2009; Buccolieri et al., 2018; Gromke and Ruck, 2016). From the analysis of the reference models and through comparison with reference studies, we find that air quality generally improves in a wider open space and with increasing H/W, which means that the vertical air exchange with the environment also increases. In other words, with a wider street profile and at the same time a greater distance from linear sources of traffic pollutants, exposure at street level is relatively lower. The latter is true in cases where traffic pollution is more problematic than ambient levels of air pollutants. Otherwise, pollutants from other sources, such as emissions from industry or heating systems, are more problematic, and the street-level ventilation of the urban fabric itself is of secondary importance.

Model simulations allow us to conclude that urban design, including the morphology and street greenery, is central to the local conditions of wind flow and transport of traffic and other pollutants, and consequently to air quality. The observed differences found in urban environment models support the findings of Aurora Monge-Barrio and others (Monge-Barrio et al., 2022). Building volumes, together with other building blocks in space, as a whole, influence air flows in a way that stops or accelerates them where applicable:

– Buildings perpendicular to the prevailing wind direction moderate the wind speed, while those parallel to the wind direction channel the wind currents and maintain the wind speed to a greater extent.

– Narrow street canyons running transverse to the prevailing wind direction reduce wind speeds and the rate of air exchange from street and roof levels, and larger building setbacks improve ventilation.

– Intersections are places of increased turbulence, vertical air exchange, and in some cases higher levels of traffic pollutants.

– Larger continuous building masses or other built obstructions impede wind flow more than individual buildings.

The local properties of street greenery for air quality therefore requires a site-by-site approach. However, as street greenery elements in the city also have many other positive effects, it is recommended that the guidelines be followed only in cases of existing or projected high traffic pollutant loads in locations where vulnerable populations such as children, the elderly or the sick are also at risk.

The modelling studies considered the aerodynamic effects of built barriers and trees, as well as the effects of pollutant transport under idealised scenarios. Through our assessment of some basic urban planning and landscape-architectural design decisions, we have identified the importance of spatial building blocks on mass-traffic flows, microclimatic conditions and air quality in urban space. More open areas allow for higher levels of air circulation, providing greater opportunities for pollutant removal, which is consistent with the findings of similar studies (Fu et al., 2017; Oke et al., 2017; Vardoulakis et al., 2002). Reduced air circulation capacity leads to a limited ability to disperse pollutants and to exchange air with the surroundings and the upper atmosphere. This may

imply a deterioration in scenarios where traffic pollutants represent the most significant air quality burden or where the situation at the level of the thoroughfare is worse than the ambient values in the urban atmosphere.

Conclusion

It can be concluded that the built environment and spatial building blocks have an impact on air quality at street level, and that guidelines for urban design and planning, in terms of ensuring better air quality, can be set. However, it should be underlined that these recommendations are not necessarily applicable in all cases or locations. They depend on local microclimatic conditions and chaotic (turbulent) wind conditions, and consequently the response needs to be tailored to individual cases and configurations. Ideal scenarios thus relate to urban density and street greenery, and it is only reasonable to ensure these spatial relationships when developing new urban areas. For the renewal of urban fabric and degraded urban areas, these guidelines are limited, and the results are theoretical.

Due to the assumptions of the study and the limitations of the computational model, the above conclusions should be applied with caution, carefully checked, and local specificities and priorities considered before the positive effects of the vegetation barrier are realised in the actual space. This is because the pattern of pollutant transport and deposition is a locally dependent variable. The research is limited to simplified models with limited results and accuracy of pollutant dispersion simulations.

In future research, we therefore propose to address more complex spatial patterns with more advanced computational models that address the temporal component of transport, deposition and resuspension processes of transport pollutants.

[Translated by Tjaša Kresnik, LEEMETA, specializirane prevajalske rešitve, d.o.o.]

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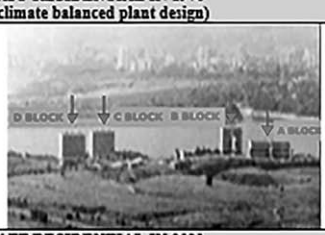
Conceptualization: K.L., J.G. and A.F.; methodology: K.L.; software: K.L.; validation: K.L., J.G. and A.F.; formal analysis: K.L. and J.G.; investigation: K.L. and J.G.; resources: K.L.; data curation: K.L.; writing – original draft preparation: K.L. and J.G.; writing – review and editing: K.L., J.G. and A.F.; visualization: K.L.; supervision: J.G. and A.F.; project administration: J.G. and A.F.; funding acquisition: K.L. All authors have read and agreed to the published version of the manuscript.

AERIAL PHOTOS OF THE ACADEMIC STAFF RESIDENTIAL IN 1976
(Çukurova University Photo Archive - Before climate balanced plant design)



RESIDENTIAL TYPE

Type-1/A Block
Construction Date: 1975
3 Main+3 Mezzanine
Villa Style Building (h=14)
Oriented NE-SW

Type-2/B Block
Construction Date:1974
3 Main+3 Mezzanine
Villa Style Building (h=23)
Oriented NE-SW

AERIAL PHOTOS OF THE ACADEMIC STAFF RESIDENTIAL IN 2021
(Çukurova University Photography Archive - After climate balanced vegetative design)

Type-3/C Block
Construction Date:1976-1979
Building with 6 floors (h=23)
Oriented NE-SW

Type-3/D Block
Construction Date:1976-1979
Building with 6 floors (h=23)
Oriented NE-SW

Block Type	Orientation	WidthxLengthxHeight(meter)	Distance Between Buildings
A BLOCK	35 degree SW	15x38(double block) x14	Distance between A-B:15 m.
B BLOCK	35 degree SW	15x38x23	Distance between B-C:210 m.
C BLOCK	28 degree SW	17x45x23	Distance between C-D:40 m.
D BLOCK	28 degree SW	17x45x23	Distance between C-D:40 m.
RK BLOCK	30 degree SW	15x16x7	Distance between RK-D:50 m.

A and B Block Photos.

C and D Block Photos

	East	West	South	Northwest.	North
A	Not Long wide tree	Not in place	Long wide tree, low bush	Not in place	Long wide tree,Narrow tree
B	Not Long wide tree	Not in place	Long wide tree, low bush	Not in place	Narrow tree
C	Not in place	Long wide tree	Long wide tree, low bush	Long wide tree	Long wide tree, Narrow tree
D	Not Long wide tree	Long wide tree	Long wide tree, low bush	Long wide tree	Long wide tree, Narrow tree
RK	Long wide tree	Long wide tree	Long wide tree, low bush	Long wide tree	Narrow tree

Orientation to wind

A	is open to S-SW breezes blowing in summer and closed to undesirable N-NW wind direction
B	is open to S-SW breezes blowing in summer and closed to undesirable N-NW wind direction
C	is open to S-SW breezes blowing in summer and closed to undesirable N-NW wind direction
D	is open to S-SW breezes blowing in summer and closed to undesirable N-NW wind direction
RK	is open to S-SW breezes blowing in summer and closed to undesirable N-NW wind direction

Fig. 1 Building and outdoor features

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Holistic Approach to Ecological Design Parameters of Building and Landscape Design on Outdoor Thermal Comfort in Hot, Humid Climate

ENERGY PERFORMANCE
HOT, HUMID CLIMATE
OUTDOOR THERMAL COMFORT
PLANT DESIGN
UNIVERSITY RESIDENTIAL BUILDING

In this study, academic staff residential buildings were studied as part of a university campus located in a hot and humid climate zone in Türkiye. Within the scope of the study, the energy efficient architectural and landscape design decisions of the buildings built in 1976 were examined. The aim was to determine the energy performance of buildings built about 50 years ago and to quantify the effect of changing landscape conditions on thermal comfort. In this aim, the outdoor thermal comfort level was determined by creating microclimate simulations for the hottest day and time of the year. Microclimatic analyses were performed with ENVI-met software and thermal comfort was evaluated with two metrics, average PMV and ASHRAE scale. The energy performance of the buildings was determined using ecological design parameters. An approach to global environmental problems is the use of ecological design principles, including architectural and landscape design principles. It is important to consider both architectural design criteria and landscape design criteria when discussing an ecological design in the built environment. Architectural and landscape design decisions for hot and humid climate regions together increased energy efficiency by 51.1% to 75.5%. It was found that although the plant design improves energy performance in buildings by that range value, it improved outdoor thermal comfort by 15% to 22%. As a result, the study evaluated climate-balanced plant design with building energy performance in order to improve outdoor thermal comfort.

Introduction

According to the United Nations report, the built environment, including residences, consumes approximately 40% of the produced energy and natural resources, while construction materials consume approximately 4% (Li, 2006; UNEP, 2017). According to the Energy Information Administration survey, it has been reported that 41.7% is consumed by the built environment and 5.9% is consumed from the use of construction materials (U.S., 2020). The construction sector, which causes environmental pollution, uses energy in the stages of construction, use and demolition, starting from the extraction of raw materials. Ryn (2007) describes that environmental crisis is as a design crisis. Buildings, landscapes, and how things are constructed contribute to environmental crises and pollution (Ryn, 2007).

NATO Foreign Ministers approved the agenda on climate change and security on 23-24 March 2021. On 1-12 November 2021, the 26th United Nations Climate Change Conference (COP26) decided to gradually reduce the use of coal and other fossil fuels. NATO's attention was drawn to the issue of global warming, albeit late, due to the negative rate of increase in global warming in the next ten years and the obstacles it will create in terms of military operations. If carbon dioxide emissions cannot be reduced by 2050, it will be inevitable for our planet to face global climate disasters. As a result, various design parameters need to be reconsidered in order to reduce energy consumption and improve thermal comfort in new buildings. The reconsidered built environment is based on an ecological design approach. In order to reduce high energy losses, ecological design methods have been developed at the international, national, regional, and local levels. To achieve this objective, standards, regulations, and codes have also been developed and implemented around the world based on the performance of buildings. Over the last ten years, Türkiye has implemented important legal regulations in accordance with the European Union Building Energy Performance Directive. With the general requirements of building energy performance regulations, the Energy Performance Regulation in Buildings entered into force in our country in 2009. On October 11, 2021, the Ministry of Environment, Urbanization and Climate Change was formed, extending the responsibility of the Ministry responsible for the environment and urbanization of the country. Accordingly, all buildings designed and constructed after 2009 are evaluated by an interdisciplinary team, constructed as energy-efficient buildings, and controlled by the ministry that has expanded its responsibilities. However, in order to increase the energy efficiency of the building stock built before 2009, a thorough analysis of the buildings' current energy performance is necessary (Karagöz, 2016).

By calculating the microclimatic effect caused by changing landscape conditions, the study aims to reveal the energy performance of buildings built about 50 years ago and the importance of improving thermal comfort. The study chose a building group built in 1976 for residential academic staff at the university campus. The relationship between the energy efficient criteria of this building group and architectural design has been examined. Thus, the energy performance and architectural design of the buildings, as well as outdoor comfort, were evaluated together. This study compared the outdoor thermal comfort inside the campus between 1976 and 2021, and also presented the active role of climate balanced vegetative design on improving outdoor thermal comfort. This study shows how changes in planting design and tree species affect thermal comfort in a built environment using microclimate simulation (with ENVI-met software).

A value was reached for the influence of architectural design parameters on outdoor thermal comfort conditions at the end of the study. This context suggests that the design principles of university residential buildings and their immediate surroundings will support the production of housing in the future to cope with changing climatic conditions.

Literature Review

Some research has been done on outdoor thermal comfort in the built environment. It has been seen that these studies can be classified into two groups, namely comparative studies of urban heat islands in metropolitan centers and historical cities and thermal comfort studies of the relationships between buildings, building environments, and public spaces (Allegrini et al., 2012; Boeri & Gaspari, 2015; Gaspari & Fabbri, 2017).

It is evident that previous studies have investigated the correlation between the morphology of residential blocks and microclimates from different perspectives as second group. Some explored the influence of morphology on the wind environment (Kubota et al., 2008), while others simulated ventilation between buildings (Mei et al., 2017; Rosheidat et al., 2008). Some emphasized the energy budget balance and influence of urban morphology (Unger, 2004), while others examined the outdoor thermal comfort in extreme temperature conditions depending on the climate zone. Some of them focused on relation with building type and outdoor thermal comfort (Berkovic et al., 2012; Zhang et al., 2022), while other focused on relation with landscape design and outdoor thermal comfort (Tan et al., 2021.; Shashua-Bar et al., 2011.; Yılmaz et al., 2018; Rui et al., 2019; Mutlu and Yılmaz, 2021; Yang et al., 2018).

Although different perspectives have been used to examine thermal comfort's impact on pedestrian microclimates, there are still some limitations as a holistic assessment. So, it is important that the relationship between the energy performance of the buildings and, the architectural and landscape design be evaluated together with outdoor comfort conditions. It differs from other studies in evaluating building typology and landscape design together to determine outdoor thermal comfort, including plant design types. A major difference of the research is how buildings and building environments interact for outdoor thermal comfort in humid and hot climates, including location, orientation, distances between buildings, types of buildings (building shapes, dimensions, etc.) and landscape design.

Material and Method

• **Identification of the study area** – The study area was chosen as the academic residential structure group in Adana province, Çukurova University campus in Türkiye. On the east and north sides of the Seyhan dam lake, this area is a natural park located north of Adana. It is at an altitude of about 50 meters above the lake level. Residential blocks are designed in three different types. In Fig. 2, the location of the study area in Türkiye and the location of the study area within the university campus are given.

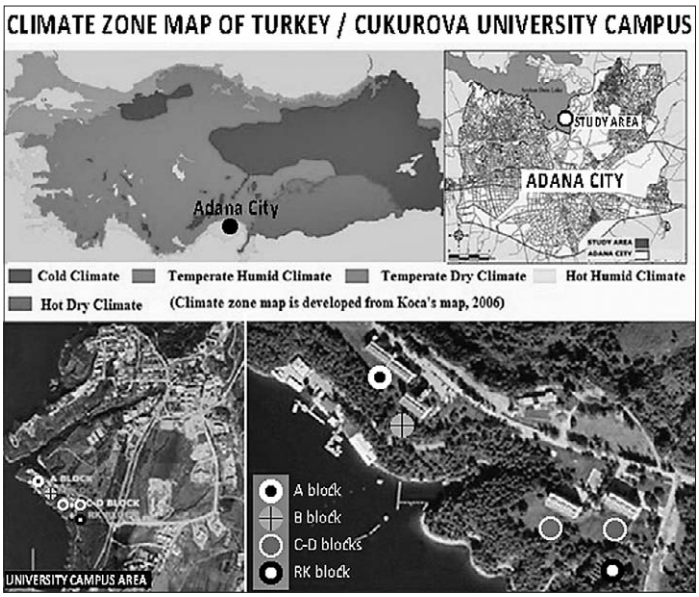


Fig. 2 Location of the study area at the Çukurova University, Türkiye

• **Information about features of building and outdoor green area** – When the old photographs of the blocks as A, B, C, D and RK, which are included in the residential group, and it's the current photographs obtained through on-site inspections are examined, the improvement created by the landscape design is seen in Fig. 1 building type and building orientations are included. The figure 1 includes the characteristics and design parameter of the buildings, including the year of construction, the number of floors, floor height, the type of building and building orientations.

The tree species detected in the field study are as follows: *Acacia cyanophylla* (Cyprus Acacia), *Acer negundo* (Maple tree), *Casuarina equisetifolia* (Iron tree), *Cercis siliquastrum* (Judas), *Cupressus sempervirens var. horizontalis* (Splayed Cypress), *Eucalyptus camaldulensis* (Eucalyptus), *Fraxinus excelsior* (Ash tree), *Jacaranda mimosifolia* (Jacaranda), *Melia azedarach* (Margosa tree), *Olea europaea ssp. oleaster* (Wild olive tree), *Pinus brutia* (Red pine tree), *Pinus pinea* (Pine tree), *Platanus orientalis* (Sycamore tree), *Schinus molle* (Wild black pepper tree), *Thuja orientalis* (Thuja tree), *Washingtonia filifera* (Palm tree), Cynodon dactylon (Bermuda Grass) is used in grass areas.

• **Information about location and texture** – This section evaluates the climate, geography, and building texture data of the residential building group. Residential area has hot

and humid climates. In accordance with the hot and humid climate, the study area's buildings are located close to water and on top level of hilly terrain in forest land. This area is located in a dense plant/green texture with its current situation. It is located in a low-density residential area. On a monthly basis, Adana province sees the highest monthly temperature of 35.1 °C (August). The 16th of August is the hottest day of the year, and 14:00 pm is the hottest hour of the year on the defined date (Meteorology General Directorate, 2020). Settlement texture and buildings are arranged in a dispersed and discrete manner to benefit from air flow. As the location selection, the high region, which can benefit more from the effect of the wind, was preferred. It is to be planted away from the structure at a distance of ¼ of the mature height of the tree to reduce solar gain (Williams, 2021). In order to be protected from extreme heat effect of summer in Adana, protection from the sun was provided outdoor with the shade area formed by the trees on the south and west facades of the buildings. It was preferred to be planted at a distance from the building, as it would cut off the desired southwesterly wind at a rate of 1/4.

Method

The methodology of this study includes three main stages:

– The first stage includes the evaluation of architectural and landscape design parameters that determine effective energy use. At the end of the chapter, the evaluation of architectural and landscape design parameters that effective efficiency performance values of the built environment are determined.

– The second stage includes microclimate simulation. Within this scope, two different thermal comfort models were produced. The first includes the analysis of microclimate simulation for the period when the settlement area was first formed. This stage covers the first period of the studies to improve the thermal comfort situation. The second covers the analysis of microclimate simulation for the year 2021, which is the current conditions of the built environment. This stage covers the period when the work to improve the thermal comfort situation is completed. At the end of the stage, a comparison of the thermal comfort model for the two periods is performed. According to the comparison results, suggestions are presented to improve thermal comfort.

– At the end of the study, architectural design parameters that determine effective energy use and outdoor comfort were evaluated together. Thus, the energy efficiency performance values that occur together with the improved outdoor thermal comfort conditions of the sample buildings located in the hot and humid climate region have been revealed.

First of all, the tree species in the study area were determined. For this purpose, the shape, size and texture characteristics of tree species planted 40-45 years ago in the university campus were determined. Climate-balanced outdoor design criteria have been obtained, which will be the basis of the studies to improve the thermal comfort of the study area. These criteria are location and texture (Lechner, 2001; Zeren, 1978), building orientation (Guzowski, 2010; Yıldız et al., 2012; Kısa Ovalı, 2009; Özdemir, 2005; Göksal & Özbalta, 2002; Altunkasa, 1990; Watson, 1983; Olgyay, 1963), building and outdoor green area features (Loibl et al., 2010). The situation of outdoor design criteria and tree species in the study area was evaluated.

The data to be used in the microclimate simulation model are handled separately for two different periods. Climatic data and spatial data are calculated separately for the initial construction period and current use. Thermal comfort analysis is conducted using ENVI-met SCIENCE simulation software. Adana province has the highest monthly average temperature of 35.1 °C. It is the hottest day of the year on the 16th of August, and it is the hottest hour of the year at 14:00 pm (the average temperature data of the province of Adana by the General Directorate of Meteorology).

ENVI-met SCIENCE, which is used in the study for climatic modeling and thermal comfort analysis, is a three-dimensional local climate model designed to produce simulations of surface, plant and air interactions in the environment in spatial grids of different sizes from 0.5×0.5 m to 10×10 m. The purpose of simulation is to reveal the thermal comfort status according to the climatic characteristics, spatial characteristics (building mass, open spaces and green areas) and user characteristics of the area examined.

In the study, it was found appropriate to determine the plan-square scale of 2×2 m, considering the goal of obtaining detailed data and compliance with the building dimensions. In this case, the area where thermal comfort analyzes are carried out consists of 14,960 grid-squares (230×260 m^2), together with the external environment, which is thought to affect the thermal comfort of the campus. Adana is located in a hot and humid climate zone. Therefore, it is of great importance to be protected from the heat in outdoor in summer. For this reason, two 24-hour climatic simulation data were used for the hottest day of the year (16 August). Thanks to the BioMet software, which is an extension of the ENVI-met SCIENCE software, 2 thermal

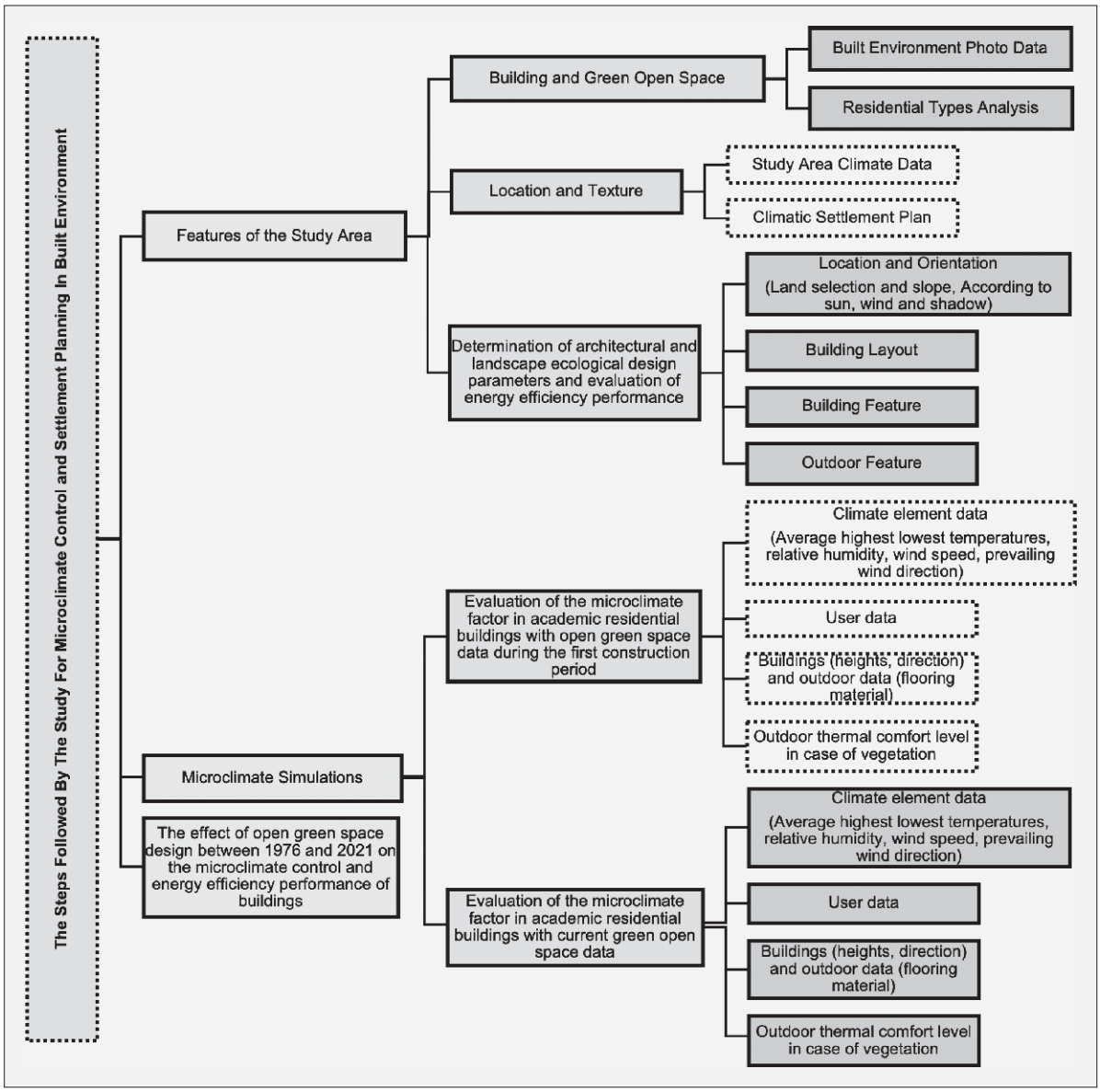


Fig. 3 Flow chart of the study

comfort models were produced, in the hottest (14:00 pm) hours.

After evaluating the thermal comfort data formed by the changing microclimate factor between the current state of the residential blocks (2021) and their first construction period (1974-1979), a comparison was made (based on Adana's year-round bioclimatic comfort and thermal requirements, based on ISO 7730 pmv index and ASHRAE scale). Based on all the findings obtained, the suggestion is that plant design should be considered in order to improve the outdoor thermal comfort.

According to the ecological design criteria, the energy performance of the buildings and the thermal comfort of outdoor spaces were analyzed at the end of the study. In order to apply the method determined in the field study, on-site observation technique was used. In the application of the observation technique, a criterion observation scheme was created for the residential buildings. A three-step answer section and a notes section have been added to each criterion. In this answer part, "Yes", "Partly" and "No" options were included. For these options, the point value of "5, 3, 0" was accepted, respectively. In one criterion, 100% – 71% performance impressions were evaluated as 5 points, 70% – 31% performance impressions were evaluated as 3 points and 30 – 0% performance impressions were evaluated as 0

points. In addition, the weights of each category are taken equal. Thus, the evaluation of the energy efficiency performance of the building and its surroundings has been provided (Vardar & Karadayı, 2020).

As shown in Fig. 3, the flow chart of the study is used to determine if the layout and outdoor green space design of the building group contribute to the ecological design criteria and microclimate control, as well as to evaluate the energy efficiency of the building.

Results

In the study, the prevention of heat gains by architectural and landscape design in the hot and humid climate region in summer was compared with two different methods. In order to understand the built environment and provide data for analysis, first of all, buildings, outdoor green area features, residential area selection criteria and texture features were examined. Then, architectural and landscape design parameters that determine effective energy use were evaluated together. Finally, Adana's year-round bioclimatic comfort and thermal requirements are discussed in a microclimate simulation of the residential area. At this stage, it was evaluated how much the improvement in the microclimate and landscaping in the hot and humid climate region affected thermal comfort.

Evaluating the Energy Efficiency Performance of Ecological Architectural and Landscape Design Parameters

External environmental factors (topography, climate conditions, etc.) and structural factors such as the location, orientation, form of the building at the settlement scale, adjacent building spacing and heights, and the building envelope are among the parameters that determine energy efficiency in buildings (Akın & Kaplan, 2019). Lechner (2021) argues that the right decisions made during the design phase of the building can reduce the building's energy use by between 50% and 90%. Another important aspect of building energy efficiency is a climate-appropriate design of the building envelope, which includes the roof, walls, and foundation (Manioğlu & Koçlar Oral, 2010). This study evaluates the measures taken in and around the building to reduce the negative effects of high temperatures during the hottest period of the year on comfort conditions. As a result of the wind direction factor having a much greater impact on orientation decisions in hot humid climates than solar radiation, there is important data that the prevailing wind direction in the study area is 225 degrees southwest (August 16) and 45 degrees northeast (February 5). The long facades of the building are oriented in the direction of the prevailing wind to reduce the discomfort caused by humidity with passive cooling techniques (Karagöz, 2016). In site selection, the cool windy hill regions of the south-facing slopes (0-6 degrees land slope) are preferred (Özdemir, 2005). When the studies on Energy Efficient Settlement and Building Design Principles in Hot-Humid Climate Regions are examined, it is seen what various design parameters given in the Table I are focused on (Koca, 2006; Ovalı, 2009; Manioğlu & Oral, 2010; Dikmen, 2011; Beyaztaş, 2012; Oscan, 2013; Özaydoğdu, 2015; Harputlugil, 2016).

The energy efficiency performance range values of these criteria were used while determining the status of architectural design parameters determined for effective energy use in the study area. Site selection was evaluated as 5 points for the slope between 0-6% on top of the slope, 3 points on the slope between 6% and 10%, and 0 points if the slope is higher.

The type selection of the green tissue around the building was used in accordance with the directions. However, the distance between the building and the tree on the south façade is greater in the C and D blocks, which does not provide a shaded area outside for the hottest period. Depending on the climate zone (hot and humid climate zone), the open space between buildings should be between 5H and 7H away from the prevailing wind direction (Özdemir, 2005). This interval is given 5 points, between H-5H 3 points. At this distance, the interval below and above the optimum value (-H, +7H) according to the appropriate building spacing parameter was evaluated as 0 points.

The Form of the Building, provided that the facade is orientated in the most appropriate direction, the ratio of the building length to the depth is among the factors affecting energy efficiency (Göksal & Özbalta, 2002). Building dimensions located on the hills on the east-west axis (Zeren, 1987, Orhon et al., 1988), optimum 1:1.7 (0.58) or maximum 1:3 (0.33) buildings provide optimum conditions for comfort (Olgyay, 1963; Karagöz, 2016). The values of the blocks area were calculated in the study as A: 0.39, B. 0.39, C: 0.37, D: 0.37, RK: 0.93. The optimum and maximum range value was evaluated as 5 points, the maximum value between 0.33 and 0.39 was evaluated as 3 points, and above this value was evaluated as 0 points.

The most suitable covering material to be used on the floor between buildings in outdoor space has been determined as gravel, grass, light color asphalt (Özdemir, 2005).

Grass and dark color asphalt materials are used around Blocks A, B, C and D. Therefore, this criterion was evaluated as 3 points. In the RK block, 5 points were given because grass was used as a cover instead of asphalt.

Optimum, good and valid orientation ranges were evaluated together according to the hot and humid climate region determined by Zeren (1987), Orhon et al. (1988), Altunkasa (1990), Gültekin et al. (2001), Özdemir (2005) in their studies. The most inclusive values are given in Table II.

According to the samples examined, priority is given to protecting the internal energy of the building in the least hot period (winter) and increasing the ventilation and cooling possibilities in the hottest period (summer) depending on the hot and humid climate zone feature. In the study, structures with a building orientation between 3° southeast and 30° southwest were given 5 points and a performance range of 100% – 71% was used for this criterion. For the 0° south-35° southwest range, 3 points and 70-31% performance representation were applied, while 0 points and 30 – 0 performance representation were applied to the orientation outside these values. Orientation in accordance with the prevailing wind was evaluated as 0° south – 45° southwest orientation 5 points, 45°-50° southwest orientation was evaluated as 3 points, and above 50° southwest orientation was evaluated as 0 points.

The building roof systems need to cover with light colored materials that reflect sunlight. The double skinned roof system is another method that can be preferred to provide indoor comfort. When the continuous circulation of the air between the two roof layers is ensured through ventilation, the heat stored in the indoor roof is lower than the external roof (Koca, 2006). In the study area, a double skin roof system was applied in blocks A, B, C and D. However, dark colored material is used in A and B blocks, and light-colored reflective material is used in C and D blocks. For this reason, it was evaluated as 5 points for a light-colored roof material and double skin roof system, 3 points for a dark colored roof material and double skin roof system, and 0 points for the absence of a double skin roof application. A hipped roof system was applied in the RK block, and a dark colored roof material was used (Fig. 4).

Architectural and landscape design parameters determining energy efficiency performance values were evaluated. The status of these criteria in the study area is showed graphically. When the percentages of meeting the architectural design parameters that determine the energy efficiency performance values are evaluated, D block ranks first with 75.5%, C block ranks second with 70%, A

Table I Ecological design parameters

Site selection/orientation	Building layout	Buildings features	Outdoor layout
Location of the structure	Width/length rate of plan	Building material	Ratio of hard material and grass surface
Slope	Width/length rate of facade	Building shell	Tree design
Orientation	Distance between building	Building facade	Tree type selection
Shadow effect	Distance between building rows	Solar energy use	Type/location relationship
Wind effect	Building array		Wind effect
			Shadow effect

Table II Building orientation for hot and humid climate region

Optimum solar orientation	Good orientation ranges	Valid orientation ranges	Proper settlement according to the wind
Wide facade, 3° south to southeast	10° southwest to 19° southeast	19° southwest to 30° southeast	Structure raised above ground open to the wind. 0-43° northeast is the wind direction that should be avoided in the least hot period. In the hottest period, 180° south and 225° southwest are the wind direction that should be protected.

Fig. 4 Architectural and landscape ecological design parameters and energy efficiency performance values

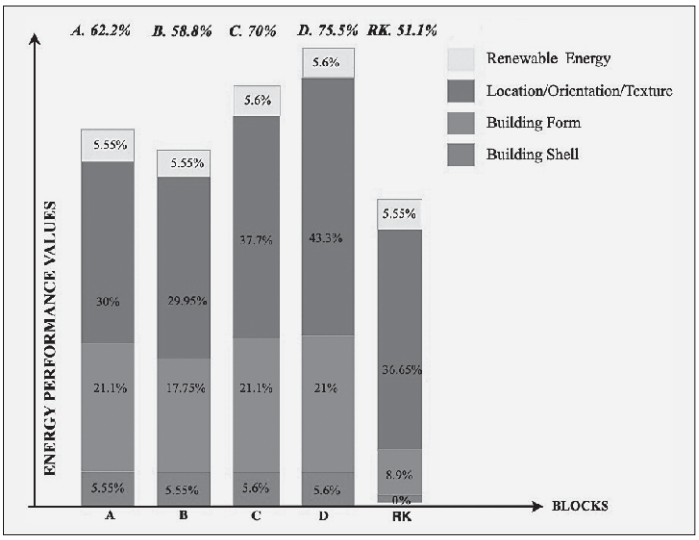


Fig. 5 Energy performance values of building

block ranks 3rd with 62.2%, B block ranks 4th with 58.8% and RK block ranks 5th with 51.1%. The percentage of meeting the 1st criterion (Location/Orientation/Texture) for blocks A, B, C, D and RK was calculated as 71.1%. The percentage of meeting the 2nd criterion (Building Form) was calculated as 64.8, the percentage of meeting the 3rd criterion (Building Shell) was 80%, and the percentage of meeting the 4th criterion (Renewable Energy) was calculated as 100%. Figure 5 includes the energy efficiency performance values of the buildings.

Microclimate Simulation Model of the Study Area

Space thermal comfort is one of the most important factors that increase its performance in terms of technical, functional, and behavioral aspects. A comfortable thermal environment is one in which the majority of people, both indoors and outdoors, can maintain their physical and mental activities regardless of the climate conditions. Depending on the level of ambient conditions, distress, palpitation, and other disturbances may occur if the places where individuals are located do not meet thermal comfort conditions (Boeri & Gaspari, 2015; Gaspari & Fabbri, 2017; Toksoy, 1993; Orhon, 1998; Santamouris, 2011; Yeang, 2012; Altunkasa, 2019; Altunkasa & Uslu, 2020). To monitor the changes in outdoor thermal comfort, two different situations in the area were compared in this context. These conditions are as follows:

– Evaluation of the situation where the buildings are placed and the surfaces outside the forestation areas made by DSI (General Directorate of State Water Works) on the shores of the dam lake are left as bare soil, asphalt, and concrete,

– Evaluation of soil floor surfaces other than asphalt and concrete surfaces covered with grass and trees detected in the study area.

It was determined that simulations should be sampled with the C and D blocks and the rectorate's residence, due to physical similarity between the two buildings and the complexity that can result from the approximately double number of grid-squares being analyzed and the excessive simulation time being required. Thermal comfort analysis was carried out using ENVI-met SCIENCE simulation software. This software analyzes outdoor thermal comfort at the grid-square or pixel level, with grid-square dimensions ranging from 0.5-1.00 m^2 indoors to 2×2, 4×4, 5×5, and 10×10 m^2 outdoors. In order to obtain clearer results, 2×2 m^2 grid squares were used in this study. Thermal comfort analyses were performed on 14,960 grid squares since the study area measures 230×260 m. As the time period for the simulation, the climate data of the day with the highest temperature on who Ali-Toudert & Mayer (2006, 2007), Allegrini et al. (2012), Doya, Bozonnet & Allard (2012), Srivanit & Hokao (2013), Almhafdy et al. (2015), Ramyar, Zarghami & Bryan (2019) were used in their studies. So, the average highest temperature of 35.1 °C in the study area during the period of 1985-2020 occurred on August 16 at 14.00, the data of this time period were also used. In addition, Table III provides information about the space and users.

Based on Fanger (1972) Predicted Mean Vote (PMV) index, thermal comfort analysis was conducted according to ISO 7730 standard. PMV is a measure of thermal comfort perceived by individuals based on various combinations of climate elements, space, and user characteristics, reflecting thermal comfort in any situation of the examined space and users. PMV also analyzes the numerical values of climate elements to determine thermal comfort, which provides a qualitative result. These results are described using the seven, nine, or eleven-point ASHRAE scale (ASHRAE Handbook, 1981). The ASHRAE scale, which was originally organized as a seven-point scale, can be modified to include two or four levels to measure thermal comfort in areas with extreme climate conditions (Gaspari & Fabbri, 2017; Toksoy, 1993; Bruse, 2004; Huttner, Bruse & Dostal, 2008; Huttner & Bruse, 2009; ASHRAE, 2018). Thus, the eleven-point scale in Table IV was used because there are extreme climate conditions according to the ASHRAE scale in the study area. Adana's year-round bioclimate comfort and thermal requirements table, as well as PMV and ASHRAE scales, were used to evaluate the simulation model results.

As part of the simulation model, 24-hour data on August 16 and data on the place and user

Table III Data on climate, space and user used in thermal comfort analysis

Climate elements			16 August 02:00 pm	User data	
Average highest temperatures (°C)			35,1	Average age	40
Average relative humidity (%)			45,6	Average height	1.68
Average wind speed(m/s)			2,9	Weight average	65
Prevailing wind direction			225° (GB)	Body mass index	18.5-24.9 kg/m$_{.}$ (normal weight)
DATA on BUILDINGS and OUTDOORS				Metabolic ratio	0.80 (for outdoor events)
Building heights	C and D blocks	23 m		Clothes feature	For summer 0.60 clo (trousers, skirts and shirts made of thin fabric) For winter 1.10 clo (trousers, skirts and shirts, sweaters and jackets made of thick fabric)
	RK block	10 m			
Building directions	Wide facades of all buildings with NW-SE Axis and NE-SW View				
Surface finishing materials	Asphalt, concrete, soil and grass surface			Elevation above ground level	1,50 m

Table IV The Eleven-point ASHRAE scale used in the study

More than 4.50		Unacceptable extremely hot	Added according to climate values
3.50	**4.50**		
2.50	**3.50**	Very hot Hot Slightly warm Comfortable (neutral) Slightly cold Cold Very cold	Seven-point ASHRAE scale
1.50	**2.50**		
0.50	**1.50**		
0.50	**-0.50**		
-0.50	**-1.50**		
-1.50	**-2.50**		
-2.50	**-3.50**		
-3.50	**-4.50**	Extremely cold Unacceptable	Added according to climate values
Less than -4.50			

shown in Table III were used to calculate PMV values using ENVI-met BioMet. The two cases of the study area were calculated separately. Using Leonardo's thermal comfort visualization module, data were classified and converted into PMV maps (Fig. 6).

Using the microclimate simulation maps in Fig. 6, two basic conclusions can be drawn regarding plant design:

– In the absence of vegetation and in the current situation, there were significant differences in thermal comfort with the PMV unit. Those areas above 4.50, which is the lowest level of thermal comfort acceptable; while 80.90% of the total area is covered when vegetation is absent, this rate decreases to 69.14% when vegetation is present (thermal comfort gain 14.54%). In the absence of vegetation, the areas between 3.50 and 4.50, which constitute the extreme hot level, were 19.10%, but with vegetation, this rate increased to 23.29% (thermal comfort gain 21.94%). There were no very hot levels (2.50-3.50) in the absence of vegetation, but 7.57% (thermal comfort gain 100%) when there was vegetation.

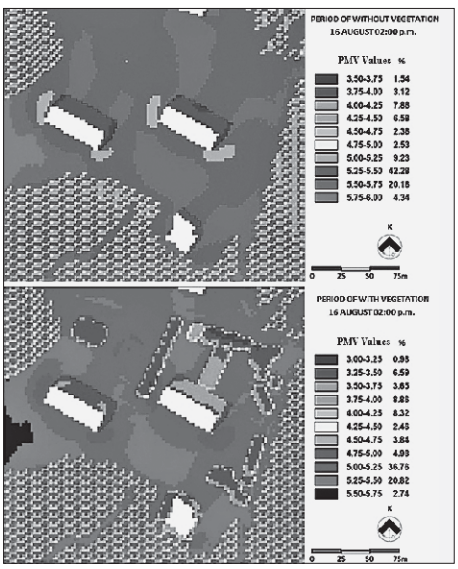
– The studies describe the thermal comfort situation at 1.50 m above the surface, that is, the microclimate perceptions of outdoor users on green areas or hard surfaces. For various outdoor activities throughout the year, the open spaces in the south of the buildings provide the best thermal comfort. Due to the complete exposure of west and southwest building areas to solar radiation, PMV values were unacceptable. For this reason, it is important to plant trees that are deciduous in winter, branch high and have a sparse/medium density texture in areas west-southwest of buildings to prevent this problem. Furthermore, this composition must be positioned within the building's height.

Discussions

Through microclimate simulations, the study investigates how planting design and tree species affect thermal comfort in a built environment. In order to improve outdoor thermal comfort, climate-balanced plant design and building energy performance are evaluated together. El-Bardisy et al. (2016) conducted microclimate simulations with ENVI-met to demonstrate how trees regulate microclimates in the outer space of a Cairo public school (Egypt). Simulations were run based on Ficus nitida (evergreen) and Delonix regia species on days with the highest temperatures during the school period (4 May 2014, 11:00 am). As a result of these findings, the average PMV value is 3.60 when there are no trees in the area, 2.90 when there is a crown of evergreen trees, and 3.00 when there is a crown of deciduous trees. It covers 80.90% of the total area with a PMV value of 4.50, which is the lower limit of the unacceptable thermal comfort level in the working area. Areas with PMV values between 3.50 and 4.50 constituting extremely hot level constitute 19.10% in the absence of vegetation. Areas that define the very hot level range of 2.50-3.50 PMV values are not available in the study area.

According to El-Bardisy et al. (2016) and Shashua-Bar et al. (2000), the downward radiation transmissivity on Evergreen Ficus nitida is less than 10% throughout the year, causing the PMV to be slightly lower in summer. Nevertheless, evergreen trees may reduce thermal comfort during winter due to their ability to block out sunlight. Evergreen trees were used in the south of the buildings in the study area. Since the distances of these trees to the buildings are greater than the height of the buildings, they do not block

Fig. 6 The PMV values/ratio of the study area on early condition and current condition



the sunlight during winter months. Therefore, there was no decrease in thermal comfort levels during winter months.

According to Tzu-Ping et al. (2012), who discovered that when microclimate conditions are above Taiwan's thermal comfort range, park attendance decreases by 80% to 50% when the sky view factor increases (shade decreases). As the sky view factor decreases (shade increases) during the period when microclimate conditions are under Taiwan people's thermal comfort range, park attendance is less than 20%. It can be understood from the findings of this study and those obtained around the residential buildings that evergreen trees on the northern façade of the buildings provide an advantage in terms of improving thermal comfort during hot weather. For this reason, recreation areas were placed in these areas with both the shadow formed on the northern façade of the building and the shade created by the trees in summer, which is considered to be very hot. Thanks to the thermal comfort improved by plant design, basketball and football fields were added to this area later.

Altunkasa (2019), Altunkasa and Uslu (2020), who conducted a similar study in the same campus on plans that recommend vegetation-free and climate-balanced vegetative design for the Çukurova University, Faculty of Architecture, which is in the construction planning stage, found areas with a PMV value of 2.50-3.00 at a rate of 4.64%. It was determined that the lowest PMV levels (3.00-3.25) were only 0.98% in this study. It is possible that this situation has arisen due to the main reason explained below in the context of plant design: the vegetative design study of Altunkasa (2019) was organized in accordance with the climate-balanced species selection and composition principles developed by Olgyay (1973) and implemented by Altunkasa (1987, 1990) according to the conditions of the Çukurova region.

Tan et al. (2021) presented that the relationship between increasing tree coverage and the resulting cooling effect is not linear. This result showed that the improvement in thermal comfort is related to more vegetation types and their combined use rather than increased vegetation. Three different plant combinations were used to cooling the outdoor space in the study. It was seen that the combination of trees, shrubs and plants improved thermal comfort by showing more cooling effect than the others. So, as a reference to our study comparing the thermal comfort of 1976 and currently, thermal comfort was improved with the combination of trees, shrubs and grass rather than the increasing tree cover.

A building designed according to ecological criteria reduces harmful effects on the environment, maintains ecological balance, and provides the necessary comfort and health conditions. Türkiye's existing dense building stock should be improved to reduce negative environmental effects of building energy consumption. This study found that the location, texture, and orientation characteristics of new buildings should be designed in accordance with the climate and environment in it. Moreover, in existing buildings, landscaping design and microclimate control can improve outdoor thermal comfort levels.

Conclusion

The goal of this study was to investigate, through a structured literature review that compares the outdoor thermal comfort of academic staff buildings on campus in 1976 and today. As a result of the study, the situations that cause improvement in the thermal comfort of the existing building stock are summarized. The lower limit of the thermal comfort level is 4.50; while 80.90% of the total area is covered by this level during the first stage of vegetation, this rate decreases to 69.14% during the second stage (thermal comfort gain 14.54%). In the first stage of vegetation, the area between 3.50 and 4.50, which represents the extreme hot level, was 19.10%, but in the presence of vegetation, this rate increased to 23.29% (thermal comfort gain 21.94 %). Areas defining the very hot level (2.50-3.50) were not found in the first stage of vegetation but gave a value of 7.57% (thermal comfort gain 100%). The open spaces in the south of the buildings are most comfortable for different activities throughout the year due to their thermal comfort. PMV values were found to be unacceptable in both cases in the outdoor areas to the west and southwest of the buildings. It is therefore important to select trees that are deciduous in the winter, branching as high as possible, and having a sparse or medium density texture in the areas west and southwest of the buildings in order to avoid this problem. In this composition, the height of the building must be at least equal to the composition's height. Thanks to the existing vegetation, a 15-22% increase in thermal comfort is achieved on the hottest days and hours of the year.

In the study in which the prevention of heat gain in summer for the hot and humid climate region was compared with two different methods; landscape design and prevention of heat gain in summer for the surroundings of blocks A, B, C, D and RK showed a positive performance of 84%. The effect of this positive energy performance level on human comfort was calculated with ENVI-met soft-

ware for the hottest day and time of the year. Architectural and landscape design decisions for hot and humid climate regions together increased energy performance by 51.1% to 75.5%. It was found that although the plant design improves energy performance in buildings by that range value, it improved outdoor thermal comfort by 15% to 22%. According to the study, building design alone is not enough to increase outdoor thermal comfort in hot and humid climates, and that building and plant design should be coordinated at the design stage.

The natural environment plays a significant role in the efficient use of energy in the built environment, and by improving the thermal comfort of people in hot and humid climates, outdoor space can be more effectively used. Under the heading of effective energy use, the main criteria of ground-orientation-texture, building form, building envelope and renewable energy use were examined. Renewable energy criterion showed the highest performance with 100%. While the building envelope criteria showed 80% performance and the ground-orientation-texture criteria 71.1%, the building form showed a positive performance of 68.8%. Therefore, both in the case of new architectural designs as well as in the case of the improvement of existing buildings, it is essential to analyze the factors of the natural environment correctly. The findings on the topography, climate, and natural vegetation of the study will provide valuable insights regarding energy efficiency in hot and humid climate.

As a final word, we need to rethink energy performance of the current building stock in order to improve outdoor thermal comfort levels in especially hot and humid climate, due to the direct relationship between the built environment and energy use, in today's world when effects of the global climate crisis are under way.

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Fig. 1 The Garden of Exile from Jewish Museum Berlin

Fig. 2 The Memorial for the Murdered Jews of Europe, Berlin

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Designing a Mystic Writing Pad after Auschwitz: Daniel Libeskind and Peter Eisenman

architectural criticism
Berlin memorial
Eisenman, Peter
Libeskind, Daniel
writing pad

In an attempt to revisit two architectural pieces of commemoration designed by two influential architects, the Garden of Exile by Daniel Libeskind and the Memorial for the Murdered Jews of Europe by Peter Eisenman, it is worthwhile to recall Sigmund Freud's 1925 essay "A Note Upon the 'Mystic Writing-Pad". This paper elaborates on the association between writing and memory and introduces how these architects use topography while placing gigantic rectangular blocks as a peculiar analogy to Freud's technique per se, that is, 'writing on a surface.' This argument opens up the discussion on the longitudinal cross-sections and the experiential qualities of these projects concentrating on their particular internalization of memory and time. Then comes Walter Benjamin and his notion of allegory into the picture to claim that Libeskind's concept of 'reading the note' may differ from Eisenman's in a reasonably crucial way. The latter's architecture expands the idea of memory and it's further functioning and places it in the realm of allegorical experience.

INTRODUCTION

"If I distrust my memory – neurotics, as we know, do so to a remarkable extent, but normal people have every reason for doing so as well – I am able to supplement and guarantee its working by making a note in writing" (Freud, 1925 /2001/: 227). Having a mnemic device to aid one in the process of remembering or memorizing things is what the short "note" by Sigmund Freud depends on, first time published in 1925. "In that case ..." adds Freud, "the surface upon which this note is preserved" behaves like a "materialized portion of my mnemic apparatus". The father of psychoanalysis and one of the most influential thinkers on memory studies in the early twentieth century then gives two technical procedures that can make his apparatus work: using a sheet of paper holding the writings permanently, or blackboard-like surface that keeps the writing for a certain amount of time. In the first option, "the surface will preserve intact any note made upon it for an indefinite length of time". So that one will possess "a permanent memory trace". When the sheet has been completely filled, it must be substituted with a fresh one to prevent the collection of "traces", which may become overwhelming.

On the other hand, "if I write with a piece of chalk upon a slate", Freud claims, "I have a receptive surface which retains its receptive capacity for an unlimited time and the notes upon which can be destroyed as soon as they cease to interest me, without any need for throwing away the writing-surface itself" (227). But in that case, one can never preserve a permanent trace. Freud concludes that the devices we use for memory cannot sustain "unlimited receptivity and maintenance of permanent traces"; we have to erase recorded notes or refresh the receptive surface. The Human memory, however, expresses or reveals the dual capacity; although susceptible to change, memory traces do last for long times; and yet it seems that there is always space for new – consciously or unconsciously recollected – traces. For him, these two devices are incapable of representing the memory.

Instead, Freud offered the "Mystic Writing-Pad (*Wunderblock* in German)", a thin two-layered sheet edging a wax slab underneath. The upper layer of the cover is a transparent sheet of celluloid, and the lower layer is translucent wax paper. When one writes/draws using a stylus, the upper surface reveals a series of black lines so the note becomes legible. The black lines disappear when this surface is lifted from the other two. The traces of the writing that have been drawn remain on the wax surface, and the indentations made by the stylus remain present. "Similar to human perceptual apparatus", the "Magic Writing-Pad" provides both an "ever-ready receptive surface and permanent traces of notes that have been made upon it" (228). Thus, there are infinite possibilities for writing and rewriting on top surface, and 'magically,' the traces of these writings will be recorded by the same apparatus as a series of superimpositions inscribed on wax.

Freud's hypothetical structure of the mnemonic apparatus has provided multiple reactions in various humanistic disciplines (Eng, 1980; Clough 2000; Verhoeff, 2009; Petersen, 2011; Diduck, 2011). For architects, this metaphor has offered a magical surface that spatially compresses complex, often non-sequential, temporal marks (Eisenman, 1998; Gandelsonas, 1998; Alberro, 2004; Zografos, 2019). What is vital in this short "Note" is that memory operates by inscribing, reflecting the ancient seal imprint metaphor.[1] Thus, remembering, for Freud, highlights the interpreting role of an informed author who is often confronted with a quasi-visible or an invisible underwriting rather than a blank page. The visual effect of two or more simultaneously present texts constantly creates a challenge each time s/he writes a new note. Transposing this onto architecture, designing

1 In *Theaetetus* (191c-d), Plato introduces the 'seal imprint metaphor' that explains memory as a wax-block on which our perceptions (memory-images) are imprinted just like the imprints of a seal. For more information, see Chappell, 2017: 399.

a memorial can constitute designing a magical surface for "making a note in writing" in Freud's terms. In that, the terrain becomes the already-written common ground on which the architect 'adds' new layers 'to remember' so that the ground presents the simultaneity of multiple material expressions, both visible as well as invisible, yet formative.

The deconstructivist generation in architecture has inherited this order of things and applied it, particularly in monuments and memorials related to social traumas. Mainly under the influence of Freud and Foucault, they arranged architectural works as fragmented, layered, and unstable – especially searching for "a fractured sense of the subject, the social, and the historical" (Foster, 2010: 136). In fact, in his seminal text on architectural diagram, Peter Eisenman literally refers to Freud's memory tool to formulate his own theory of diagram, that is "a series of surfaces or layers which are both constantly regenerated and at the same time capable of retaining multiple series of traces" (1998: 29). For him, a writing-pad-like diagram was a tool to expand the field of architecture into more conceptual terms. What is important for the purpose of this paper, however, is to shift the focus from the surface of the diagram to the architecture itself. Effectively placing memorials on the front row, it argues that the architectural characteristics of the mystical writing pad can be better comprehended in two commemorative projects: the Garden of Exile as a part of the Jewish Museum Berlin, designed by Daniel Libeskind and completed in 2001 (Fig. 1), and Peter Eisenman's Memorial for the Murdered Jews of Europe, ceremonially opened in 2005 (Fig. 2). Giving the writing surface a certain depth, these two influential architects have designed a *Wunderblock* to write down the 'memory' of an "immeasurable and unsharable burden", as Libeskind puts it (Libeskind, 1992: 86). Like Freud's Note, both projects emphasized the human viewpoint and the sensual experience of experiential juxtapositions of time, space, material, and memory, all regulating the force of the past in shaping the present. Each 'architectural pad' simultaneously becomes the place "where this memory has been deposited" so "reproduced at any time" (Freud, 1925: 227). As stated by Libeskind, "(the visitors) all are Berliners, were Berliners, and will be Berliners", they should also find in it a shared hope, which is something created in individual desire (1992: 84)".

Two Architectural *Aide-Mémoire* from Berlin

The first project is a permanent outdoor installation for the Jewish Museum Berlin, titled the Garden of Exile. According to Libeskind's official design proposal, the project is "between two lines of thought: one is a straight line, but broken into fragments; the other tortuous and complex, but continuing indefinitely" (1992: 86). To him, it is only possible to understand the history of Berlin by understanding the enormous intellectual, economic, and cultural contributions made by its Jewish citizens. In that sense, the meaning of the Holocaust had to be integrated physically and spiritually into the consciousness and memory of the city of Berlin (Libeskind, 2001). Following these initial thoughts, the architect designed three subterranean axes intersecting in the lower level, each represents one of three realities of German-Jewish history. The first and longest axis, the "axis of continuity", begins in the existing Berlin Museum Building as the new addition has no entrance. Visitors access through an underground passage and the axis resumes via a long staircase steeply upwards (Fig. 3). Visitors reach the exhibition floors from these stairs, where the permanent exhibition will provide an overview of the past and present of Jewish Germans. The second axis, the Axis of the Holocaust, is a dead end, leading to the Holocaust Tower left in bare concrete. It is neither heated nor insulated and remains cold and damp even in summer. During the day, light falls inside this area through a single high, thin window slit. The noise from the street is audible, but the outside world is out of reach.

The only way out of the new building is at the end of the third axis, the Axis of Exile, leading out into the Garden of Exile. The corridor leading to it rises with walking. Daylight is visible at the end of the corridor, which grows continually narrower. The walls are slightly slanted, and the floor is uneven. A heavy door

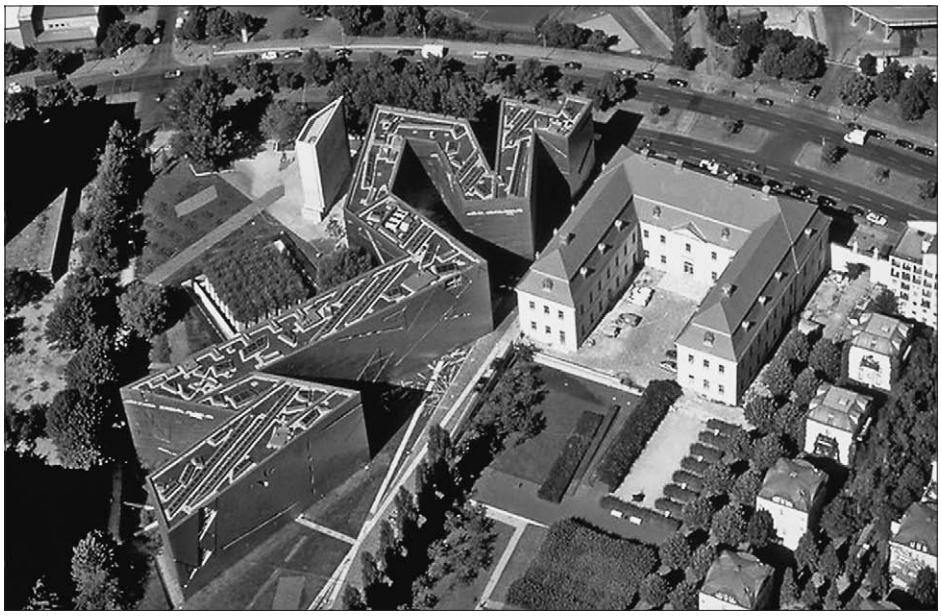

Fig. 3 The aerial view of the baroque Old Building and Daniel Libeskind's Jewish Museum Berlin designed as an extension. Upper left is the Garden of Exile.

FIG. 4 THE AERIAL IMAGE OF THE 2,711 CONCRETE SLABS WITH VARIED HEIGHTS

leads to the Garden consisting of 49 concrete pillars or stelae – a Greek term for a slab or upright stone used as commemorative markers in ancient times. Seven meters high, the monolithic pillars rise out of a 7-by-7-meter square plot, each spaced a meter apart. The whole garden is on a 12° gradient, and the slanted columns raise perpendicular to this tilted floor. They are arranged in a square of seven rows of seven pillars (Sodaro, 2013). Forty-eight columns are filled with the earth from Berlin, signifying the birth of the state of Israel in 1948, and the forty-ninth, at the center, stands for Berlin and is filled with earth from Jerusalem (Young, 2000: 18). Olive branches grow from the pillar tops, forming a green canopy over the garden.[2]

Libeskind has been a longtime friend and collaborator with Peter Eisenman. Eisenman has expressed his admiration for Libeskind's work (Eisenman, 1992: 120). However, he also criticized some of Libeskind's designs for being too focused on symbolism and narrative (Dorrell, 2004). Thus, the latter's haunting monument constitutes a comparative case study for representing a sort-of-similar but different architectural response to commemorate the millions of Jewish lives lost in the Holocaust, a phenomenon to which I will return in the concluding remarks.

Completed and opened to the public in 2005, Peter Eisenman's Memorial for the Murdered Jews of Europe is located in central Berlin, on the site of the formal ministerial gardens (Fig. 4). The project is remarkably also a field of stelae, more precisely, a field of 2,711 high-quality concrete slabs of varying heights, arranged in a grid pattern over an area of approximately sixteen-thousand square meters. They are arranged in 54 axes from north to south and 87 axes from east to west. The pillars are 95 cm apart, allowing only individual passage through the field. The paths are paved, and 180 lighting units are sunk into the ground. Forty-one trees on the site's western side lead visitors from the famous Tiergarten of Berlin.

The Memorial conceptually symbolizes the instability that exists within what appears to be a system, two undulating superimposed grids fading away over time. Eisenman sculpted the flat site into rolling contours so that the stelae's different heights were exaggerated, then tilted them from 0.5 to 2 degrees in two different directions to maintain an overall unity of a level top (not slanted) within this dynamic constructed topography. Below ground, in the southeast corner of this installation, a Place of Information is designed as a big underground exhibition area and lecture rooms. One can see the stelae of the field from this space, provoking a constant state of reflection and contemplation once inside. The monument is designed to create a sense of disorientation and unease as visitors walk through the maze of slabs on uneven topography. It creates optical illusions, with the slabs appearing to slope in different directions, adding to the sense of confusion and discomfort. The stark and cold concrete slabs evoke a sense of isolation and emptiness, which led to its public reception as "a graveyard for those who were unburied or thrown into unmarked pits" (Brody, 2012).

The common ground that holds these two 'architectural notes' together is elaborating a theme of repetition with displacement by using abstract pillars, gridded plans, and rolling terrain to create a powerful kinesthetic, tactile, and visual experience. These architects "note down a memory", representing the hideousness of the event but not in a way causing displeasure. Moreover, these 'notes' are not private archives; they were built in most public places, so anyone interested can "reproduce it at any time", as Freud would have put it. Inextricably tied to this question of bodily engagement and public presentation are the issues of memory and memorialization, the nature of mourning, and the passage of time. All things considered, the way of responding to these questions by creating layers for different temporalities is these architects' salute to Freud's magical *aide-mémoire*.

2 Amy Sodaro (2013: 85) refers to the use of greenary growing out of stone as an influence to Andy Goldsworthy's *Garden of Stones* installation in Museum of jewish Heritage.

The Architect-Author Writing Between Two Surfaces

For Libeskind and Eisenman, the only way to be able to write down the memory of this horrible act is to design a specific writing-pad. Like the mystical one, these two projects can be interpreted as a series of constantly regenerated layers capable of retaining multiple traces. Both projects are between two surfaces with different tectonic qualities. In Freud's terms, the upper layer which receives the actual stimuli is the dual paper covering where the celluloid sheet is "an external protective shield against stimuli whose task is to diminish the strength of excitations coming in". The layer underneath the protective shield represents "the system of perceptual consciousness". In the Garden of Exile, the top plane created by the upper levels of the columns constitutes the celluloid sheet of paper, while the ground plane forms the pad (Fig. 5). The outer layer where the original writing takes place, in fact, is not transparent as suggested by the magical pad but veiled by the planting growing out of the pillar tops. This particular volume's potential porosity and heterogeneity is too loose to be interpreted as an additional layer above the first one. Instead, it is combined with the top plane and creates a dark writing surface where one cannot read his writing or what is written unless the traces in the wax paper have been seen. This writing-pad is designed for the Holacoust, allowing one to write with a dark stylus on a dark surface – no need to see what to write as it is already known. The darkness of the planting suggests that only through an already-defined consciousness can one allow the other to "note down the memory" of such a disaster. Only through a semi-transparent veil can the remnants of history make sense. The wax paper underneath is the light where the script became legible, and the darkness will be read here, the darkness that the readers of this note will articulate. This layer in Libeskind's writing pad gains depth and behaves like a wax volume rather than wax paper. Put differently, the "layer which actually receives the stimuli" is spatialized and turned into a striated atmosphere that will transcribe the writing.

Despite the difference in scale between this Garden and the Memorial for the Murdered Jews of Europe, it is still possible to point out similar design ideas. The pillars in Eisenman's monument form the upper plane at eye level and stretch between two undulating grids. Although the difference between the ground plane and the top plane may appear random and arbitrary at first, a matter of pure expression, this is not the case. All planes are determined by intersection of the voids on the pillar grid. A field of calculated instability has been created in the way these two systems interact. The relatively steady, gradual change of the upper plane contrasts with the rolling topography under the feet of the observer (Fig. 6). Thus, the top plane constitutes the transparent upper sheet covering a translucent wax volume with an undulating wax slab underneath.

Fig. 5 The tilted concrete stelae and the vegetation growing within

These two gardens of pillars, understood as a stratum of superimposed traces, offer the possibility of opening up the visible to the articulated, to what is within the invisible. In this context, the experiences, if not the wanderings of visitors may reveal the key to the analogy that this paper made in order to claim that for these two architects, the only way of making a note of this horrific memory was by designing a memory-specific writing pad that operates between two magical surfaces within multiple temporalities.

Fig. 6 The view along the path between concrete stelae moving from outside to inside

The Visitor-Reader Experiencing the Unstable Writing-Pad

In the Jewish Museum Berlin, Libeskind has built several claustrophobic spaces along three axes, so visitors are never where they think they are. They know that the door at the end of the corridor should lead them outside, but the compact arrangement of walls does not allow them to breathe fresh air yet. The site slopes steeply from the entrance alongside cold grey surfaces. When they finally reach outside to the Garden, the height and proximity of the concrete columns make the

Fig. 7 The view looking up from the Garden of Exile

trees unobtainable. However, the green covering the sky creates an imaginary cloud and isolates the visitors from the outside (Fig. 7). Moving through this environment is difficult without familiar horizontal and vertical reference points. Only a glimpse of faraway buildings is level in this new world. Rhythms of spatial compression and release characterize the architecture of Libeskind's writing-pad. It creates an interplay of perspective and close-up where the Gestalt between columns directs one's attention to the scale of the columns, and thus the columnar organization performs an interplay of tactile and optical illusions. Simultaneously, the sloping ground is disorienting and makes one feel nauseous, like being on a boat – a physical sensation of how unsettling it is to be culturally adrift/in exile. It is also an appropriate metaphor for what Libeskind calls the "shipwreck of history" (1990). Moreover, the Museum and this garden speak to visitors kinesthetically, and wandering bodies feel a deliberate sense of rootlessness.

In Eisenman's case, the Memorial looks like a concrete garden with blurred borders, as the stelae on the periphery are barely centimeters in height. No main approach or portal leads one to the Memorial. All four sides of the city block are open for 'readers.' As one enters the narrow paths between slabs, the ground gradually starts plunging, and the stelae become well over his/her head. The repetition of the same elements and the dramatic changes in height creates a severe displacement, and one cannot even locate his/her entrance spot. As the reader continues to walk without knowing where to end up, the ground rises and falls in a random undulation. The pillars towering above cut off any vision of the horizon or any clue about life in the city.

One path looks like another; a sense of direction is impossible to maintain. Within this crowded forest of stelae, one sees other people passing in and out of the vision as they trespass the Memorial's paths. Based on how fast they enter and exit one's vision, people become characters with different clothing/colors operating in this system (Fig. 8). Thus, a way to memorize any one of these paths might be to record one path with a character seen there. However, as everybody is moving, all the paths are also moving. While these characters become abstract bodies, the reader still feels alone and disconnected from all others. This condition strengthens the uniqueness of the reading, one person, one note, one point of view. Though the *raison d'être* of the Memorial is a public note, the person who wants to reproduce it is now alone and can rewrite her/his memories individually. Being alone within a crowd is the feeling created by the magical writing-pad. When leaving the Memorial, if the visitor looks back on the field of stelae, s/he will see a completely different visual portrayal of the site. Now, the shades and shadows demarcating the differences in depth, colors carried by bodies against the cold 'grayness' appearing and disappearing, variations in angles and slopes, and the undulating top plane mimicking the horizon are all in one's field of sight. Appearing the same at first sight, now, the slabs are of varying heights, with degrees of slant, shading, color, and reflection. One may never be able to walk the same path and feel exactly what s/he felt in another 'reading' because each experience is as individual as each slab in the field of 2711. However, this sensitive memory is so horror-laden and multifaceted that whenever one enters the forest, the uncanny will show another face of its. More than that which is seen or which is present, it is no longer entirely a mere representation or an illustration of the past. Instead, readers' experiences can be a re-presentation of this

3 Peter Eisenman's theory of the architectural diagram is heavily influenced by Derrida. In his essay, "Freud and the Scene of Writing" (1978), Derrida questions Freud's choice of the writing pad, which is a writing machine, as a metaphor to represent the functioning mechanism of the unconscious. For Derrida, a mechanical machine, although a child's toy, will always fail to characterize the psychical apparatus and cannot be used to record phonetic signifiers. While acknowledging Derrida's reading of Freud, this paper limits itself with the use of the *Wunderblock* precisely as an architectural analogy for the simple act of 'building/writing neutral concrete blocks on earth's surface/writing pad' to make people remember.

4 Walter Benjamin's theory of allegory is a rich concept and has a rich area of scholarship, as it allows for the ex-

intervening apparatus called memorial. In this sense, the architecture of memorial is the potential space for writing a personal note about a chosen event.

As such, the main concern that these memorials address is acting as an agency that focuses on the relationship between an authorial subject, a receiving subject and the memory apparatus; it is the strata that exist between them. The memorizing process will only run with some psychical input from a subject. The subject should first write, then go back and read the note because the note cannot be "reproduced" from within the memory. According to Freud, only the subject can reconstitute the past; the note does not do so. He argues, "there must come a time where the analogy between this apparatus and the prototype cease to apply" (1925 /2001/: 230). In these two memorials, the "spatial note" becomes rational and mystical, a strange superimposition of the two. Hence, the act of reading is performed through visitors' wanderings. The wax slab/ ground surface and the cover sheet have already been separated to erase whatever was written without losing the initial writing – and the architects let the readers into the zone of countless readings. Both architects designed the way how visitor recollect the memory; they designed the space of the memory and then stepped aside to allow every individual to experience the pad and read his/her own note about the shared trauma. In that sense, these memorials act like figurative representations of the function of the memory. However, each architect had a different way of representing this abstract notion.

Conclusion

It has been showed that the space of memory and the architectural act of writing has evolved in abstract ways in both Memorials, which in turn brings us back to Eisenman's formulation of the architectural diagram. While analyzing the processes of the diagram, he refers to Derrida's comment on the mystic pad's temporal structure that includes Kant's three modes of time: permanence, succession, and simultaneity (1998: 29).[3] The first one is the perpetuity provided by the role of wax. The second aspect is a sequential order orchestrated by lifting up the upper layer and erasing/writing/rewriting new notes. The last one is the specific condition of coexistence of the superimposed traces on different levels. Embracing these three modes of time, the architectural diagram presents "a discontinuous conception of time" and is thus formulated as an "interstitial condition between space and time" (1998: 29). For Eisenman, the diagram is not a generator to architectural form, "the diagram does not generate in or of itself" (Eisenman, 1998: 29). He never commented further on the translation from diagrammatic stage to architecture stage. Yet in our cases, the exact similar idea of temporality was involved in the architecture of the stelae fields. The memorials function as an interface between the recollected event and the remembering subject. In the Garden of Exile, the stelae grew to repress the primal desires and anxieties – indeed, to repress the "savage" past – which would return to haunt future generations. Trapped in its own fixed sense of time, however, its architecture did not allow for the return of the repressed, which entails a dynamic rather than static relationship between the past and the present. Here, memory as a trace of the past remains in the conscious mind within the present moment.

In Eisenman's case, on the other hand, the architect calls for a constant change as the time of the undulating ground plane is perceptually and conceptually different from that of the top plane, which reaches zero and dissolves into the city fabric at the peripheries of the Monument. The Memorial underlines this distinction as such, thus creating a place of loss and contemplation as elements of memory. As with the mystic writing pad's working principle, the unconscious/conscious mind is multilayered, each layer constituting a different relationship to time and memory within a subjective experience. As such, Eisenman's diagram was literally translated into an architectural object that is sensed and experienced rather than just read. One can speculate more on Eisenman's temporality based on bodily movement if we do not limit the analysis to Freud's analogy but rather see Eisenman's way of note-writing as designing an allegorical experience in Benjamin's terms.[4]

The theory of allegory, as presented in *The Origin of German Tragic Drama* (1928), emerges from the playwrights and scenographers' attempt to "merge the temporal dimension of the narrative word with the spatial extension of the allegorical image into a singular theatrical experience" (Osman, 2005: 122). I argue

Fig. 8 Visitors along the paths

ploration of complex ideas and historical events through a symbolic lens. In many of his works, he used the term with associations that are at once political, philosophical, aesthetic, religious, and historical.

In "The Origin of German Tragic Drama", Benjamin argues that allegory is a crucial element in the study of German drama, as it allows for the representation of complex philosophical ideas and historical events. Similarly, in his essays on the philosophy of history, Benjamin uses allegory as a way to critique historical narratives, arguing that it can reveal the hidden meanings and suppressed aspects of history.

For further studies, see Bloomfield 1972, Cowan 1981, Beiner 1984, Owens 1994, Koepnick 1996, Isenberg and Benjamin 2001, Osman 2005.

that the design and experience of Eisenman's Memorial operate in much the same way. In a more conventional setting, visitors would have immersed themselves in the Holocaust by trying to internalize the testimonies of the witnesses or by becoming a witness by visiting the camps, the gas chambers, the ovens, the burial sites, and other places of death and torture. However, Eisenman's highly orchestrated, cold, and timeless scenography of the stelae field challenges the visual power of the one-point perspective of the reader/visitor. Throughout a walk within the Memorial, new viewpoints and moments of surprise appear as one moves. Wandering between the cold concrete changes her/his perception permanently as s/he now understands how the trauma might have impacted personal senses and hence, memories. In this context, the dense and traumatic memory of the Holocaust is set within a field designed to create a perspectival illusion constantly compromised by a series of moving subjects, plays of shade and shadow.

As explained by Benjamin, the body is very significant in the representational system in his work on allegory (1998: 166): "... in allegory, the observer is confronted with the f*acies hippocratica* (death's head) of history as a petrified, primordial landscape". Without a relationship to the past that could illuminate its significance for the present, the memorials make the reader admire the past and the transitory nature of things. To Benjamin, the history that animated these things ran like lifeblood out of bodies, leaving behind corpses. The corpse figures as the allegory of history, as the sign of its decline. In both Libeskind and Eisenman, the stelae have become such corpses but in different terms. In contrast to the momentary mystical experience of the symbol tied to the aesthetic realm in Libeskind, allegory takes its part in Eisenman's Memorial. The latter does not reveal any absolute meaning. Instead, it embraces ambiguity in significant part because of its dependence on the visual.

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Illustration sources

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Fig. 1 Centre Pompidou, Paris, France

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Interaction between a Museum and a City in Europe
Framework for Methodological Evaluation

CITY
MUSEUM
PUBLIC SPACE
URBAN IDENTITY
URBAN TRANSFORMATION

The article examines different viewpoints on the museum's role in the transformation of urban identity. The review of existing research aimed at mapping and exploring the museum-city interaction and its features throughout history. The selected studies were categorized and analysed according to the field they cover (urbanism and architecture, economy, sociology and museology). The analysis has shown that the interaction between the museum and the city can be traced throughout history and that it experienced its first rise in the mid-1970s with the construction of the Pompidou Centre, and then in the late 20th and early 21st century, influenced by modern phenomena of globalization and migration. Due to the new way of interaction, museums have changed their architecture and purposes, repositioning themselves as a new tool for urban transformation. A tentative conceptual framework and methodology were set up based on research literature to evaluate the interaction between the museum and the city. Further research is necessary to explore and define those interactions and tools that will encourage the role of European museums in promoting and transforming urban areas.

Introduction

There is no global agreement on what is a city. Rather, the many diverse definitions vary between countries and regions, ranging from those using a single criterion (e.g. population threshold) to those using a mix of criteria (e.g. combination of population size, density, administrative delimitation, economic occupation etc.) (Parr, 2007; Bettencourt and Lobo, 2016; Dijkstra, Poelman and Veneri, 2019).

Despite the attempts to find a common definition for comparative purposes, a city is much more than the number of citizens. It is a living entity with its own identity, a potent force to drive innovation, consumption and investment with a vibrant capacity to respond to the demands and needs of its inhabitants, as well as to influence its surroundings.

The development of a city depends on various factors: geographical location, population growth, the consequences of natural disasters, the presence of natural resources, agricultural activities, trade opportunities, social organization, the development of industry, new building technologies, etc. With the end of the industrial age, cities lost an important backbone of their economic development and turned to new sources of funding and growth. The post-industrial era spans from the mid-1970s to the early 1980s (Lever, 1991). At that time, the economy turned to the tertiary sector of activity (trade, transport, catering, banking and tourism), which today employs more than half of the European population. With the development of technology and socio-cultural changes, a new type of capitalism was being launched. At the local and national levels, cities and states understood the potential of cultural institutions as new drivers of urban regeneration. Museums, as globally accepted and popular cultural institutions, are particularly recognized as an important component of urban development whose value goes beyond a specific cultural object to embrace economic goals, employment and revenue (Van Aalst and Boogaarts, 2002; Brida, Meleddu and Pulina, 2012).

Currently, the museum is defined as a non-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage.[1] However, today the museum is increasingly understood as an economic unit, an enterprise able to contribute to the economic development of the city/region in which it is located (Evans, 2003; Plaza, 2006; Paül I Agustí, 2014). The museum is thus perceived as an urban focal point that transforms and enriches its environment in a socio-economic way (Ozorhon and Ozorhon, 2015).

The idea of the museum as a tool for urban regeneration was introduced in the mid-1970s with the completion of Centre Pompidou in Paris (Van Aalst and Boogaarts, 2002). This is one of the first examples of a museum as a metropolitan focal point, which was planned with the premise of urban renewal of the 4th district, the Beaubourg area. Soon enough it yielded a big success and became an example of a prosperous project for urban regeneration. Later on, the idea was followed by numerous newly-built museums, or expansions of existing ones, with the same intent. There are many famous examples of museums that have led to urban renewal, such as Guggenheim Bilbao, Tate Modern London, Louvre Museum in Paris etc. The implementation of this concept has been studied in cities in Europe and the United States. In European cities, such framework of urban development is further encouraged by the establishment of the European Capital of Culture programme, which was adopted in 1985, when the city was perceived as a place of culture after industrial production had declined and ceased to be the most important economic branch of development (Evans, 2003). The programme further strengthened the idea of culture as a driver of city development and set a new value scale for the success and socioeconomic status of the city. The transformation of parts of cities that were neglected after the industrial decline into cultural institutions was also justified by the preservation of heritage structures.

1 http://icom.museum

Rise of the Museum and Contemporary Urban Development

In recent times, cities have been faced with challenges. Rapid growth of the world's population is mostly concentrated in urban areas. New economic and cultural opportunities of globalisation leading to increased mobility of people, objects, ideas and knowledge, together with the ongoing political, economic and cultural processes of the creation of the European Union, have had a deep impact on the development of contemporary cities in Europe. Museums, as institutions historically responsible for representing society, documenting its transformations and conserving its memory and history, contribute to these changes by undergoing a process of deep transformation of their missions, strategies, practices, spaces and exhibitions (Montanari, 2013).

The second rise of the museum, which marked the end of 20th and the beginning of 21st century, has witnessed the effects of contemporary phenomena of globalisation on the form, organisation, mission and status of museums, indicating their potential role in facilitating mutual understanding and social integration in the creation of a new European identity. With the new role, museums were changing their primary function and the traditional understanding of what a museum space is, setting up a potent mechanism for the regeneration of the city or its parts and implementing new ways of interaction. In this way, museums have significantly contributed to the transformation of urban culture in the context of European integration (De Frantz, 2005). As they have grown into a key element in city marketing, attracting visitors and investments, museums are becoming one of the most popular strategies for modernizing urban areas and a potent urban landmark with the exceptional power to transform their surroundings (Ozorhon and Ozorhon, 2015; Gibson, 2013; Paül I Agustí, 2014).

The Museum-city Interaction

The museum-city relationship is complex, as they interact at many different levels. Through literature review, the present study aims to identify theoretical grounding or relevant conceptual frameworks for establishing an initial methodology to evaluate the museum-city relationship. Although there are many studies that consider the development of museums and their impact on urban development, there is a lack of a comprehensive and systematic approach to this topic. This paper will present, analyse and systematise the available literature on the subject, using an interdisciplinary approach by considering four main aspects of this topic: urbanism and architecture, economy, sociology and museology. Through an analysis of different museum-city interactions, this study aims to explore and pinpoint possible frameworks, practices and tools used to promote the role of European museums in the endorsement of urban development and urban cultural governance.

The first part of the paper describes the methodology and criteria used for selecting relevant studies that explore the relationship between the museum and the city in different time periods in Europe.

The museum-city relationship in the analysed studies is assessed and viewed from at least one out of four different approaches: urbanism and architecture, economy, sociology and museology.

The second part of the paper defines and describes the elements of interaction that were selected through literature review and classifies them into four comprehensive groups: urban policy, location, architectural form and social space.

In the third part of the paper, a link between the defined interactions and the spatial scale (state/city – city district – building – interior) is formed. This enabled creating a tool that makes it possible to select different combinations of interaction elements and spatial scale to be used for further studies, depending on the interest of the researcher.

The identified tool could be further developed in the future with the addition of new elements emerging from ongoing opportunities and challenges that drive the diversity and transformation of the museum-city interaction.

Literature Search for Elements of Interaction

The references were collected by searching for a combination of keywords – city, museum, public space, urban identity and urban transformation – in the research databases. A total of 70 papers that analyse museums in European cities over time were selected. After reviewing, 31 publications published from 1993 to 2021 were selected and they explore the relationship between the museum and the city using at least one of the four different approaches: urbanism and architecture (8 studies), economy (7 studies), sociology (8 studies) and museology (8 studies) (Fig. 2).

The selected research articles were systematized depending on the year of publication, the predominant field of interest (urbanism and architecture, economy, sociology and museology) and the period of interest. Museums which were built by the middle of 20th century were considered historical and those built from the middle of 20th century on were

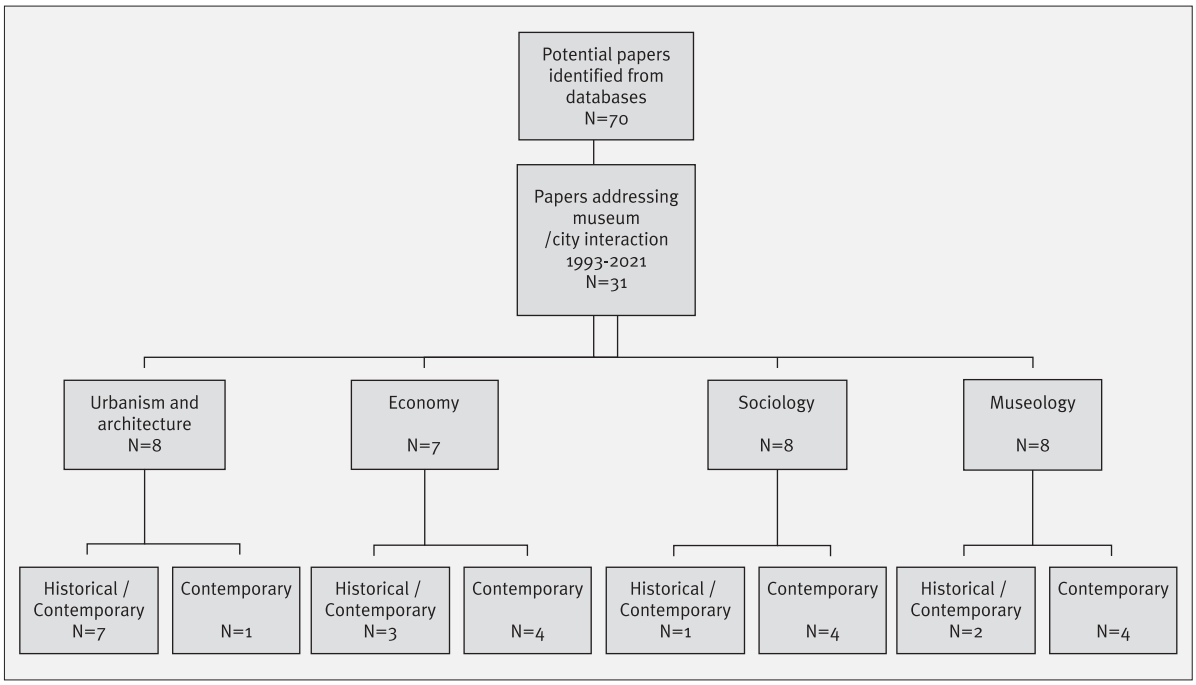

Fig. 2 Flowchart of selection and grouping of analysed studies

considered contemporary. The number of studies that examine the museum-city relationship through a parallel analysis of historical and contemporary museums is the same as the number of studies that analyse the museum-city relationship using just contemporary museums (13 studies). Five studies did not use a particular museum as a research topic (Table I).

The selected studies considered the museum-city relationship through one or a combination of areas. For example, some studies observed how the relationship between the museum and the city affected the financial aspect of the city/state and the museum itself, while other studies observed this relationship from a sociological viewpoint, studying how the museum affects the prosperity of citizens living in its surroundings. It can be seen that the studies that analysed both historical and contemporary museums were more concerned with urbanism and architecture, while the studies that analysed contemporary museums were more interested in topics from the fields of sociology and museology. The field of economy was of equal interest to both types of studies.

Definition and Systematisation of Elements of Interaction

The elements of interaction between the city and the museum were separately analysed in each paper. The exhaustive list of elements of interaction was then considered and conceptually aligned. Finally, 14 elements of interaction were profiled, defined and systematized into four comprehensive groups denoting different types of interaction between the museum and the city: urban policy (1), location (2), architectural form (3) and social space (4) (Table II).

The first group of interaction, *Urban policy* (1), relates to the city/state policies and their standpoint towards the museum. In some cases, there are very strong culture-led urban strategies where city/state governments recognize the potential of cultural buildings, including museums, for urban renewal, which is followed by economic and social well-being. Urban policy consists of four main elements: urban-economic development strategies, size, global or local impact and returns on investment. Urban-economic development strategies element explores how city/state leadership considers the museum – as an urban activator or an institution that is not expected to have particular impact on urban development. The size factor correlates the size of the city and the museum, as well as the population of the city and the number of museum visitors. The global/local impact of the museum investigates the influence of the museum on local surroundings and the city/state in general. This element explores whether the museum has become a must-see tourist attraction that brands the city, whether there has been any influence of the city on the museum, and whether the number of museum visitors correlates to the number of city visitors. The return on investment in analysed studies was assessed based on muse-

Table I Selected studies systemised in subject groups

Literature unit	Field of interest	City / Museum	Historical / Contemporary Museum	Period of interest
Urbanism and architecture				
Griffiths,1993	Urbanism	Glasgow, London	H + C	1857-1992
Van Aalst and Boogaarts, 2002	Urbanism / Architecture	Amsterdam / Museumplein Berlin / Museuminsel	H + C	1970-2000
De Frantz, 2005	Urbanism / Architecture	Vienna Museumsquartier	H + C	1970-2004
Giebelhausen, 2006	Urbanism / Architecture	Berlin, Bilbao, Groninger, Hamburg, London, Luxembourg, Madrid, Munich, Paris, Rome, Vienna	H + C	Antiquity – 2004
Tali and Pierantoni, 2011	Urbanism / Architecture	Budapest / LUMU Tallinn / KUMU Zagreb / MSU	C	1930-2009
Paül I Agustí, 2014	Urbanism / Architecture	Barcelona, Paris, Turin	H + C	2000-2013
Ozorhon and Ozorhon, 2015	Urbanism / Architecture / Economy	Istanbul / Topkapi Palace Museum, Museum of Modern Art, Naval Museum	H + C	1478-2014
Kochergina, 2017	Urbanism / Architecture	Museum Quarters Vienna, Berlin, Amsterdam, Copenhagen, Budapest	H + C	1970-2017
Economy				
Newman and Smith, 2000	Economy / Urbanism	London	H + C	1910-2000
Swyngedouw, Moulaert and Rodriguez, 2002	Economy / Urbanism / Architecture	Athens, Berlin, Bilbao, Brussels, Copenhagen, Dublin, Naples, Vienna, Lisbon, London, Rotterdam	C	1979-2009
Evans, 2003	Economy / Urbanism / Architecture	Barcelona / MACBA Berlin / Imperial War Museum, Jewish Museum Bilbao / Guggenheim Paris / Louvre, Centre Pompidou	H + C	1851-2001
Plaza, 2006	Economy / Architecture	Bilbao / Guggenheim	C	1976-2004
Plaza and Haarich, 2009	Economy / Urbanism / Architecture	Bilbao / Guggenheim	C	1980-2008
Brida, Meleddu and Pulina, 2012	Economy / Architecture	Bolzano / Archaeological Ötzi Museum	H + C	2007-2010
Degen and García, 2012	Economy / Urbanism / Architecture	Barcelona	C	1979-2008
Sociology				
Taborsky, 1982	Sociology / Museology	–	–	15th century – 1980
McTavish, 1998	Sociology / Architecture / Museology	Paris / The Louvre Museum	H + C	1895-1998
Gospodini, 2001	Sociology / Architecture	Bilbao / Guggenheim	C	1950-2000
Gospodini, 2002	Sociology / Urbanism	European metropolitan / larger / smaller cities	–	1980-2021
Mitrache, 2012	Sociology / Architecture	Bilbao / Guggenheim	C	1980-2000
Gibson, 2013	Sociology / Museology	–	–	1990-2011
Heidenreich, 2013	Sociology / Urbanism	Essen / Museum Folkwang	C	1875-2012
Ruggiero, Lombardi and Russo, 2021	Sociology / Museology	Paris / The Louvre Museum Trento / The MUSE Antwerp / Museum aan de Stroom	C	2019
Museology				
Harrison, 1993	Museology / Sociology	Great Britain	C	19th century – 1992
Abt, 2006	Museology / Architecture	From antiquity to the 20th century, European cities	–	Antiquity – 20th century
Hillier and Tzortzi, 2006	Museology / Architecture	London / Tate Museum Verona / Castelvecchio	H + C	1984-2006
Macdonald, 2007	Museology / Architecture	–	–	1960-2006
McCall and Gray, 2014	Museology	Great Britain	C	1971-2013
MacLeod, Dodd and Duncan, 2015	Museology / Architecture	Manchester / Imperial War Museum North	C	1965-2014
Tzortzi, 2016	Museology / Architecture	Antwerp / Museum aan de Stroom Athens / Acropolis Museum Berlin / Jewish Museum Rome / Museum of Palazzo Valentini	H + C	1999-2014
Tzortzi, 2017	Museology / Architecture	Aarhus / Moesgaard Museum	C	1966-2017

um earnings per year, retail per m^2, employment, whether the museum is a of part of cultural investments, ownership of the museum and number of visitors.

The second group *Location* (2) includes elements that describe the positioning of the museum in the urban context. This factor is important for the museum's impact reach and can directly lead to a positive, neutral or even negative influence, primarily on its neighbourhood and then on the city and its wider surroundings (Paül I Agustí, 2014). The location interaction group includes three elements: location in the city, spatial relations and water/greenery element. Location in the city defines the area where the museum is placed (historic, city centre or urban peripheral area). Spatial relation analyses the sur-

Table II Elements within each interaction between a museum and a city

Urban policy			
Urban-economic development strategies	**Size**	**Global / Local Impact**	**Return on investment**
Included / Not included	Size of the city	Global impact of the museum	Museum earnings per year
Part of the culture-led policy	Size of the project	Local impact of the museum	Retail per m^2
Part of cultural investments	City population	Impact of the city on the museum	Employment
Ownership	Number of visitors	City branding	Part of cultural investments
City branding		Number of visitors	Ownership
			Number of visitors
Location			
Location in the city	**Spatial relation**	**Water / Greenery**	
Historic centre	Surroundings similar/different usage of space	(Non) Existing	
City centre	Impact of the city on the museum and *vice versa*	Size	
Urban peripheral area	Connected / Not connected with the surrounding city area	Usage	
		Public or private	
Architectural form			
Museum cluster	**Freestanding building**	**Impact**	
Position in the city	Position in the city	Impact on the surroundings or if the surroundings had an impact on the building	
Surroundings similar/different usage of space	'Iconic' architecture		
	Landmark		
Connected / Not connected with the surrounding city area	Architectural layout		
Spatial and visual relations between buildings	Adjusted to the pre-existing urban fabric/or not		
Social space			
Placement	**Form**	**Additional content**	**Impact**
Adjacent to the building	Square	Museum shop, coffee shop, spaces for education, multipurpose hall, theatre, library etc.	Impact on the surroundings
Inside the building	Linear / Path		
Non-existing social space	Part of the communication area		
Connected with the surrounding city area / Not connected	Courtyard		
Accessibility	Dispersed over several areas		

roundings of the museum, whether their usage of space is similar or different from the museum's and whether the museum has an impact on the nearby city area and *vice versa*. The last element of interaction regarding the location of the museum in the city is water/greenery. It considers four factors: if there are water or green areas nearby (e. g. pond, river, fountain, park, garden, etc.), what size they are, how they are used and whether they are under public or private ownership.

The third group of interaction, *Architectural form* (3), features elements that describe the museum building and its layout. The new architectural approach recognises the needs of a growing number of different groups of city residents, formulates them and creates strategies that will best respond to new trends. These new strategies use architectural solutions and museum layouts as a means of responding to the identified trends in community needs. Thus, the museum layout is subject to constant change under the influence of a cultural, political and wider social context. The architectural form interaction observes whether the museum is part of a museum cluster or a freestanding building, the impact that the architectural form of the building has on the city or whether the city has in some sense influenced the museum layout. The first element establishes whether the museum is part of a museum cluster, if it is surrounded by similar or different usage of space, if there are other objects of the cluster connected in any spatial or visual way and whether they benefit each other or if the museum is not connected to its surroundings. The position of the museum cluster in the city should be analysed as well. The freestanding building element analyses the museum building, whether it is an 'iconic' architectural building – designed by a famous architect and if the building yielded success by itself, esteemed by both professionals and members of the lay public (Sklair, 2006). A museum building can also be a landmark, meaning that it is different/unique compared to its surroundings and a point of reference (Lynch, 1960). The architectural layout element analyses the museum layout and what type of content there is in a certain area of the museum. The last element analyses whether the museum building is adjusted to the pre-existing urban fabric regarding the size and height of the building. The last block of interactions that consider architectural form deals with the impact of the city on the design and position of the museum building, or any impact of the museum building on the city.

The fourth group, *Social space* (4), examines the museum's public space. The element of placement provides input into the existence of social space within or around the museum: where it is located, if it is adjacent to the building or inside, if it is connected to the surrounding city area and how/when it is accessible for usage (whether it can be used/accessed regardless of the working hours of the museum), what form the social space creates, if it is a square, linear/path, part of the communication area, courtyard or dispersed over several areas. Additional content element analyses what content the social space provides – museum shop, coffee bar, spaces for education, multipurpose hall, theatre, library, etc. The last element is the impact of the social space on the surrounding area.

Interaction and Scale

In further analysis, 14 defined elements, differentiated into 4 interactions, were associated with each analysed study (Table III). The majority of studies observe the museum and

the city through more than one interaction, confirming the complexity of the museum-city interaction. The museum-city interaction that appears most often is urban policy (21), followed by architectural form (18), social space (16) and location (11).

Studies that are in the urbanism and architecture subject group research the museum/city interaction mostly through urban policy elements (8/8), followed by location (6/8), architectural form (6/8) and rarely social space (1/8). Economy studies also mostly use urban policy elements (7/7), occasionally location and architectural form (3/7) and rarely social space (1/7). Studies from the sociology group analyse the museum/city interaction by using social space elements (8/8), occasionally urban policy elements (3/8), while location and architectural form are rarely addressed (2/8). Museology studies examine the museum/city interaction mostly by using elements of architectural form and social space (6/8), and sometimes urban policy (3/8). The location element was not relevant for this group of studies.

Subsequently, the connection between the four groups of the museum/city interaction and scale (state/ city, city district, building, interior) was formed (Table IV).

It is easily read from Table IV which elements should be analysed depending on the scale and the area of research interests at a given time. The table can be read both horizontally and vertically. For example, if one wants to research the location of a museum building in a city district, elements that one should use as preliminary research are location in the city, spatial relations and the existence of water/greenery nearby (horizontal and vertical reading at the same time). If the subject of interest is the location through all spatial scales, then Table IV is read horizontally under the interaction – *Location*. Likewise, if we want to analyse the museum/city interaction from the state/city point of view, then Table IV should be read vertically under the scale – *State/city*.

This proposal is based on the analysis and definition of the interactions between the museum and the city that have been used so far in the literature and does not exclude new approaches that could be applied in future studies and which should complement the existing analysis.

Conclusion

The role of the museum goes far beyond its primary task of displaying selected exhibits in an appropriate manner. Through repositioning themselves as a new tool for urban development, museums are changing their architecture and function as well (Aalst and

Table III Museum-city interaction in selected studies

Literature unit	Field of interest	Period of interest	Interaction
Urbanism and architecture			
Griffiths, 1993	Urbanism	1857-1992	Urban policy
Van Aalst and Boogaarts, 2002	Urbanism / Architecture	1970-2000	Urban policy / Location / Architectural form
De Frantz, 2005	Urbanism /Architecture	1970-2004	Urban policy / Location / Architectural form
Giebelhausen, 2006	Urbanism / Architecture	Antiquity – 2004	Urban policy / Architectural form
Tali and Pierantoni, 2011	Urbanism / Architecture	1930-2009	Urban policy / Location / Architectural form Social space
Paül I Agustí, 2014	Urbanism /Architecture	2000-2013	Urban policy / Location / Architectural form
Ozorhon and Ozorhon, 2015	Urbanism / Architecture	1954-2014	Urban policy / Location / Architectural form
Kochergina, 2017	Urbanism / Architecture	1970-2017	Urban policy / Location / Architectural form
Economy			
Newman and Smith, 2000	Economy / Urbanism	1910-2000	Urban policy / Location
Swyngedouw, Moulaert and Rodriguez, 2002	Economy / Urbanism Architecture	1979-2009	Urban policy / Location
Evans, 2003	Economy / Urbanism Architecture	1851-2001	Urban policy / Architectural form
Plaza, 2006	Economy / Urbanism	1976-2004	Urban policy
Plaza and Haarich, 2009	Economy / Urbanism / Architecture	1980-2008	Urban policy / Location / Architectural form
Brida, Meleddu and Pulina, 2012	Economy / Architecture	2007-2010	Urban policy / Architectural form Social space
Degen and García, 2012	Economy / Urbanism	1979-2008	Urban policy
Sociology			
Taborsky, 1982	Sociology / Museology	15th cent. – 1980	Social space
McTavish,1998	Sociology / Architecture Museology	1895-1998	Social space
Gospodini, 2001	Sociology / Architecture	1950-2000	Urban policy / Location / Architectural form Social space
Gospodini, 2002	Sociology / Urbanism	1980-2021	Urban policy / Social space
Mitrache, 2012	Sociology / Architecture	1980-2000	Location / Social space
Gibson, 2013	Sociology / Museology	1990-2011	Architectural form / Social space
Heidenreich, 2013	Sociology / Urbanism	1875-2012	Urban policy / Social space
Ruggiero, Lombardi and Russo, 2021	Sociology / Museology	2019	Social space
Museology			
Harrison, 1993	Museology / Sociology	19th cent. – 1992	Urban policy / Social space
Abt, 2006	Museology / Architecture	Antiquity – 20th century	Urban policy / Architectural form
Hillier and Tzortzi, 2006	Museology / Architecture	1984-2006	Architectural form / Social space
Macdonald, 2007	Museology / Architecture	1960-2006	Architectural form / Social space
McCall and Gray, 2014	Museology	1971-2013	Urban policy / Social space
MacLeod, Dodd and Duncan, 2015	Museology / Architecture	1965-2014	Architectural form
Tzortzi, 2016	Museology / Architecture	1999-2014	Architectural form / Social space
Tzortzi, 2017	Museology / Architecture	1966-2017	Architectural form / Social space

Table IV Interaction and scale

Scale Interaction	State/City	City district	Building	Interior
Urban policy	UEDS	UEDS	UEDS	G/L Impact
	Size	Size	G/L Impact	ROI
	G/L Impact	G/L Impact	ROI	
	ROI			
Location	Location in the city	Location in the city	Location in the city	Spatial relations
		Spatial relations	Spatial relations	Water / Greenery
		Water / Greenery	Water / Greenery	
Architectural form	Museum cluster	Museum cluster	Museum cluster	Museum cluster
	Freestanding building	Freestanding building	Freestanding building	Freestanding building
	Impact	Impact	Impact	Impact
Social space	Placement	Placement	Placement	Placement
	Impact	Additional content	Form	Form
		Impact	Additional content	Additional content
			Impact	Impact

See Table II for the definition of each interaction
UEDS – Urban-economic development strategies; G/L Impact – Global or local impact; ROI – Return on investment

Boogaarts, 2002). Modern technology is transforming museums from spaces of observation and learning to spaces of interaction, participation and engagement. The aesthetics and architectural design of new museums are dynamic and intend to amaze and attract tourists and citizens of all profiles, satisfying their needs for new experiences in the global social and cultural context while achieving popularity and profit for the city. Consequently, this transformation forms a new interaction between a museum and a city.

Systematic studies on the potential regenerative impact of museum buildings on the city are scarce, especially concerning their role within urban development, apart from rare exceptions, such as the Guggenheim Bilbao (Tali and Pierantoni, 2011). The field of interest of selected studies ranges from urbanism and architecture to economy, sociology and museology, reflecting the complexity and different layers of the museum-city relationship (Table I). This complexity is further manifested through a number of elements according to which individual studies have evaluated the museum-city relationship (Table II). A special challenge in this paper was the definition of individual elements, and the delineation of their conceptual content, which enables the use of this classification in future studies on the topic. This paper aimed to set a framework and a starting point for future research on the interaction between a museum and a city, possibly identifying those models that benefit the positioning of museums as vehicles for urban development. The elements that were selected from research papers were defined and divided into four main interactions so that they could be selected and used depending on the topic of future research. Even though it can be concluded that a city can only be analysed from the state/city and city district aspect, whilst a museum from the building and interior, should in our opinion be analysed both through all the criteria and the complete spatial scale since only by considering all elements of their interaction through time and space can we get a better global view and anticipate future perspectives of the museum-city interaction. In this paper we have created a setting for future research as through interactions and scale presented, it is easy to read what elements should be analysed depending on the scale and groups of research interests at a given time. The advantage of the presented guidance is that it can instruct those interested in the topic of the museum-city interaction which elements to include in the analysis depending on whether they are primarily interested in urban policy, architectural solutions or social or economic aspects. The spatial aspect can be selected as well as a specific period of time that is of interest to the researcher.

In this context, the present study serves as a starting point for further research that could implement the proposed methodology for putting forward the best practices for future urban cultural planning. The existing framework needs to be continuously upgraded in the future with the addition of new elements as new concepts are developed following the transformations of museums and cities based on political and cultural community needs.

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Fig. 1 Cities of Jijel (Algeria) and Naples (Italy)

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Business Models as a Decision Support Tool for City Management: Translation from Generalized Qualitative to Adapted Quantitative

Case Study of Jijel and Naples

Business Model Canvas
heritage
Jijel, Algeria
Naples, Italy
urban requalification

Faced with the transformations of cities due to the introduction of new technologies and the shift in value from infrastructure to services, city managers are in search of new urban economic models. The current paper examines the development of business model frameworks as a practical tool to assist two cities in assessing business model efficiency by adapting Business Model Canvas (BMC) components to operationalize sustainable cities.
This article defines the business models and their usefulness, presents the requalification of the city of Jijel (Algeria) and the selection of the Canvas business model, explains the model selected for the city of Naples (Italy), and, through these two examples, extrapolates the approach towards the generalization of the tool and the approach, which can be adapted to the local context of each city. That is why the models can act as a management strategy and decision-making support tool with a scientific basis. The findings demonstrate that these business models are a practical tool incorporating all actions and a thorough organizational structure that considers all operations and choices. They offer a framework that facilitates effective communication and sustainable growth. Furthermore, they may promote innovative approaches to the creation of sustainable value.

Introduction

According to the UN Department of Economic and Social Affairs (2018), the increasing migration of the global population from rural to urban regions and the global increase in urban population might result in an urban boom. In response to these developments, cities are faced with the challenge of providing citizen-centric, high-quality services enabled by new information and communication technologies (ICT), as well as the Internet of Things (IoT).

This service change affects several areas, including energy distribution, energy performance, urban transportation, mobility services, garbage collection, and circular economy. Every time, there is an evident shift in value from infrastructure to services. This begs the issue of how these transforming urban ecosystems should be regulated. The main cities of the globe have already adopted new urban economic models and business model blueprints. For an effective and efficient orientation, local authorities have incorporated these business models into their development plans via a process of comprehension and a transversal and focused reading of each situation. Applying management methods to urban planning implicitly acknowledges that cities are governed like businesses.

The existing research on smart cities focuses on the influence of city dynamics on technological progress and the resulting benefits. However, the knowledge gap between theory and reality regarding smart cities is still in its infancy (Mora et al., 2017: 20). Understanding the finances, infrastructure, roles, rules, services, and innovative governance and resource models is crucial for policy-makers seeking efficient assessments and guidance (Smart City Governments, 2019). However, local authorities are not well instructed on operational and implementation regulations. Insufficient knowledge and tools are lacking in the literature to allow the practical implementation of smart cities with business models (Lee et al., 2014: 1).

There is no widely accepted approach to comprehending smart city business models (Walravens, 2012: 122). Although studies have identified many business models for smart cities, these approaches have limited generalisability (Abbate et al., 2019: 9). The restricted generalisability is due to the fact that a successful business model based on certain contextual circumstances may not be applicable to the economic, environmental, technical, and social context conditions of various settings (Ode, Wadin, 2019: 17).

This research addresses the knowledge gap on the smart city business model and provides a perspective on the implementation of the global Business Model Canvas for smart cities. The development of a theoretical business model that is then applied to two cities, one Algerian (Jijel) and the other Italian (Naples), is utilized for future planning in urban requalification activities. The purpose of this comparison is to describe the two business models and attempt to develop a generalizable model for each, considering the researched environment. The two business models and attempts to derive a generalizable model for each situation by considering the investigated environment are presented in this paper.

The paper hypothesizes the following: The use of Business Model Canvas (BMC) components as a practical tool to assess business model efficiency can help urban managers adapt to the transformations of cities. The adoption of these business models can support decision-making and promote innovative approaches to sustainable urban development. The first is a business concept for the urban requalification of Jijel, while the second one is for the urban requalification of Naples. Located on the opposite sides of the Mediterranean Sea, the two seaside communities have both investigated a business strategy. The criteria for comparing these two samples are provided in Table III.

The purpose of this comparison is to describe the two business models, both using the "participatory approach" technique, and to develop a model that can be extended to

each scenario while taking into consideration the researched environment. The purpose of this research is to explore the effectiveness of business model frameworks as a practical tool for assessing the efficiency of sustainable cities.

It should be noted that the Business Model Canvas originated in Alioua & Zehioua Bernia's Ph.D. dissertation (Alioua, Zehioua, 2022). It was only applied conceptually to the city of Jijel, and the present article shall serve as a decision-making tool for authorities, especially because commercial models applied to urbanism in Algeria have not yet been created.

Methodology

This study has employed a comparative case study approach to investigate the application of business model frameworks in two cities, Jijel (Algeria) and Naples (Italy), in order to evaluate the effectiveness of business models and promote sustainable urban development.

Hence, the current article aims to address the following questions: How does the use of BMC components contribute to more innovative and sustainable approaches to urban development? What is the effectiveness of BMC in promoting innovative and sustainable approaches to urban development?

Case studies can be a useful method for investigating the use of Business Model Canvas (BMC) components in urban management. Two cities with varied degrees of technological adoption and socioeconomic settings can be represented by the selected scenarios. Case studies may be conducted using a variety of data sources, including interviews and document analyses.

The objective of the case studies would be to acquire a greater knowledge of how BMC components are utilized in practice and how they contribute to the efficiency of urban management. The research included qualitative data collection techniques, such as document analysis and semi-structured interviews with stakeholders and important urban requalification players in Jijel. The Business Model Canvas (BMC) was adapted to operationalize sustainable cities, and its components were utilized to evaluate the effectiveness of the business models in the two cities.

Development of the Smart Cities Global Business Model Canvas

The business model is the central component of a company creation project and specifies the profit-generating approach that will be applied. It is simultaneously a support mechanism for the entrepreneur, a guide to boost the company's chances of success, and a powerful tool to persuade financial partners to invest in the entrepreneur's idea. A business model represents the means through which activity generates income. It is also connected with ROI (return on investment). The emergence of new players permits the creation of new business models, which are intrinsic to the notion of human growth, corporate development, and natural resource sustainability. Using the global Business Model Canvas for smart cities, the first phase in the technique shall be to create a theoretical business model. This approach shall be applied to Jijelin order to develop a decision-making framework for urban requalification initiatives.

The Business Model Canvas shall be evaluated in two scenarios, Jijel and Naples, to determine the model's applicability and efficacy in distinct circumstances. Comparisons shall be made between the application's outcomes, and a generalizable model for urban requalification shall be constructed.

The Technique of the Participatory Approach

It allows residents to be involved in the whole process of urban operations, from the creation of goals to the construction of the program and the "considered" options for development. The participatory process involves the recomposition of social representations and identities, as well as the alteration of the paradigm imposed by the learning of skills about empowerment, solidarity, participation, and volunteerism. The public interest and the fact that it is regarded by society take on a global dimension with observable effects at the social level, on citizenship, solidarity, and democracy (Ranjatoelina, 2019).

However, this approach adapts the idea that the city operates like a company. The approaches presented are significant, but the participative approach is readily applicable to our daily situations. Citizen engagement in decision-making has evolved into a potent driver of dynamism in the study cities of Jijel, Algeria, and Naples, Italy. The study should provide evidence for the efficacy of BMC in fostering innovative and sustainable approaches to urban development and should have significant consequences for urban managers, policymakers, and other urban development stakeholders. The results should aid in the promotion of more effective and sustainable approaches to urban management.

Materials and Methods

Description of the Municipality of Jijel

Jijel is a coastal and port city in the Algerian Northeast, with a maritime frontage of more

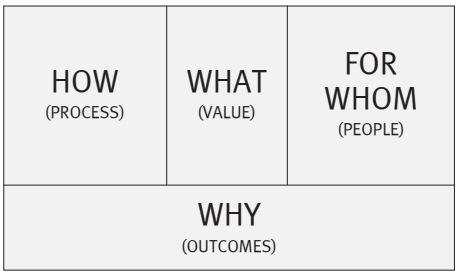

Fig. 2 The business plan's structure

than 120 kilometres along the Mediterranean Sea. It is the capital of the Jijel Wilaya. Due to its strategic geographical location, with a large commercial port (ranked among the first in the Mediterranean), Jijel is expected to become a regional development pole (in 2030) according to the development plan of the Wilaya of Jijel. Nonetheless, the changing urban system of this city, like that of other Algerian cities, is plagued by several flaws, including the deterioration of its old centre, the proliferation of unplanned housing on the city's outskirts, accessibility issues, and pollution, which damage the city's image and identity references. In addition to these factors and the authorities' interest in the development of large-scale projects, there is a growing demand from its residents for a higher quality of life, which justifies requalification operations to secure its future role.

Currently, Jijel is undergoing significant transformations that are altering its image and urban dynamics due to the initiatives being executed. Jijel will be transformed from a small landlocked city into an important industrial, tourism, and business hub through the implementation of several planned major projects, including the modernization of the port of Djen-Djen, the realization of a highway penetration linking it to the East-West highway, the construction of a railroad between the port and the axis El Eulma-Setif, and the realization of a third university pole in El Ouana.

However, the issue is: Where are the residents and their demands in these speeches? The tactics taken by the decision-makers to requalify the city of Jijel fail to meet the requirements and ambitions of the Jijel populace. On the other hand, we might see all of these initiatives as the first step toward a genuine metropolization of Jijel, linking its destiny within a global vision of metropolization, resulting from a genuine political ambition to place Jijel at the heart of regional and national levels. The development of this city, which necessitates a comprehensive action of urban requalification, is conditioned, according to its residents, by the involvement of public authorities and residents in this dynamic by utilizing professionals in the fields of tourism, urban marketing, and sociology of space, and by strict monitoring of the authorities' application of regulations.

Analysis of Business Model Canvas (BMC) Components in Urban Management

The current proposal seeks to identify the criteria (useful information for decision-makers) that promote a better approach to decision-making in the intervention of a city by referring to residents' needs and by ensuring a better handling of the space's particularities. Defining a participatory approach should allow residents to be involved in the entire process of urban operations, from objectives definition through program elaboration to the development strategy and "thought through" choices. Nonetheless, every requalification procedure must answer the questions listed below:

- Who? Any intervention in a given space must respond to the needs and desires of the people who reside there permanently or temporarily: permanent residents, tourists, university students, and investors.
- What? The response to this question summarizes the stakes and aims of these urban activities, including what they will offer to the present living environment to please the people, respond to issues, and add value.
- How? This question necessitates simultaneous complementarities of the needs of the population, the constitutive elements of the territory in question (its resources and key activities) on which any requalification process must be based, and finally, the partners necessary to ensure an effective consultation that takes into account all stakeholders.
- Why? It enables a global, comprehensive, and efficient view of the chosen strategies by emphasizing the concerned area's particularities and resources, enabling it to develop in an original and specific manner while assuring the participation of the concerned players.

The transformation of a broad scientific discourse into an operational tool necessitates an adoption of suitable means and instruments that contain problems, aims, and methods. For this reason, the Business Model Canvas functions as a decision-making assistance tool. These technologies have been adapted to the Algerian context.

The tool's usefulness derives from its shape, synthesis principle, and interaction between its several boxes. Moreover, the presence of all factors required to requalify a region on the same piece of paper enables providing a comprehensive and global perspective to address all the aspects without the danger of ignoring, disregarding, or prioritizing one part over another.

Adapting Business Model Canvas for Urban Requalification

The Business Model Canvas was established by Strategyzer's Alexander Osterwalder. He is an author, public speaker, and business model consultant. He founded Strategyzer, a software firm specializing in the creation of

information and tools for strategic innovation and management. He is the creator of the business model matrix, which is used in several industries by firms such as Coca-Cola, General Electric, Procter & Gamble, MasterCard, Ericsson, LEGO, 3M, etc. As a speaker, he addresses prestigious corporations and institutions, like Stanford, Berkeley, and MIT.

The primary purpose of the Business Model Canvas tool, which is primarily intended for the fields of economics, business, and marketing, is to distinguish oneself from competitors (Carre, 2018). It aims to build an economic model and launch a product or service based on a company's activities and key resources. It enables the transcription and concretization of aspirations and important parts within a cohesive, relevant, and creative project. Implementing this instrument in urban planning to requalify a city enables a comprehensive and effective global view of the selected strategies by emphasizing the territory's essential resources and activities (Fig. 3).

The objectives for the adaption of this tool are summarized in Fig. 4. The steps are as follows:

1. Think and design the entire requalification process/strategy, ensuring the ownership of its identity and the involvement of all relevant actors.
2. Basing the requalification strategy on a better exploitation of the territory's identity elements.
3. Identifying all the stakeholders and allowing them to take part in the process.
4. Ensuring a better consultation process with the population and consequently knowing their needs and expectations while trying to meet them.

The boxes "key activities", "key resources", and "consumer segments" are separate from the box "value proposition" (Table I). The absence of one of the first three boxes can result in the failure of the requalification strategy. In contrast, the effective and efficient interaction between the four boxes can result in a comprehensive urban requalification strategy based on a strategic way of thinking that puts all the necessary factors for its success into interaction.

The foundation of this economic strategy is identical to that of historical preservation. In other words, the model is conditioned by the local context and customized to the peculiarities of the land for each activity.

Also, the authors have worked on a thesis on the conservation and safeguarding of the heritage of the city of Constantine (Fantazi, Zehioua Hecham, 2021), in which they proposed a new conservation strategy in order to succeed in these operations in our country

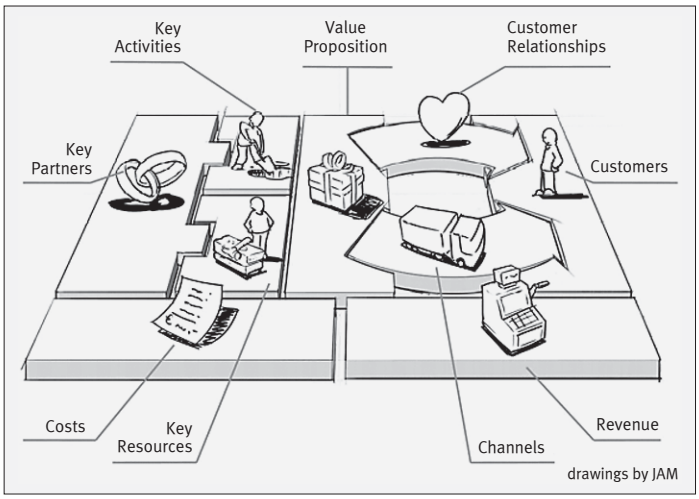

Fig. 3 The Business Model Canvas – The basic model

and particularly in Constantine, with a clear futuristic vision of the heritage, adapting itself depending on the world news, and in line with Algerian regulations, and with a focus on new, independent financial resources.

Heritage preservation has become an important resource for sustainable urban development initiatives. UNESCO has included the preservation of cultural assets as a sustainable response to these changes. As a result, a number of studies have been conducted to identify new paradigms with which to confront the world's present massive transformations.

In 2019, a team known as CLIC (Circular models Leveraging Investments in Cultural heritage adaptive reuse) developed a business model that addresses the specific problems

Fig. 4 Adaptation of business model frameworks for urban requalification operations

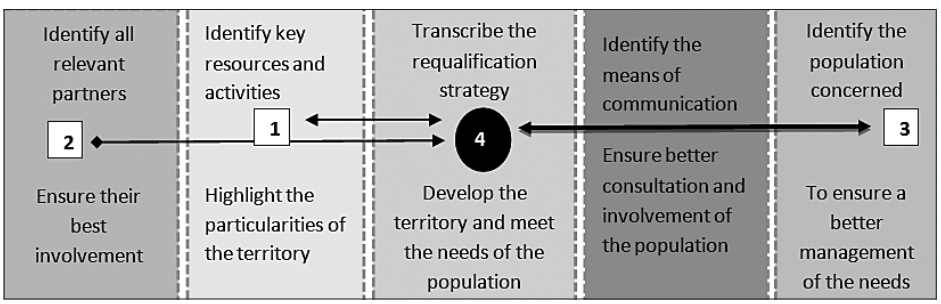

Table I Elimination of the last two boxes related to the financial aspect of the tool

Key partners	Key activities	Value proposition	Customer relationships	Customer segments
With whom?	What?	What and why?	How?	For whom?
	Key resources		Channels	
	With what?		How?	
Cost structure How much?		**Field for economists to be consulted for better support and refinement of the tool.**	Revenue streams How much?	

Table II Business plan for conservation operations

The site						
The team						
The date						
Processes			Value	Actors		
Historic urban landscape mapping	The resources of cultural capital	Partnership	Co-creation value	Relationships	Stakeholders	Ecosystem actors
Spatial integration	Adaptive reuse	Circular governance	Co-destruction value	Information channels		Needs and constraints
Cost		The objective		Advantages		
Results						

of governance and financing process of the project in accordance with the guidelines of the Historic Urban Landscape (HUL) approach. It views cultural heritage as an economic resource that must be exploited for the development of cities.

This approach attempts to solve cultural heritage challenges such as preservation, conservation, and adaptive reuse, as well as to preserve cultural heritage assets, extend their lifetime, and promote the co-creation and regeneration of new sustainable values in the area of heritage (Ost, Saleh, 2019). It offers a comprehensive perspective on sustainable ideals, stakeholders, processes, and results. This plan's format is outlined in Table II.

The conservation operations business plan is being implemented in three European countries: Croatia, Italy, and Sweden (Ost, Saleh, 2019) and is regarded as an innovative strategic instrument that assists nations in developing their economies by counting heritage as a new income stream. In this regard, a proposal has been elaborated for a business plan that fits the context of the old city of Constantine, in order to have a strategic document that helps to preserve the city's heritage through the use of new modes of financing that differ from the precedents (Fantazi, Zehioua, 2021), and that of Jijel in a 2022 thesis (Alioua, Zehioua Hecham, 2022).

The other business model is called "URBACT" and concerns the urban regeneration of European cities.

The Business Model URBACT Focuses on the Revitalization of European Cities

Europe is the subject of the second business model, which is intended for larger distribution. Indeed, Europe has begun creative urban requalification programs for its cities and is dedicated to constructing a new shared strategy based on a common culture and good governance by emphasizing the local administrations, inhabitants, and diverse technology devices as key players. The greatest difficulty is restoring economic attractiveness and capital movement. This strategy has resulted in significant recovery and development operations by implementing this extensive program to degraded metropolitan areas, assuring the program's viability, and establishing a management system of sustainable development efforts.

Since 2002, URBACT has been the European territorial cooperation initiative promoting sustainable and integrated urban development in the cities of the European Union, Norway, and Switzerland. It is a cohesion strategy instrument, sponsored by the European Regional Development Fund (ERDF) and the Member States, for the exchange of experience and learning between cities, with the goal of discovering solutions to important urban difficulties. The networked European cities enhance skills and capitalize on best practices while assisting public decision-makers and actors on the ground, including citizens, in order to build sustainable solutions that combine the economic, social, and environmental components of urban development.

The URBACT approach is a component of the expansive Community Initiative Program. URBACT is founded on the formation of a network of European cities and, in its execution, provides a satisfying working framework that handles many issues in accordance with the requirements of the network's member cities. The budget of the European Union is cofinanced at a rate of 50% with the aid of specialists selected by the cities themselves.

To develop a business model with important characteristics, it was required to examine examples and visit locations. Specifically:

– The physical and urbanistic components of the projects.
– The socioeconomic and environmental aspects of regeneration.
– The governance and execution procedures for the projects.

On the basis of these three dimensions, a customized grid including, several circumstances and scenarios, was constructed. This grid serves as a guide for any urban regeneration operation based on priority goals such as the exploitation of various transversal studies, the intrinsic understanding of the location, and the identification of new techniques to-be-utilized.

The effort has stimulated economic appetites, propelling the notion toward the utilization of this urban regeneration for tourism that is defined by continual expansion and generates an estimated turnover of billions of Euros or Dollars. Prior to its formation, URBAN existed as a modest program. Several cities have joined.

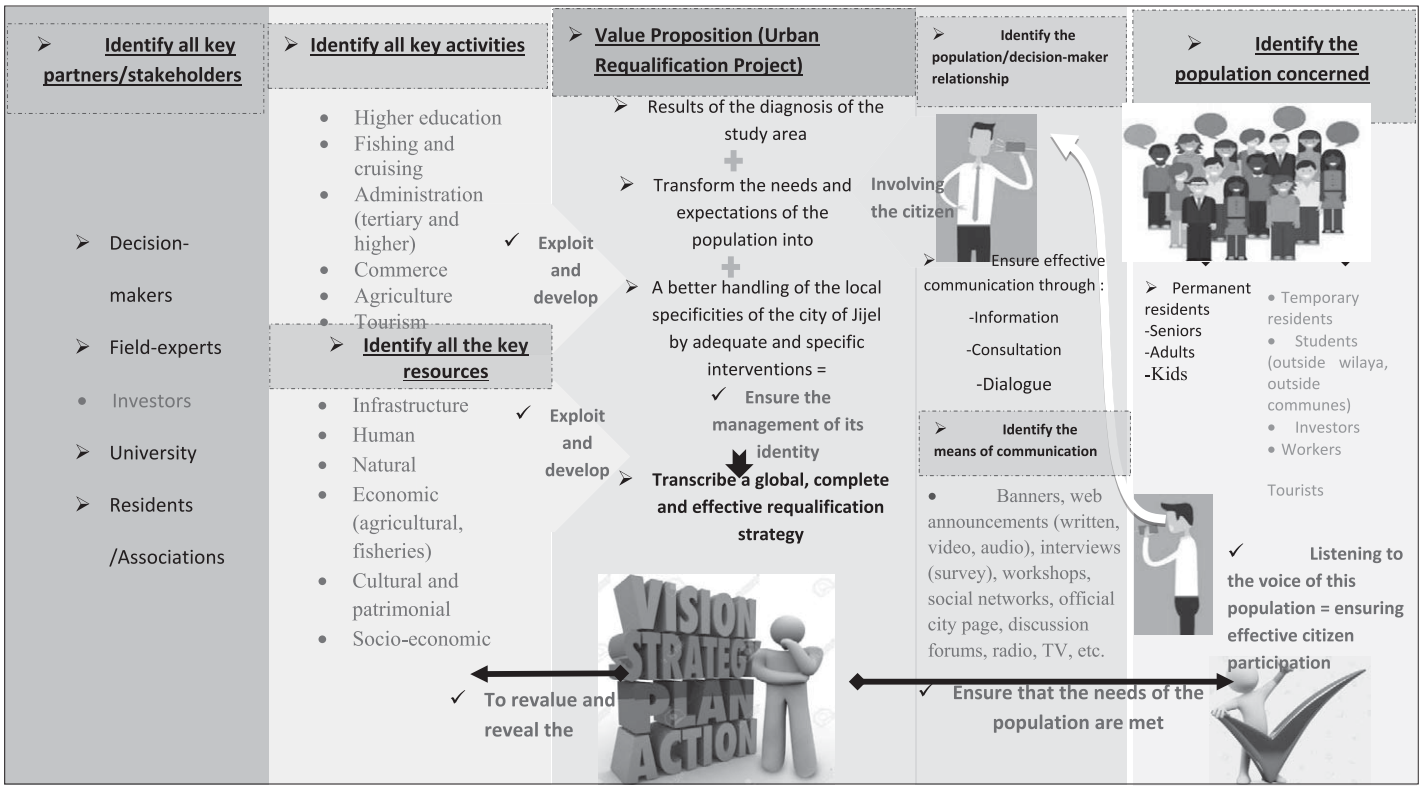

Fig. 5 The Business Model Canvas: A decision support tool to requalify the city of Jijel

URBACT is organized on three primary goals:

1. The development between cities of an exchange of good practices and structured experiences through the creation of thematic networks and working groups.
2. The capitalization and dissemination of lessons learned from URBAN programs.
3. The improvement of action capacities of the concerned actors assisted by residents in a participatory approach, and thus of cities, in various fields that characterize the integrated requalification policies.

As a business concept, the URBACT program is based on three indicators: competitiveness, economic expansion, job creation, and resident involvement.

This strategy defined in Lisbon and Gothenburg is in line with the objectives of sustainable development and is based on the construction and management of urban development plans/projects incorporating the following innovations:

– The local action plan will have to be elaborated (in advance) within the framework of the defined theme;

– The local support group shall have to be involved in the network activities and in particular in the elaboration of plans;

– Better synergy between the local support group and network activities.

This curriculum addresses the following aspects:

– Priority axis 1: Cities, Growth Engines, and Jobs as sub-themes: entrepreneurship promotion; innovation and knowledge economy enhancement; employment and human capital.

– Priority axis 2: Attractive and Cohesive Cities with the subthemes of integrated development of urban areas in difficulties or likely to become so; social inclusion; environment; governance and urban planning. URBACT is regarded as a business model due to its content, objectives, and stakeholder engagement.

Results

Two separate business concepts were implemented in two distinct cities. An Algerian one (Jijel) on the southern shore of the Mediterranean Sea, a tourist destination suffering from multiple wounds, and the other Italian (Naples) on the northern shore of the same Mediterranean Sea, also a tourist destination, but suffering from the degradation of its built environment and thus abandoned not only by its residents but also by tourists (Table III). This economic collapse was the reason that prompted precautionary measures and urban revitalization. The selection of the city of Jijel is based on an empirical study from a 2022 doctoral thesis (Alioua, Zehioua

TABLE III COMPARISON CRITERIA AND SIMILARITIES BETWEEN THE TWO CITIES

Comparison criteria	JIJEL	NAPLES	Common observations
Geographical location	Coastal on the Mediterranean Sea	Coastal on the Mediterranean Sea	Two medium-sized coastal cities with ports
Caracteristics	Before 2000: – bad image (terrorism), landlocked locality, abandoned heritage, unique natural landscape on the Algerian coast and known gastronomy After 2000: – regional, national and international economic integration with the commissioning of the large port of DJENDJEN (international commercial) – industrial pole of tourism and business with the steel complex Bellara managed by Qatar, the enlargement of the international airport Farhat Abbes, the university of Mohamed EssedikBenyahia, the zones of tourist expansion – road and hotel infrastructures In the near future: – a tourist pole, residential, flowered city, street-art present, local dialect – very present associations – plan of urban requalification programmed in the process of realization.	– anarchic, noisy, disorderly, city of the Neapolitan mafia, historical heritage and its unique natural panorama – very famous gastronomy – city of flowers, street art (marketing tool) – local dialect – city threatened by the volcano of Vesuvius – very dynamic associations – urban requalification plan applied on the city that has metamorphosed it	– poor quality of the living environment and urban space – lack of a quality territorial offer – lack of a specific and affirmed image – dynamic associations adopting the participative approach – program of requalification of urban regeneration and improvement of the living environment

Hecham, 2022). After a dark decade, Jijel has become a tourist attraction in recent years (terrorism in the 1990s). In these cities, these two business models shall be implemented.

BUSINESS MODEL CANVAS FOR JIJEL CITY

This city's development, which requires a global urban requalification, depends on public authorities and residents' involvement in this dynamic by using tourism, urban marketing, and sociology of space professionals and strict follow-up by the public authorities through regulations. Municipal authorities in Algeria are unfamiliar with the commercial model. We offer a citywide coherence and development plan governed by a Business Model Canvas assessed theoretically in our thesis.

Municipal authorities in Algeria are unfamiliar with the commercial model. We offer a citywide coherence and development plan governed by a Business Model Canvas assessed theoretically in previous empirical work (Table IV).

URBACT AND THE CITY OF NAPLES

The URBAN and URBACT programs have been the subject of comparisons between cities, thus becoming a common heritage in the language of local administrators: an integrated approach, transversality, project work, governance, partnership, real consultations with the inhabitants, bottom-up logic, anchoring in the territory, participation of the inhabitants, capitalization and dissemination of results; but also with regard to keywords that bring local administrators together: an integrated approach, transversality, project work, and governance.

The URBACT initiative is a consortium of 22 cities from seven European nations, headed

TABLE IV REQUALIFICATION OF THE CITY OF JIJEL USING THE BUSINESS MODEL CANVAS PROPOSED BY AUTHORS

Key partners	Key activities	Value proposition (Value added/offer)	Customer relationship	Customer segments
Identification of relevant stakeholders: 1. Decision-makers: the State and its decentralized services; responsible for implementing and monitoring the guidelines. 2. Design offices and specialists in the field: in charge of project design. 3. Investors 4. University 5. Residents (individual, in the form of associations and neighborhood committees): In this case, they are considered to be effective actors. According to the survey results, residents must be more than mere beneficiaries and be involved more in the requalification process through adequate supervision of their local initiatives.	**For an operation of strategic urban requalification and revealing of the specificities of the city of Jijel, the key activities to be taken into consideration are:** Tourism, Fishing, Cruising, Administration (tertiary and higher tertiary), Commerce, Agriculture, Higher Education **Key Resources** 1. Infrastructure: Port, Airport. 2. Human (youth population) 3. Natural potentialities: sea; beaches, ledges *mountains and forests, natural landscapes, fauna and flora, water resources 4. Economic: *Fisheries wealth: fish, shellfish. Agricultural products: such as strawberries, sheep and cattle 5. Cultural and patrimonial: gastronomy of Jijel, religious and national festivals, crafts and traditions archaeological and historical sites 6. Socio-economic: quiet, conservative and secure city, welcoming population	**The operations of requalification of the city of Jijel must take into consideration the following points:** 1. To found a strategy of requalification for and with the inhabitants. 2. Respond to the needs and aspirations of its population, to this end, decision-makers must pay attention not only to all the needs expressed by its permanent residents (expectations of the people interviewed), but also to those of its temporary residents. Knowing the expectations of the latter, i.e., having an outsider's view could help to better refine this process. 3. To take charge of the essential points for the revelation of the identity that has been identified, among which: – creating new modern spaces based on cultural, architectural and historical values; – promoting commercial activities related to culture and traditions specific to the region; – multiplication of large-scale cultural events, etc.	**Two steps are both complementary and essential to ensure effective communication between decision-makers and the citizen as beneficiary:** 1. Information through: banners, posters, web announcements (written, video, audio), etc. 2. Consultation: to share decisions – to know the clients' needs and try to meet them through: interviews (survey), neighborhood committees, cultural associations, etc. **Distribution Channels** Workshop, Réseauxsociaux, Page officielle de la ville, Forums de discussion, Radio, TV, etc.	**Identify the target audience for the urban redevelopment project:** 1. Residents (men, women): 1.1. Permanent: – elderly – adults – children – from one age group to another the needs are different. 1.2. Temporary: – students (outside the Wilaya, outside the communes): due to the presence of university and training centers. 2. Investors – workers – tourists – young people – families. A city known for its conservative character, which has made it a popular tourist destination for Algerian families.

Table V The European business model / URBACT of Naples (Italy)

Key partners	Key activities	The value proposition (The added value/offer) 50% Co-financing from the EU	Objectives of the client/ decision maker relationship	Customer segments
– The European Union – European cities – Regions – Municipalities – All the cities of the member states of the program – Universities and research centers in the field of sustainable urban development.	– Urban regeneration – Attractiveness of European cities – Development of historic urban centers and exchange of best practices – Capacity building among administrators – Creation of 20 thematic networks – 8 working groups – 3 study groups – Economic activity – Small/medium enterprise innovation – Local action plan – Local support group – Synergy of different vertical levels – Participation of structural funds managing authorities – Axis 1: Cities, Engines of Growth and Jobs – Axis 2: Attractive and Cohesive Cities – The European Commission's initiative and the selection of certain projects called "Fast Track Label"	– URBACT I and II Community Initiative Program containing sub-plans like URBAN I&II – Socio-economic and environmental aspects of regeneration – Governance and implementation modalities – Specific grid or guide to regeneration development Goals: – Competitiveness, economic growth, and employment – Transcription of an urban requalification strategy – Impact on the populations of European cities in neighboring countries with a similar policy.	– Professional integration – Integrated approach – Capitalization of the experiences of the whole European network – Positive impact on the European administration in the policies of urban requalification – Constitution of networks: Municipality/Region/ State/European Union – Training of managers – Common culture – Vocabulary and concepts close to each other	– Youth population – Citizen participation – Participando: key to social cohesion – C.H.O.R.U.S (Regeneration of urban centers through cultural valorization) – Good Practice/ Governance (Concrete participation of municipalities and regions) – Ascending and descending scales: Think global / Act local

by the city of Rome. It strives to capitalize on and distribute lessons learned through public engagement in urban revitalization policies and practices. The strategy of the "Participating" project is based on local surveys and topic workshops in order to develop effective instruments to increase public awareness of urban concerns. The purpose of the network is to emphasize the implementation of tangible experiences to enhance the administration of future integrated urban strategies. The network's goals are:

– Create larger local democratic policies;

– Raise a strategic vision of local development focused on environmental, social, economic, and political sustainability

– Improve social networks, solidarity, and fairness, and acknowledge the significance of cultural and natural heritage.

Citizens may play a crucial role in bolstering their cities' sustainable territorial growth. In recent years, European towns (particularly those in disadvantaged regions) have undergone a crisis in terms of capacity development and public engagement. In this situation, the decision-making process has encountered several obstacles. The methodological approach chosen by the URBACT network to improve the quality of urban management experiences is predicated on the premise that public involvement is a complicated process whose actualization is intimately tied to social elements.

Discussion

This research aimed to address the knowledge gap on smart city business models by providing a perspective on the implementation of the global Business Model Canvas for smart cities. The development of a theoretical business model was first presented in Jijel, followed by its assessment of two cities, Jijel and Naples, as a tool for future planning in urban requalification activities. One of the key findings of this study was the lack of a widely accepted approach to comprehending smart city business models.

Although many business models for smart cities have been identified in the literature, their limited generalisability is a major barrier to their practical implementation. The development of a generalizable model for each situation by considering the investigated environment is crucial for future smart city planning. The analysis helped identify key resources, activities, and partners required for the project and provided a structured approach to planning and implementation. Similarly, the URBACT model was used in Naples to foster community involvement and improve social cohesion by enhancing public spaces and promoting cultural activities.

The comparison of the two business models has highlighted the importance of the participatory approach in urban planning and requalification. Both models have emphasized the involvement of local communities and stakeholders in decision-making processes, which helped to create a sense of ownership and engagement. The models also highlighted the need to consider the local context and tailor solutions to fit the specific needs and challenges of each city. The study's findings have several implications for urban planning and governance. First, the Business Model Canvas and URBACT model offer a structured and systematic approach to decision-making in urban requalification operations. These models can help to identify key resources, activities, and partners required for the project and ensure that objectives are met efficiently and effectively. Second, the participatory approach is critical in engaging local communities and stakeholders in urban planning and governance processes. It is essential to involve the community in decision-making processes to ensure

that their needs and concerns are addressed, which can help foster social cohesion and create a sense of ownership.

Further, the development of a generalizable model for each situation can help policymakers and urban planners to apply the models to other contexts, with adaptations made to suit the specific environment. In conclusion, this research provides a theoretical and practical contribution to the development of smart city business models. The Business Model Canvas is an effective tool for decision-making in urban requalification operations, and its application to Jijel and Naples will demonstrate its potential for future smart city planning.

The comparison of these two models highlights the importance of considering the local context in the development of smart city business models, and the criteria for comparison can be useful for future urban planning projects. The sustainability of future planning is crucial in the context of urban development, and business models can be a useful tool in achieving sustainable and innovative outcomes. Nonetheless, it is essential to continuously update and enhance the business model as new skills, innovations, and methods emerge. Particularly, the concept of sustainability has been gaining prominence in urban planning with eco-friendly approaches, green development, and urban revitalization. Adapting business models to reflect these trends enables cities to promote sustainable development practices and realize greater environmental, economic, and social benefits.

Thus, it is necessary to include sustainability in future planning and to continually update and enhance the business model to reflect the most recent advances and trends. This will help cities to produce creative and sustainable solutions and successfully handle the difficulties of urban growth.

Conclusion

This article provides a comprehensive analysis of the smart city business models and proposes a framework for the development of a generalizable business model for smart cities. The research results indicate that the development of a theoretical business model, followed by its application to real-world scenarios, can provide decision-makers with an effective tool for urban planning and requalification operations.

The use of the Business Model Canvas in urban requalification has yielded a number of significant outcomes. First, the Business Model Canvas has offered a clear and straightforward decision-making framework for the urban requalification process. The study found that BMC components can provide urban managers with a clear and structured way to evaluate the effectiveness of their business models, helping them to identify areas for improvement and make informed decisions about resource allocation and investment.

The study also found that the use of BMC can promote a more innovative and flexible approach to urban management, enabling managers to respond more quickly to changes in the market and to emerging technologies. In addition, the deployment of the Business Model Canvas has helped the creation of a clear and unified strategy for Jijel's requalification. The Canvas can help decision-makers to map out the many components of the urban ecosystem and determine their interdependencies.

Further, the usage of the Business Model Canvas promotes an identification of the requirements and expectations of Jijel's residents and a guarantee that they are taken into consideration throughout the requalification process. In doing so, decision-makers can establish a more open and participatory approach to the requalification process, resulting in increased community support and acceptance.

The implications of this research are significant for urban managers and policy-makers. The use of BMC components can help to promote more sustainable urban development by encouraging a shift in focus from traditional infrastructure to services that promote efficiency, collaboration, and innovation. The use of BMC can also promote greater transparency and accountability in urban management, helping managers to communicate more effectively with stakeholders and to build public trust.

Further research can be conducted to evaluate the effectiveness of the Business Model Canvas as a decision-making tool for urban requalification and regeneration. The research can include case studies of cities that have implemented this tool and their outcomes. The research can also assess the applicability of the Business Model Canvas to different urban contexts and the role of stakeholder engagement in the success of urban requalification and regeneration.

Moreover, research can be conducted to explore other decision-making aids available and to compare their effectiveness to the Business Model Canvas. This research can also include the exploration of the challenges faced by decision-makers in adopting the business model approach and the strategies that can be used to overcome these challenges.

In conclusion, the study provides evidence that the use of BMC components as a practical tool to assess business model efficiency is an effective approach to urban management that can help to promote sustainable urban development.

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Sources of illustrations and tables

Fig. 1	Up: authors, 2023; down: "https://www.tourist-destinations.com/2013/10/naples-italy.html" Naples, Italy – Tourist Destinations (tourist-destinations.com)
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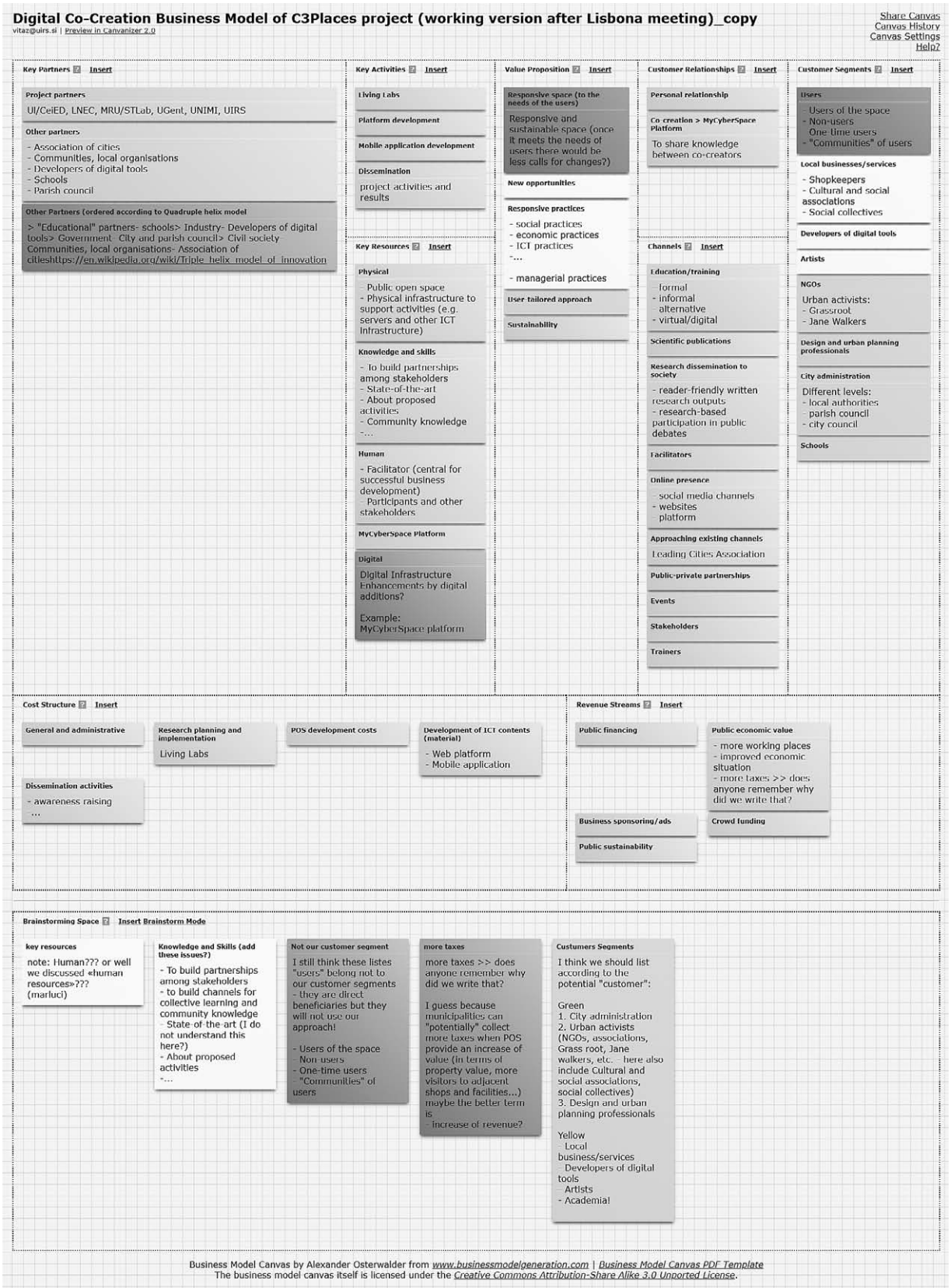

Fig. 1 Development of the C3Places BMC through online communication and filling in of the framework on the website canvanizer.com by all project partners

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Understanding the Exploitation Plan and Business Model in EU-funded Research Projects by Applying the Business Model Canvas Approach in Public Space

business model canvas
European research scheme
exploitation
public benefit-oriented projects
value proposition

European Commission has obliged Horizon 2020 and Horizon Europe beneficiaries to specify the dissemination and exploitation of their funded activities' outcomes. In this way, research results can be extended to benefit the wider society. However, beneficiaries have difficulties meeting these goals due to the overlap between dissemination and exploitation and the uncertainty of how to translate research activities and outputs into socio-economic benefits for the society. This paper developed a framework based on the business model canvas to operationalise an approach to exploitation. The framework was tested within the EU-funded research project C3Places in the fields of urban planning and sustainable spatial development. The resulting reference framework can be used as a guideline for the design and development of research project exploitation plans. It is especially valuable for projects in the fields which usually do not have 'sellable' or even marketable outcomes and products but rather result in soft measures and recommendations for public policies. Accordingly, it can support the decision-making processes of both policy-makers and private organisations.

Introduction

The exploitation and dissemination of research project outcomes has become an integral part of European research and innovation funding. In Horizon 2020, the European Commission (EC) has put forward Rules for Participation (EC, 2013), which oblige beneficiaries to exploit and disseminate the outcomes of their funded activities. The applicants are required to submit a draft Plan for the Exploitation and Dissemination of Results (PEDR) at the project proposal stage. Through this plan, EC aims to increase the availability of research results to relevant policymakers, peers in the research field and industry for direct use in public policymaking, commercial purposes and indirect contribution to the development of science (EC, no date).

The Rules for Participation (EC, 2013) define exploitation as 'the use of results in further research activities other than those covered by the action concerned, or in developing, creating and marketing a product or process, or in creating and providing a service, or in standardisation activities' and dissemination as 'the public disclosure of the results by any appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium'.

The draft plan should define clear objectives adapted to the relevant target users and establish a concrete protection, exploitation and dissemination strategy. According to the guidelines for PEDR drafting (European IPR Helpdesk, 2015), the strategy should address questions related to the needs addressed by the project, problems identified and solutions offered, characteristics of the new knowledge generated, users of the results and benefits delivered. In addition, it should detail the geographic coverage and economic size of target markets, potential users, main competitors, analyses of state-of-the-art, analyses of intellectual property introduced in the project, facts and figures on the planned exploitable results, business model, timeline of the planned dissemination activities, etc.

The implementation of the Horizon 2020 programme showed that distinguishing among the dissemination, communication and exploitation activities was not easy for beneficiaries (EC, 2022). There were overlaps among these activities, especially for the research projects with marketable outputs (EC, 2022).

In the Horizon Europe funding programme, communication remains a requirement, but EC emphasises dissemination and exploitation as crucial to ensure impact at three levels: scientific, societal and economic (European Parliament, 2021). It also requires a continuous reporting of communication, dissemination and exploitation activities throughout the project. For dissemination and exploitation activities, project consortia are also required to continue such reporting after the project has ended, informing EC of potentially exploitable results within one year of the project's end (EC, 2013). In Horizon Europe, the Plan for Dissemination and Exploitation, including Communication activities (PDEC), was made an integral part of the project design from the beginning. Once a project starts, the PDEC should be developed based on the proposal content and then further widened to include the perspectives of all stakeholders (EC, 2022).

Both the guidance from Horizon 2020 and the updated guidance from the Horizon Europe funding programme (EC, 2022) are applicable to all research areas. However, we are interested in determining how such a plan can be drafted for research projects in the fields of urban planning and sustainable spatial development. This question was found relevant since projects in these fields usually do not have 'sellable' or even marketable outcomes and products but rather provide soft measures and recommendations for public policies. Accordingly, it can be challenging to set an exploitation strategy and business plan as defined by guidelines and accessible models. Therefore, it is necessary to first translate research activities and outputs clearly into socio-economic benefits for the society, which can be understood as an exploitable value proposition of the project.

The research activities and results reported in this paper were developed within the research project funded by the European Union (EU) under the Joint Programming Initiative (JPI) Urban Europe/ERA-NET Cofund Smart Urban. JPI Urban Europe was designed to implement the European Research Area, which aims to promote strategic cooperation between EU member states and associated countries. The project was titled *C3Places – using ICT for co-creation for inclusive public places*, and its aim was to increase the quality of public open spaces (POSs) (e.g. squares, parks and green spaces) as a public good, reflecting the needs for different social groups through information and communication technology (ICT). Developing an exploitation plan and a related business model was one of the tasks in Work Package 6 (WP6) 'Dissemination and Exploitation'. Due to the predominant research orientation of the project, the dissemination strategy and exploitation plan were developed in a way to fit the outcomes, mostly related to methodologies and tools to support public services for public goods, and are not a directly 'sellable' product. Deriving from WP6 activities, we mainly aimed to develop a framework to operationalise an exploitation approach to understand the generated value, the relations between the stakeholders and the project's social benefits and financial components.

This article presents, compares and assesses the approach adopted to draft the exploitation plan developed for the C3Places project. The business model canvas (BMC) is a framework that can describe how a project creates, delivers and captures value (Osterwalder and Pigneur, 2010); therefore, it is often used as a basis for the analytical evaluation of business model items. This article hypothesises that the BMC can be a useful tool for research grant beneficiaries to better frame research project outputs; however, it requires certain adjustments to apprehend the values which are not marketable or sellable but critical for public benefit. Our purpose was to test whether the BMC can also be a promising method to ease the knowledge transfer and integration of outcomes from research to practice.

The resulting reference framework can be used as a guideline for the design and development of exploitation plans for research and public benefit-oriented projects. It can also support the decision-making processes of both policymakers and private organisations to cooperate and communicate more efficiently with stakeholders and the public.

State-of-the-art

To determine how different beneficiaries develop their exploitation activities around projects, this paper starts with the exploration of best practices adopted by various EU research projects, targeting projects under the topics of urban development and spatial design. However, since the search returned scarce results, the exploration had to be broadened to projects under other topics and some useful exploitation and dissemination plans were identified, such as the OI-Net project (*Sustainability & Exploitation plan & monitoring: WP8 _ deliverable 8.1*, 2017), SafeCity project (Gallego et al., 2012), SciGaIA (SIGMA ORIONIS, 2015) and PATHS project (Skjćvestad and Bergheim, 2014). This review indicated that most project reports focused on dissemination strategies, and many combined dissemination and exploitation strategies. Very few targeted result exploitation, and even fewer framed their exploitation as a business model, which confirms the frequent overlap between dissemination and exploitation in projects' outputs. Moreover, some observations have indicated that the design and implementation of an effective valorisation strategy that can sufficiently promote projects and their outcomes is difficult for promoters and coordinators of European research projects (Antunes, 2011).

There have been several other attempts to use a business model approach to analyse and evaluate the outputs of different projects in urban planning, smart cities and mobility. For example, Tanda and De Marco (2019) studied how a business model framework works for smart city mobility solutions; Díaz-Díaz, Muñoz and Pérez-González (2017) used this framework to evaluate and map sustainable city projects; Kajanus et al. (2019) explored its application in the European forest sector and Gasparin et al. (2020) defined a business model for social innovation. Although these projects addressed value generation and the way stakeholders interact with each other, to various extents, this was not their prime focus. We believe that C3Places can not only provide a strategy to exploit project results but also act as a role model for future exploitation strategies and a guideline for using a business model approach to present the value of public benefit-oriented projects with outcomes in public interest.

BMC and Value Proposition

The business model concept can be understood and defined from different perspectives (see Gasparin et al., 2020 for a review). Osterwalder, Pigneur and Tucci (2005: 10) stress the importance of the business model to describe the value a company offers to one or several segments of customers. A business model describes how a company organises itself to create, distribute and retain value (Baden-Fuller and Morgan, 2010). Apart

Fig. 2 Creation of first draft of the C3Places BMC jointly with contributions of all partners at the meeting in Ljubljana, Slovenia, during 17-19 September 2018

from different businesses in accounting and entrepreneurial settings, business models have been increasingly applied in the public sector as well (Gasparin et al., 2020). This has been facilitated especially by the development of BMC (Osterwalder and Pigneur, 2010), which is a well-known standard for designing or analysing business models. Because of its simple and concise structure, the BMC is also convenient for individuals with non-business backgrounds.

BMC is a strategic management template for developing new or documenting existing business models. It is a visual chart with elements describing a firm's value proposition, infrastructure, customers and finances, assisting them in aligning their activities by illustrating potential trade-offs (De Reuver, Bouwman and Haaker, 2013). The main elements included in the BMC structure are key partners, activities and resources; value proposition; customer relations and segments; channel cost structure and revenue stream (Osterwalder et al., 2014, Strategyzer.com).

BMC was proposed as an effective tool for preparing an exploitation plan in C3Places by a project partner from a business school. The project partner, responsible for delivering the exploitation plan, had expertise in spatial planning and decided to test whether BMC can be used as a tool to translate C3Places's research outcomes into a language understandable to policymakers and other end users, as defined in *customer segments*. The 'translation' was based on the assumption that the project results are intended primarily to provide added value to the public policy and public goods (i.e. to improve POS attractiveness, accessibility and inclusiveness). The purpose of the exploitation plan for such a project is to describe how the consortium intends to use the results of activities conducted during and after the project and what C3Places outcomes are mostly intended for public use (*C3Places – using ICT for co-creation of inclusive public places*, no date).

A crucial component of a business model is *value proposition*. It refers to the value to be delivered, communicated and acknowledged and can apply to the entire project or specific products or services. Value proposition addresses customers' problems or satisfies their needs. Each value proposition bundle of products or services is linked to the requirements of a specific *customer segment*. Thus, value proposition is an aggregation of the benefits that a project offers to customers. Value proposition can be innovative or similar to existing market offers but with added features and attributes (Strategyzer AG, no date a). Values may be quantitative (e.g. price and speed of service) or qualitative (e.g. design and customer experience). This study used value proposition canvas (VPC) (Strategyzer AG, no date b) to better understand the target user group's needs and to develop and interpret the value and different benefits of the project outcomes in detail.

Methods

C3Places's Approach to Exploitation Activities

C3Places was a multidisciplinary research project which included basic and strategic research, innovation and application, involving partners from different European countries and cultures.[1] It was aimed at developing strategies and tools to increase POS quality through ICT by positively influencing co-creation and social cohesion. The project generated a knowledge base and know-how for a co-creation approach, which was used to merge the use of ICT with the essential functions of POSs. It explored the new dynamics of open spaces as a trusted service for the community and expanded the understanding of how mediated POSs function, focusing on stakeholders, the local context and different social groups. Through ICT and co-creation with users, C3Places also expanded the knowledge on meeting citizens' emerging needs regarding future POSs. In particular, it aimed at advancing knowledge on the interactions among POSs, urban design and urban sociology with behaviour research and ICT, on one hand, and exploring the possibilities and benefits of using ICT for the co-creation processes of POS, on the other (*C3Places – using ICT for co-creation of inclusive public places*, no date).

The C3Places activities were divided into seven WPs. The objective of WP6 was the dissemination and exploitation of project results. WP6 ran in parallel with other WPs throughout the project lifecycle. Its principal objectives included the development of a dissemination strategy and its coordinated application, ensuring the widest possible dissemination of the project results among target audiences (i.e. stakeholders, society, urban practitioners, policy makers, ICT developers and researcher community), and the analysis of further exploitation methods, including drafting of appropriate exploitation plans and a related business model for the C3Places solution (*C3Places – using ICT for co-creation of inclusive public places*, no date).

WP6 encompassed dissemination and communication, innovation management and exploitation. The exploitation focused on explor-

1 Further details can be found on the project website: C3Places.eu.

ing opportunities within the project and beyond, which could lead to creating new solutions, services or products. It also aimed to create connections between the consortium and external stakeholders, such as policymakers, NGOs and SMEs. In this WP, the exploitation plan and a related business model for C3Places were drafted as deliverable outputs (Žlender and Šuklje Erjavec, 2020).

This article focuses on WP activities related to exploitation only, since this is largely an unresearched and undefined area in the guidelines for EU research programmes' outputs. Next, the BMC's application is presented as a framework to guide the exploitation of C3Places' outputs. Further, the success of the BMC application is evaluated and its potential application to research projects in urban development is discussed.

Building the Exploitation Strategy

The exploitation plan was developed by the coordinating partner of WP6 with the support of all project partners. The BMC was used as a starting point to discuss and develop different relevant parts of the C3Places business model, such as customer segments (end users), value proposition (benefits) and customer relationships.

The BMC framework was first presented to all C3Places partners and then jointly discussed. This was achieved through a brainstorming workshop in which all C3Places partners collectively filled in the original BMC (Fig. 2). The contents of the framework were further discussed and developed through online communication and filling in of the BMC created on the website canvanizer.com (Fig. 1), where all partners were free to add content to align the framework as closely as possible to the C3Places exploitation plan needs. The frame was then discussed again in person during two workshops, which occurred during two further meetings of the project partners. The workshops were the milestones for the exploitation strategy and the 'C3Places business model' development. These involved discussions in person, which facilitated exchanging views on different topics, resolving emerging disagreements and issues and proposing new ideas in an open and involving manner (Fig. 2; Žlender and Šuklje Erjavec, 2020).

During this process, the project partners identified areas of exploitable outcomes, some of which were common to all project partners, while some were applicable to individual partners only. Based on the data gathered from the workshop and on the draft created on the website, data were analysed to further develop the BMC and exploitation strategy for C3Places.

Analysis and Results

General Exploitation Framework

In drafting the C3Places exploitation strategy, the first step was to determine the exploitable results and deliverables. To begin, aspects such as potential geographical spread with respect to the spatial level of the markets targeted for the project results' exploitation, potential users of the C3Places results, analyses of the state-of-the-art of the ICT-supported co-creation to highlight the innovation value of the results, difference from existing competing products and services and management of the research data generated and/or collected during the project were considered (*C3Places – using ICT for co-creation of inclusive public places*, no date).

Given these aspects, the objectives (Table I) and main goals of the exploitation plan (Žlender and Šuklje Erjavec, 2020) were defined:

(1) Elaborate a continuous work plan for establishing the main exploitation aspects to maximise the benefits of project results.

(2) Establish suitable actions for successful further exploitation of C3Places results achieved during project implementation.

Accordingly, the exploitation strategy identified and described the exploitable outcomes, potential users (target groups), activities, instruments and channels through which project results were to be exploited. To develop this further, BMC was used, facilitating exploratory research into customer value, information sharing and business model design.

Each BMC component was addressed in detail, starting with an explanation of how the C3Places project relates to the component, continuing with the list of relevant guiding questions and leading further to the detailed C3Places exploitation content addressed by the component.

To better address the specific contents of C3Places, each component was translated into more closely related terminology and supported by guiding questions relevant to the project.

Expected C3Places Exploitable Outcomes and Value Proposition

In continuation, the VPC (Strategyzer AG, no date b) was used to better define the value of the deliverables to different users. Figure 3 shows the building blocks of VPC and its relation to BMC.

The main objective of C3Places was to produce results that would influence public policies in POS development. Most of the project's

Table I Objectives of the C3Places exploitation plan

IDENTIFY	**ACTIONS to take:**
Identify the expected outcomes and deliverables from the C3Places project	• Align partners' exploitation activities for a more efficient and effective exploitation; • Coordinate all levels and types of exploitation of the knowledge produced by the project; • Identify the project's know-how and knowledge transfer opportunities.
↓ **PROMOTE**	**ACTIONS to take:**
Promote and raise awareness about the project's contents and results	• Establish interactions and networking to create a core group of stakeholders interested in exploiting C3Places results; • Strengthen the visibility of the project results beyond the core target groups to other organisations, policymakers, etc., which can promote the project to their own networks.
↓ **EXPAND**	**ACTIONS to take:**
Explore how the project's deliverables can be further utilised	• Define additional interactions and networking aimed at addressing a wider group of stakeholders interested in exploiting C3Places results; • Specify channels for exploitation; • Determine possible directions in which the C3Places topics can be extended.
↓ **TRANSFER**	**ACTIONS to take:**
Transfer results to appropriate external agents	• Transfer exploitable project results through different channels to different targeted users; • Ensure availability for continuous use of project results and enable further development.

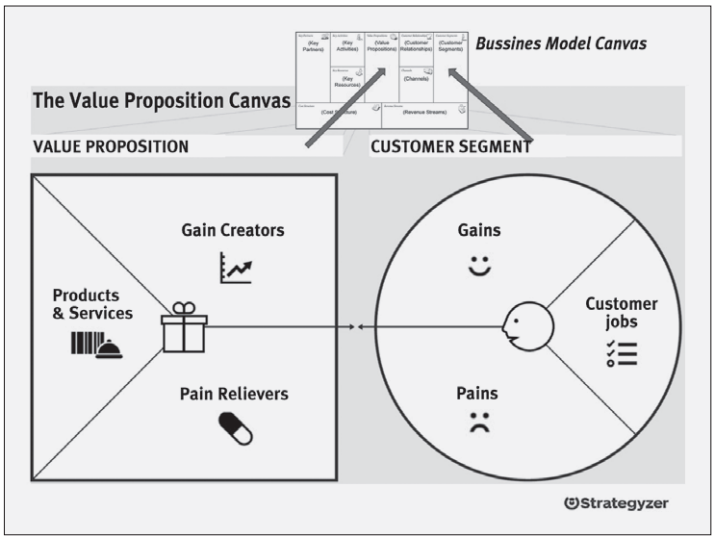


Fig. 3 VPC and its relation to BMC

co-creation actions aimed at raising awareness, creating more responsive behaviours, successfully involving different stakeholders and interlinking them with decision-making and public policymaking (Žlender and Šuklje Erjavec, 2020). Accordingly, the values developed by the project were qualitative and mostly related to improvements in present policies and strategies. The guiding principle of C3Places' *value proposition* was to offer scalable solutions adjusted to different target audiences (customer segments) and situations or places. According to the VPC, '*Who do you help?*' is the key question for defining customer segments. To define the target audience or *end users* of C3Places outcomes, the following guiding questions were used:

– For whom is the value being created? For whom is the project being delivered?
– Who benefits from the results?
– Who supports future applications?
– Who could be the user of (different) project results?
– Who are the most important users/stakeholders?
– How do they differ from each other?

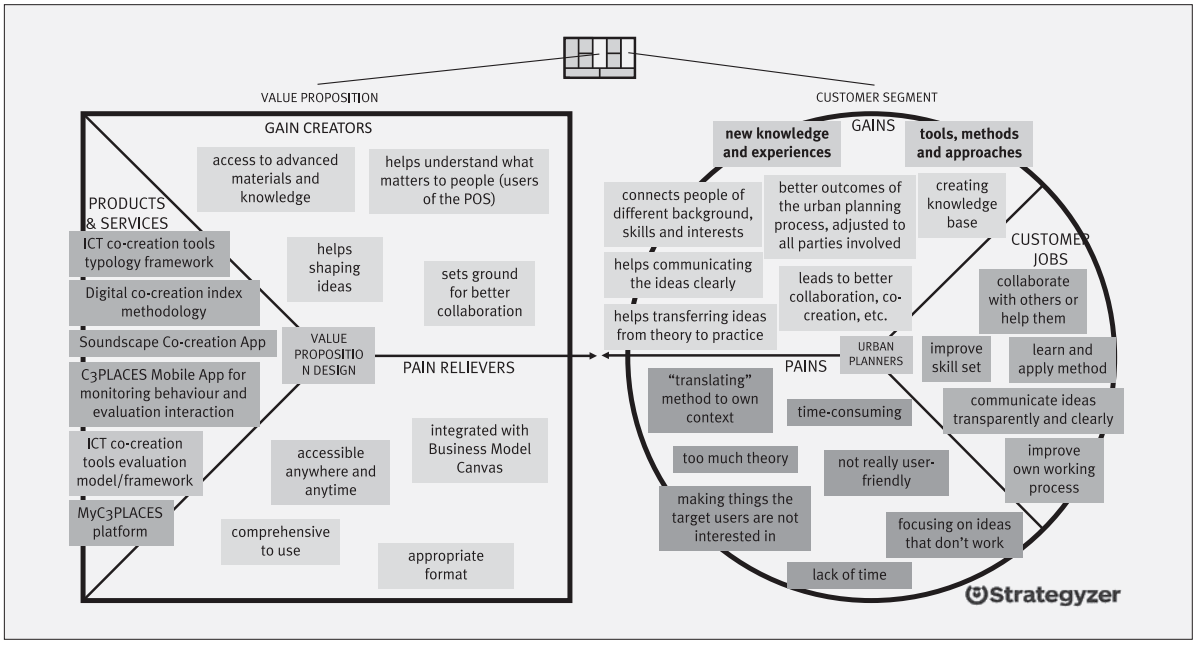
By answering these questions, three main C3Places 'customer segments' were defined as *end users* to adopt or apply project results and potentially benefit from the knowledge produced:

I. **POS users**, which can benefit directly from project outcomes during the project (through co-creation), as participants of living labs, and after the project through future improvement in POSs, new ways of using and experiencing them and more general future improvement in quality of place, quality of life conditions and enhanced well-being and satisfaction.

II. **POS developers** (spatial development stakeholders), which encompass parties for which C3Places can propose a user-centric approach. Concerning their role in the process, POS developers can be structured into four main groups: city administration at different levels as policymakers and decision makers, experts as POS planners and designers, citizens as active co-creators and similar.

III. **Supporters of POS development** as users related to new opportunities that C3Places outcomes would open for new business and market developments related to POS and digi-

Fig. 4 VPC (Strategyzer AG, no date b) applied to C3Places: example of the application for *customer segment* of 'POS developers'



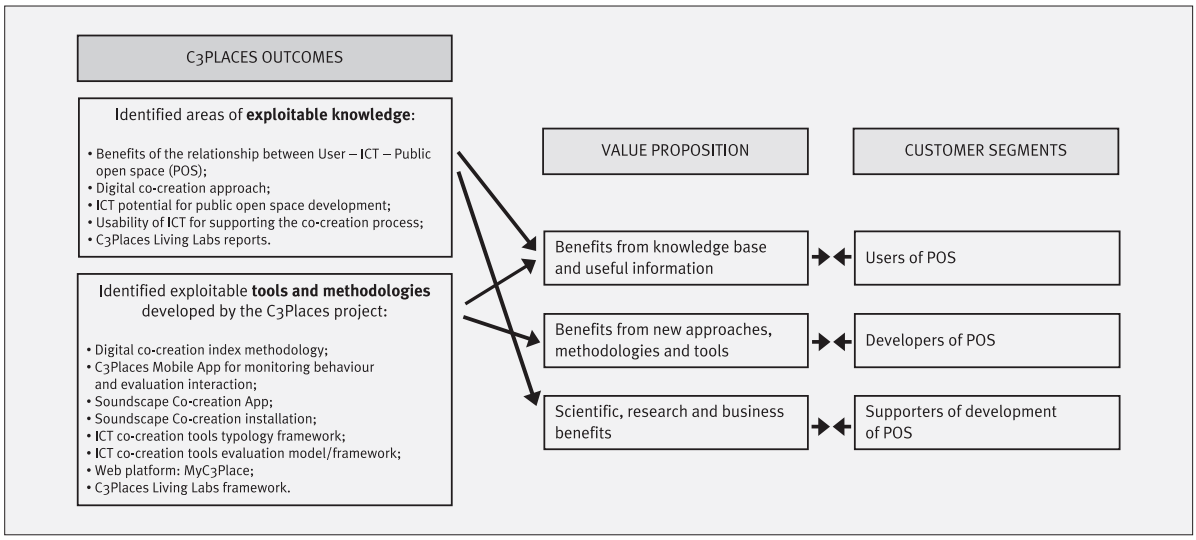


Fig. 5 Identified C3Places outcomes and corresponding customer segments and their value proposition

tal tools, such as local businesses, developers of digital tools, developers of urban furniture, artists, educational institutions and academia.

Considering these, the value proposition of C3Places was divided into two groups of exploitable outcomes: exploitable knowledge and exploitable tools and methodologies. Figure 5 illustrates how these two groups are related to the value proposition component and its three groups of benefits, as well as its correspondence with the customer segments (end user) groups. Such structuring of the exploitation process can help researchers understand how the aspects of project outcomes should be understood and presented to overcome challenges and sustain project objectives.

Since value proposition is a key building block in the BMC, VPC was applied to determine C3Places' value proposition in detail for each identified 'customer segment'. Figure 4 presents the VPC applied to 'POS developers'. The C3Places partners identified many *gains* and *pains* which developers may encounter. Note that in Figure 4 'new knowledge and experiences' and 'tools, methods and approaches' are put in bold since these *gains* were identified for all C3Places customer segments (Žlender and Šuklje Erjavec, 2020). Among the listed jobs and activities relevant for developers, the emphasis lies on communication and collaboration, which the C3Places partners learned from project expe-

Fig. 6 VPC for public benefit-oriented project: guiding questions for each building block

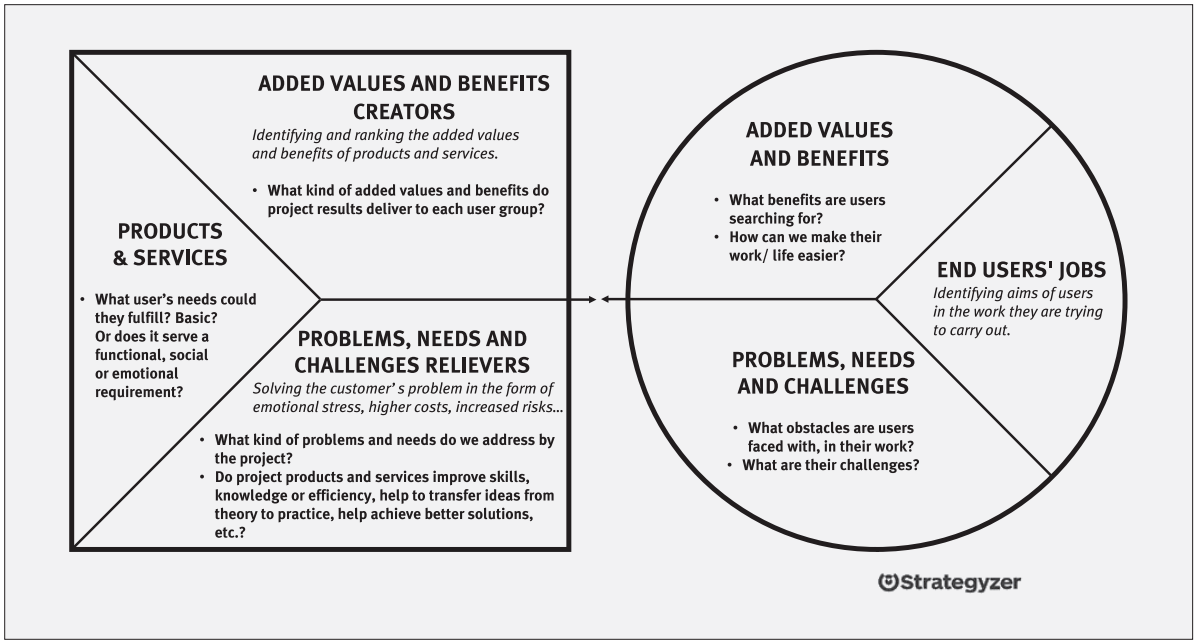


TABLE II BMC FOR THE C3PLACES PROJECT

Key partners	**PROJECT PARTNERS** **OTHER SUPPORTING PARTNERS:** • **Government:** city and municipal council • **Civil society:** communities, local organisations, associations of cities • **Industry:** developers of digital tools • **Academia:** experts' education **+** • **Practitioners** • **Other public institutions**
Key activities	**LIVING LABS** **MYC3PLACES PLATFORM DEVELOPMENT** **MOBILE APPLICATIONS DEVELOPMENT** (developing, testing within Living Labs, improving for final use, presenting to relevant user groups, sharing /selling to the interested public) **DIGITAL CO-CREATION INDEX** (development of the index, testing within Living Labs, sharing via project website, publishing and presenting) **OVERVIEW OF ICT TOOLS' FRAMEWORK DEVELOPMENT** **ICT TOOLS' EVALUATION MODEL FOR CO-CREATION OF POS** **DISSEMINATION STRATEGY**
Key resources	**PHYSICAL RESOURCES** [POC, physical infrastructure to support activities (e.g. servers and other ICT infrastructure)] **RESEARCH RESULTS, KNOWLEDGE AND SKILLS** **HUMAN:** • **facilitator** (central for successful business development); • **public participants and other stakeholders;** • **POS users** **DIGITAL:** • **digital infrastructure,** • **co-creation process enhancements by digital additions;** • **software products**
Value proposition	**BENEFITS FROM KNOWLEDGE BASE AND USEFUL INFORMATION** **BENEFITS FROM NEW APPROACHES, METHODOLOGIES AND TOOLS** **SCIENTIFIC AND RESEARCH BENEFITS**
Customer relationships	**REAL-TIME AND PLACE DEVELOPERS of a chosen POS** **CO-CREATION (for planning design, implementation and management) ON THE CITY LEVEL** **CO-CREATION ON THE LOCAL LEVEL** **SCIENTIFIC AND RESEARCH COMMUNITIES** **PERSONAL CONTACTS AND AMBASSADORS** **EDUCATIONAL INSTITUTIONS**
Channels	**SCIENTIFIC PUBLICATIONS** **RESEARCH DISSEMINATION TO SOCIETY** **ONLINE PRESENCE** [social media channels, websites (project, institutional), MyC3PLACES platform] **EXISTING CHANNELS** (e.g. Leading Cities Association, social centres in the area, facilitators, municipalities, parishes and zone councils) **PUBLIC–PRIVATE PARTNERSHIPS** **PERSONAL CONTACTS AND AMBASSADORS** **EDUCATION/TRAINING** (formal, informal, alternative, in-person, virtual/ digital)
Customer segments	**USERS OF POS**: • **regular users of the space, one-time users,** non-users/potential/virtual users; • **cities, neighbourhoods, local communities** **DEVELOPERS OF POS:** • **city administration at different levels** (local authorities, municipal councils, city councils); • **experts** (design and urban planning professionals, co-creation process mediators, stewards, etc.); • **citizens, NGOs and urban activists;** • **public institutions and companies** (schools, museums, galleries, cultural centres, etc.) **SUPPORTERS OF POS DEVELOPMENT:** • **local businesses/services** (shopkeepers, cultural and social associations, social collectives); • **artists;** • **developers of digital tools;** • **developers of urban and park furniture** • **academia and educational institutions**
Cost structure	**GENERAL AND ADMINISTRATIVE** **RESEARCH PLANNING AND IMPLEMENTATION** (Living Labs) **POS DEVELOPMENT COSTS** **DEVELOPMENT OF ICT CONTENTS (MATERIAL)** (web platform, mobile application) **DISSEMINATION ACTIVITIES**
Revenue streams	**PUBLIC FINANCING** **PUBLIC ECONOMIC VALUE** **BUSINESS SPONSORING/ADs** **PUBLIC SUSTAINABILITY** **CROWD FUNDING** **PUBLIC EVENTS**

Note: The BMC blocks are organised as a table to improve the legibility of their content.

TABLE III BMC FOR A PUBLIC BENEFIT-ORIENTED PROJECT: GUIDING QUESTIONS FOR EACH BUILDING BLOCK

Key partners →	**Key actors – Who helps you?** • Who are our key actors? • Who is producing and supplying? • What are the incentives and impediments for actors? • Who may be projects' key supporters? What are the possibilities for joint partnerships and strategic alliances with them? • Which key activities do key actors perform, and which key resources do they have?
Key activities →	**Key activities – What do our key actors do?** • What key activities do our benefits and added-value possibilities require? • How are activities related to the communication approach and interactions and relationships/co-creation process? • How to achieve suitable revenues/public benefit-oriented streams?
Key resources →	**Key resources – What you are and what you have?** • What key resources do our benefits and added-value possibilities require? • Using which communication approaches do our end-user segments want to be reached?
Value proposition →	**Benefits and added value possibilities – How you help?** • Who could be the users of the project outcomes/results? • For what purposes could the outcomes/results be used? • With this outcome/result, what services are being offered to each user segment? • Do the outcomes meet the needs of specific actors? • Are the actors interested in adopting our outcomes/results? • Which one of our user problems are being solved? • What value does our outcome/result deliver to users? • Are our outcomes a plausible improvement in the quality of life of users?
Customer relationships →	**Interactions and relationships/co-creation process – How different users interlink and interact?** • How does the project define, get, keep and grow networks of possible users? • Which relations have the project established for interactions? Which are still needed? • How costly and time-consuming are they? • How are they integrated with the rest of the project's business model?
Channels →	**Communication approach – What are the ways to reach relevant end users?** • What communication approaches does the project (or each partner) use to reach the targeted audience? • How do other similar projects reach them now? • Which ones work best? • Which ones are the most cost-efficient? • How are these being integrated with customer routines?
Customer segments →	**End users' segments – Who you help?** • For whom is the value being created? For whom is the project being developed? • Who benefits from this? • Who supports the use? • Who could be the user of (different) project results? • Who are our most important users/stakeholders? • How are they different?
Cost structure →	**Cost structure – What you give?** • Which key activities and resources are the most expensive? • How high or low are our costs compared to similar services provided on the market? • Are our sources of costs less, equal or more diversified compared to similar services provided on the market?
Revenue streams →	**Revenues/public benefit-oriented streams *result from benefits and added value possibilities successfully offered to the users.*** • What project benefits and added value possibilities are users really interested in and willing to use? • What kind of added value can such use bring? • What are the currently used methodologies, tools and approaches? • What are the risks involved? • What are the costs involved? • What are the benefits? • How does it affect economic value?

Note: The BMC blocks are organised as a table to improve the legibility of their content.

rience in order to be critical for a successful application of developers' products.

Similar to BMC, VPC was originally designed for businesses with an economic mission. To better fit the aim and purpose of C3Places and the nature of its outputs, its guiding questions were modified to better fit the non-business approach. As presented in Fig. 6, the questions are closely related to the possibilities which VPC offers to a (research) project for public benefit. This can be clearly seen, for example, in the building block of *products & services*, where users' social and other requirements are prioritised over creating 'sellable' products. *Gains* are 'translated' into *added values* and *benefits of project results* and *pain relievers* into *problems, needs* and *challenges* to be addressed by the project.

Business Model Canvas for a Public Benefit Oriented Project

In this section, the BMC optimised for C3Places is presented. As shown in Table II, the joint work of all project partners through workshops and online communication resulted in a substantially filled-in canvas, compared to the initial ideas presented in Fig. 1. Whilst some building blocks were easy to fill in (e.g. key partners, resources and channels), others, such as value proposition and customer segments and relationships, were elaborated more profoundly after completing VPC, which helped define these blocks more clearly.

Using BMC, the generated knowledge and innovation for the purpose of public use was brought at different levels, hence 'translating' the classic business market, as defined originally for business plans, into the public interest and non-monetary values. At this point, we faced two challenges in drafting the 'business model for public interest': (1) the use of available frames for business models (such as the BMC) for public benefit-oriented project results and content, and (2) the translation of common business and exploitation plan terminology to match the public benefit-oriented project results. In translating the terms, some, such as business plan and value proposition, were retained to make the new approach more comparable to the original.

Table III presents our suggestions on how to deal with these challenges. To better fit the specific contents of the project, each BMC block was partially translated into terminology more closely related to spatial planning while being supported by relevant guiding questions related to the involvement of all actors in contact with public space, the potential co-creative role they can play and the benefits for the community. Such a framework can be used to develop other 'business models' for public benefit-oriented projects.

The proposed framework was later tested within another EU-funded research project titled 'Vertical Green 2.0: Vertical greening for living cities – co-creative innovation for the breakthrough of an old concept' (*Vertical Green 2.0*, 2018). In a workshop which took place within a project partners meeting, the BMC framework was first presented and then jointly filled in following the guidance questions presented in Table III. The participants found the framework useful in determining their research project outcomes and structuring the BMC blocks in a way to create value for the public. Furthermore, they applied the framework to their project and structured the blocks to best suit the theme and goals that the project pursued.

Discussion

Potential Implications

This paper presents and discusses how an exploitation plan and business model can be applied to a public benefit-oriented project and how value can be generated through defining and proposing solutions for social, cultural, environmental and other issues. Business models are recognised as 'crucial in determining an organisation's strategic direction and sustainable development' (Schaltegger et al., 2011); thus, it was considered worthwhile to see whether this approach could be appropriately modified for exploitation plans in research projects, thereby improving the understanding of non-monetary value. Examining some of the published exploitation plans of different EU research projects, as discussed in section 1.1, most of them were found to be limited in demonstrating the applicability and transferability of projects' outputs to benefit the public. Specifically problematic were the conceptualisation and definition of value, a lack of clear distinction between exploitation and dissemination and the disability to enable in-depth project analysis. Based on BMC, a framework was prepared to analyse and establish public benefit-oriented models in the design and development of research projects predominately in urban development and similar areas (Table III). This framework provides a common dictionary to describe the characteristics of public benefit-oriented projects and to illustrate how they create and deliver value. Scholars and academics can use this framework as a reference for analysing their (public benefit-oriented) research projects and understanding the dynamics behind their implementation. Accordingly, they can use it as a tool to further develop and direct their research projects depending on the value that they want to provide. It can also help them identify partners and stakeholders to develop and implement research projects effectively and efficiently and to discuss the outcomes of public benefit within research projects with

more business-oriented stakeholders. The framework can also help scholars and academics to discuss the public benefit outcomes of the research project with more commercially oriented stakeholders or to identify partners and stakeholders for its efficient and effective development and implementation.

The C3Places project, which was presented as an example in this paper, explored the use of ICT for the co-creation of inclusive public places. By using BMC in such a project, it was shown how a simple business planning tool can also be used to develop an exploitation plan for public benefit outcomes, how such a model can help identify different values and target audiences (stakeholders) and how it can be used as a strategic tool for researchers and the target audience. By applying the public benefit-oriented BMC, researchers can determine the research outcomes in public interest (products and services) in a structured manner. They can shape their outcomes in a way that is adapted to a specific exploitation context and can best serve the end user.

Such a framework can also be useful for experts, policy and decision makers as it enables them to compare different public benefit-oriented projects. Thus, it can help them in deciding how and why they might engage with stakeholders, how to approach financing, which solution is the most beneficial to citizens, which one delivers the desired policies most cost effectively, etc. Therefore, this framework acts as a tool not only for academics but also for public authorities to apply and further develop their own model applications for public benefit-oriented projects, products and services. This is a crucial contribution for exploring the possibilities for implementing project outcomes. Although it needs further development and testing, this framework has great potential to be used in the fields of spatial planning and urban development, as it emphasises a strong participative approach in specifying common values and ways to create them. This is crucial for creating inclusive and sustainable public spaces. It can also be used as a management tool for POSs.

Interestingly, the concept of co-creation also originated in the business world and has only recently been recognised as an important aspect for improving and further developing participatory approaches in spatial planning, especially in co-creating inclusive and quality development of POSs (Žlender, Šuklje Erjavec and Golićnik Marušić, 2021). Similarly, the business model, as developed for the needs of producer customers and simplified according to BMC, can broaden the view of urban planners and POS designers to a more holistic involvement of all relevant stakeholders in the process of creating different public benefits and solutions.

LIMITATIONS

In the application of the BMC to C3Places, several obstacles and limitations were identified for any future deployment of results. These include usability (will the results meet user needs?), acceptance (will the users accept any C3Places outputs and are there alternatives on the market?), technical limitations to the implementation of C3Places results and funding for further work. Researchers should focus on addressing these issues and their resolution to an as wide as possible extent during the project proposal phase through a joint discussion among all partners in a co-creative manner.

Another limitation of the content presented may be the critical or reluctant attitude of experts and practitioners towards the transfer of experience and tools from the business environment to areas such as spatial planning and provision of public goods, particularly from the viewpoint of the often-prevailing influence and pressure of investors on the spatial development of cities, as they prioritise their short-term benefits over long-term benefits for the community. With this in mind, the case presented in this article was taken up. Particularly, these monetary and business values seem to be followed by public funding systems that require the research results to be *marketable, sellable,* etc., as goals that EU funding bodies have emphasized in recent calls. A wider debate may be required to re-examine and set the long-term objectives of the EU-supported research.

CONCLUSION

This article explores the use of the business model approach to exploit public benefit-oriented project results. It illustrates how BMC can act as a tool for delivering research outcomes to different stakeholders according to their values and in a language familiar to them. This also confirms the hypothesis set at the beginning of this paper.

Although business models are gaining popularity in academic circles as a useful tool to sustain growth, only a few practical tools/frameworks are available for designing and supporting public benefit-oriented business models (Gasparin et al., 2020). Our proposed model, based on the BMC framework, is an attempt to fill this gap. Its testing within the C3Places and later the Vertical Green 2.0 project validated its effectiveness in structing the exploitation of research outputs, especially those of a non-monetary value. Further research should validate the framework and improve its structure, especially in terms of value proposition, to align it even closer to the common aims of public benefit-oriented organisations, particularly in sustaining their long-term social, economic and environmental value.

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Sources of illustrations and tables

Fig. 2, 5	Authors' own
Fig. 1	https://canvanizer.com
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Fig. 1 The symbolic images of the city of Djidjelli

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Forging the City Image during the French Colonial Period (1883-1962) in the Case of Jijel (Algeria)

city image
colonial urbanism
French colonial period (1883-1962)
Jijel (Djidjelli), Algeria
urban branding

The urban configuration of Algerian cities reflects the influence of French colonization (1883-1962). This is characterized by a collection of contrasts and overlays of different forms of architecture and urbanism. In all urban agglomerations in Algeria, the colonial section remains the most prominent and structured. This legacy of colonial architecture and urban planning has ignited a national debate in political and academic circles regarding its classification as heritage. This current study contributes to the debate by adopting a neutral and scientific approach in order to smooth things out and shed light on the role and creation of urban form and its image, specifically through the example of Jijel. The notion of urban image is explored through colonial architectural achievements, urban planning, and artistic endeavours that were emblematic of the city during the colonial period and continue to be so today. This article showcases various works created during the colonial period in Jijel, those that still convey an identity that defines the city. The concern for this identity is substantiated by a research project that seeks to identify the city's image through significant architectural works across different epochs and determine those that accurately convey the city's identity within the country.

Introduction

The urban fabrics of Algerian cities are comprised of multiple layers, each representing distinct historical periods and often overlapping or coexisting. These strata showcase noteworthy architectural accomplishments ranging from the Roman and Phoenician eras to the Arab-Muslim and colonial periods. Being the most recent, the colonial period has left a significant imprint on the urban space and architectural landscape of contemporary cities. At the onset of colonization, the inadequate state of urbanization in the country offered an opportunity to experiment with imported urban models and architectural styles.

In addition to the principle of installing urban spaces that are more suited to the Western way of life, these works also conveyed a sense of civilizational development and symbolized the level of development of the occupants. Furthermore, they aimed to establish colonial authority and imprint the mark of new power through urban and architectural works.

Architects and urban planners expressed themselves through their works, spanning from the north to the south and from the east to the west of the country, by promoting an urban and architectural style that adhered to the trends prevailing in Europe at the time. Over the last 130 years, Algerian cities have undergone a significant transformation in their appearance due to urban planning and development that set them apart from previous eras.

Each city has witnessed the metamorphosis of its territory and the creation of its unique urban identity, which is manifested in notable architectural structures, urban landmarks, and a distinct urban configuration. The new configuration of our cities, under the framework of urban reappropriation, catered primarily to the occupying culture and society, which favored a different urban model and epitomized a "civilized" way of life. The urban marketing of that time assigned to each city a symbolic urban image that essentially represented civilization.

The Algerian society is currently engaged in a debate regarding the urban and architectural heritage of a specific period. This debate seeks to address the question of whether colonial achievements can be considered national heritage. Algerian daily newspapers have continuously followed this fervent debate, with the November 13, 2014 edition of El-Watan (Pp 02) titled "Colonial Architecture, Asset or Burden?" and opening the discussion by asking: "Sixty years later, can these "ramifications of war" be claimed as part of Algerian identity?"

While waiting for the resolution of this challenging issue, there is a growing interest in the current research on the production of city images during the colonial period. This problem is being explored through the example of Jijel, a medium-sized city called Djidjelli. The research aims to identify the most representative image of the city and analyse the process of the production of the urban and architectural elements that shaped the city's image over a long period, extending until the present.

Situated in the North East and overlooking the Mediterranean, Jijel has had a tragic urban history. The destruction of the old city by a swamp in 1873 coincided with the arrival of the French in the region. The Ottoman city was 80% demolished, leading to the displacement of the city's inhabitants. The reconstruction of the city on a virgin land provided the French colonization authorities with an opportunity to express their urbanistic and architectural ideas freely.

During this period, the city acquired a collection of architectural structures and specific urban accomplishments that have shaped its distinctive identity. Postcards serve as a crucial communication tool for portraying urban imagery in contemporary urban marketing. Among the urban images depicted during the French period, we will initially select the images of the city that elicited the most significant responses in communication and conduct a survey to determine the representative image and evaluate its sustainability. To deconstruct the process involved in creating this image, we conducted architectural analysis tests

in the urban areas. Our work entailed scrutinizing the symbolism of the fabricated image and its adoption by the general public.

Does French Colonial Heritage have a Collective Meaning?

The presentation of the concepts of "urban identity" and "heritage" serves as a logical extension of this section since these two ideas are frequently intertwined. Belhadef (2016) emphasizes the importance of identity in constructing any society, asserting that the act of building reflects the builder's identity and inspirations. Today, our cities strive to establish a distinct identity amidst the globalization of constructions and architectural styles. Unfortunately, the production of post-colonial architecture and urbanism has not facilitated the reconstruction of recent urban identities. As Oulebsir (2000: 26) notes, urban and architectural identity elements are still associated with the colonial period, and many view the notion of heritage as a legacy of French colonization.

According to UNESCO's definition of heritage, it is a legacy of the past that we enjoy today and pass on to future generations. Vincent (1992) defines heritage as a set of tangible and intangible cultural elements charged with multiple meanings that have a collective dimension and are transmitted from generation to generation. Based on these definitions, the question arises whether French colonial heritage carries meaning with a collective dimension (Vincent, 1992; Aiche, 2006; Kaufmann, 2009; Obad Ščitaroci et al., 2019). This issue, as Aiche (2006) assert, becomes destabilizing for a whole generation that identifies its roots with a heritage representing otherness. Beyond the artistic or economic value of cultural goods (Palaiologou & Griffiths, 2019; Terracciano et al., 2017), the notion of identity is fundamentally linked to heritage and its translation into the symbolic urban image (Kagan, 2022; Low et al., 2005; Phetsuriya & Heath, 2021). The recognition of a legacy as heritage that does not carry values recognized by all as determining its own identity can be an insurmountable compromise for some ideologies (Kaufmann, 2009; Obad Ščitaroci et al., 2019). This debate is still relevant in Algerian cities and, regrettably, is often tainted by nostalgia and ideology.

Whether or not the architectural works that carry references to Algerian architectural identity during the French period should be considered heritage depends on several factors (Ginting & Wahid, 2017; Ujang & Zakariya, 2015; Remini et al., 2011). One important factor is whether these works have enduring cultural or historical significance to the local community or the wider world. If they are recognized as important cultural or historical artefacts, then they may be considered part of Algeria's heritage. The loss of built heritage in cities like Jijel, which also resulted in the loss of their urban identities, is a common problem in many parts of the world. The destruction or alteration of historical structures can have a profound impact on a city's sense of identity and can lead to the loss of important cultural and historical information.

In the case of Jijel, the city's urban image was created by the French during the colonial period, and no urban or architectural elements were inherited from its past. This underscores the importance of preserving historical structures and urban fabric in order to maintain a city's sense of identity and cultural heritage. In cases where historical structures have been lost, efforts can be made to reconstruct or replicate them in order to revive the city's cultural heritage and identity. Its past, which was ravaged by natural circumstances and overrun by French colonization, has been forgotten and ignored by the architects and urban planners of the time. The city and its image were reconstructed during this period by the new occupants, namely the French.

Materials and Methods

In order to approach the subject of study we have adopted a working method in 3 phases:

– **The first phase: Image selection** – The primary objective of the initial stage is to underscore the architectural, artistic, and urban aspects that were featured in postcards during and after the French era. To achieve this, we will adopt a case study approach, drawing upon a series of tourist postcards of Jijel, accessible on the Internet. Through this investigation, we shall endeavour to demonstrate how postcard imagery, as a medium of communication and representation, contributes to the creation of urban identity. Our research involves the selection and analysis of over 100 historical postcards predating 1962. Among these, we have identified the five most frequently depicted images, which we examine within their urban context to comprehend the symbolism they convey.

– **The second phase: Field survey** – The second phase encompasses a perceptual approach to survey both the local and visiting population, with the objective of determining the most representative image of the city of Jijel. Throughout this essay, our focus is on the depiction of the city during the colonial period. Therefore, we aim to address the following questions:

1. Among the images of the city portrayed during the colonial period, which image best epitomizes the city?

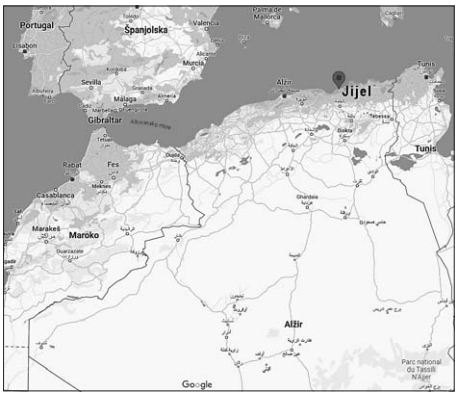


Fig. 2 Location of the city of Jijel on the map of Algeria

2. Do the perceptions of the city's representativeness differ between local inhabitants and visitors?

3. Does the population's nostalgic perception of this period affect the image of the city?

To answer these questions, we conducted a survey over a ten-day period, including the weekend when there was a higher influx of visitors to the city. The sample size of 400 participants was determined by the number of responses obtained during this survey period. The four images of the city analysed from postcards were compared to identify the most fitting representation and the one through which the city is commonly recognized.

The distribution of respondents based on their origin (local or visitor) aims to address the second question regarding differing perceptions of the city's representativeness (Merzoug et al., 2020; Ali Khodja et al., 2019). Furthermore, the distribution of the surveyed population by age group (under 40 and over 40) was carried out to account for any nostalgic effects that could potentially bias the results.

– **The third phase: Syntactic analysis** – Through a syntactic analysis and in the form of an essay (Spain, 2014; Lenzholzer et al., 2018; Van Nes &Yamu, 2017; Önder & Gigi, 2017), we aim to explore the principal urban elements that have contributed to the construction of the urban image of Jijel city. By situating the representative urban image within its urban context, we endeavour to dissect the urban and architectural factors that have facilitated and continue to facilitate the emergence of this image.

Results

Subheadings can be used to structure this section, which aims to present a succinct and accurate account of the experimental findings, their analysis, and the resulting conclusions. Specifically, it should describe the results in a clear and objective manner, explain their significance and implications, and draw valid inferences based on the data.

The City of Jijel Deprived of History and Identity

The examination of the historical record of Jijel city brings to light the unfortunate events that occurred in this coastal urban centre in 1856, as well as the circumstances that led to the establishment of the colonial city (Van Nes & Yamu, 2021; Mahbub, 2019; Roula & Bouchair, 2021).

Jijel, which was known as "Djidjelli" during the French colonial era, is an ancient city situated in the North-East of Algeria. According to Retout (Bouhelouf et al., 2019), the Phoenicians were credited with the founding of the city, establishing a counter or emporium, or perhaps encountering a pre-existing sedentary population. It is likely that a Berber village had already existed on the peninsula, which was considered an easily defensible location against external attacks, a factor that the Kabyle have traditionally taken into consideration when selecting village sites (Malaurie, 2003). The remaining witness of this period is a cemetery "consisting of tombs" located northeast of the city.

This ancient city experienced a unique fate, as it was devastated by a flood in 1856 that destroyed 80% of the old city. Historical accounts, such as L.C. Feraud's work, which was republished in 2014, describe the events in detail. On the night of August 21 to 22, 1856, a violent tremor accompanied by an underground noise, similar to thunder, was felt in the small town of Gigelli. Almost all houses were shaken by the initial shock. The following day, the people returned to the city, feeling reassured by the calm that was beginning to return. However, around noon, an even more violent tremor, accompanied by underground detonations, produced deep cracks in the ground and made the sea bubble, shaking the earth again. The destruction was total, and an immense cloud of dust covered the scene of desolation like a funeral veil. Not a single house was left standing. This vivid description portrays the fate of the Phoenician city formerly known as Igilgili (Eshuis et al., 2014) and marks the end of pre-colonial heritage. This tragic event has remained etched in the collective memory of the city's inhabitants, robbing them of their urban identity.

This historical event coincides with the establishment of colonization (Fig. 3), presenting an opportunity for the latter to occupy the strategic "peninsula" space, which was highly valued by the military, while relocating the city to the surrounding plain. As a result, the citadel was transformed into a military ground, thus completing the urban and architectural traces of the precolonial period.

The Construction of Djidjelli

Capitalizing on this urban vacuum, the authorities of that era initiated the construction of the new city with the aid of military engineering as early as 1863. This impetus, reported by L.C. Feraud and re-edited in 2014, provided a remarkable impetus for the construction work of the new city. The European population swelled from 450 to 1200 inhabitants in a mere year and a half.

The new city was constructed on the agricultural land that was formerly situated in the plain adjacent to the citadel, designed as a city-district. Inscribed in a triangle, the verti-

DJIDJELLI en 1664, estampe de DUVAL

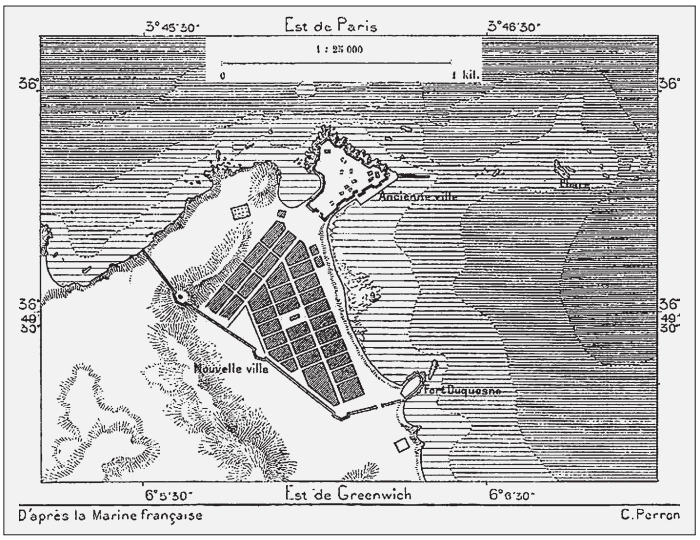


Fig. 3 Sketch Of Igilgili

Fig. 4 Map of Scheslat 1887

ces of this triangle corresponded to the various entrances to the city. This urban grid likely resulted from an adaptation to the site. The implantation site, situated between the sea and the surrounding hills, was previously used as vegetable gardens by the indigenous population (Fig. 4). The axes that define the new city correspond to the boundaries of flat land. The urgency of constructing the city was a significant factor in selecting the site for the new city (Benzerra et al., 2012).

In 1861, a French surveyor named Scheslat hastily created the first master plan for the city of Djidjelli. The new urban layout consisted of a triangular shape with straight streets and blocks arranged in a chessboard pattern, and it had a program of facilities similar to that of European cities. This new urban grid drew inspiration from the urban planning of its time and was dominated by a military imprint, with straight streets leading to peripheral boulevards that intersected at the entrances to the city. These entrances, in the form of traffic circles, served as control points for major roads coming from the east and west (Mohdeb, 1988).

The islands formed by this grid were shared between the European and Algerian population. Most of these islands contained collective gardens, which were remnants of the agricultural past of the land in the blocks occupied by Europeans. Inner courtyards equipped with lemon trees and vines were occupied by the "natives." The reconstructed city can be viewed as a matrix, a set of micro-territories that groups were more or less likely to appropriate based on their social belonging and the meanings attributed to the space. The micro-territories created were reflected in the islands, with each islet attributed to a group, either "French" or "indigenous" Algerian, and each group organizing their urban space according to their ethnic and social belonging.

As a result of the post-war reconstruction, several notable architectural achievements emerged and were integrated into the new urban landscape. In an effort to assert their religious authority, the new leaders prioritized the construction of a church at the intersection of the urban triangle's diagonals. This grandiose and commanding structure with an architectural style reproducing the European model, served to establish the newcomers' religious power. Over time other significant achievements and artistic works were also erected in the urban area, conveying diverse symbolic aspects of Djidjelli city. These works collectively contributed to the formation of the city's urban image. The monumental works were prominently featured on postcards, which served as a highly effective tool for urban marketing during that time and played a key role in shaping the city's overall image.

Architectural and Urban Images Representative of the City of Jijel

To identify the architectural and urban images that represent the city, we conducted an online search and reviewed old postcards (as shown in Fig. 1), using specific keywords. We selected a sample of 100 postcards based on the following:

- old photos Jijel,
- postcard Jijel,
- photos Djidjelli,
- postcard Djidjelli.

The findings of this study reveal the unsurprising identification of four urban images that effectively represent the city of Jijel during the French period, namely the town hall, church, casino hotel, and statue of the fisher-

TABLE I TABLE OF IMAGE PROCESSING RESULTS

	Number of matching images out of 100										
	Church		Town hall		Fisherman's statue		Hotel casino		Other		Total
Old photos Jijel	16	16%	12	12%	5	5%	8	8%	59	59%	100
Postcard Jijel	9	9%	11	11%	9	9%	14	14%	57	57%	100
Pictures of Djidjelli	6	6%	15	15%	8	8%	12	12%	59	59%	100
Postcard Djidjelli	11	11%	11	11%	7	7%	11	11%	60	60%	100
Average		11%		12%		7%		11%		59%	100

man (Table I, Fig. 5). These images, each depicting a distinct theme and building, are integral to the process of urban identification that was adopted in French cities, and their presence in Jijel is a reflection of the replication of this process in the city. (Picard, 1994; Blibli et al., 2015)

URBAN MARKETING AND THE SEARCH FOR THE NEW IMAGE OF THE CITY OF DJIDJELLI

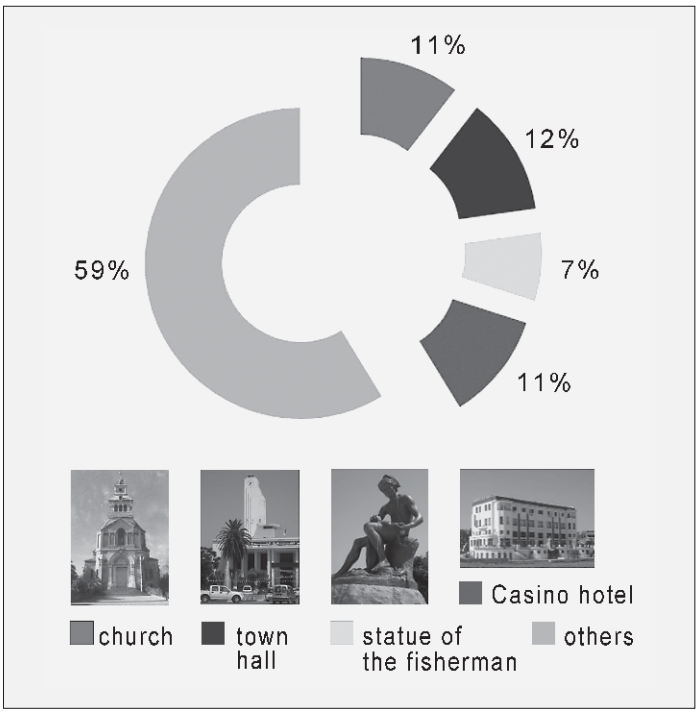
To impose their influence and replace local history, the occupiers constructed the city according to the principles of French urban planning, with no reference to the pre-colonial city. Following the layout of the new city, streets and squares were named after historical figures and locations, such as Place Louis XIV, Rue des Gardes-Françaises, de Picardie, de Normandie, alluding to the French expedition of 1664 on this African coastline, aimed at appealing to both locals and tourists (Retout, 1927; Labelle, 2007). It is worth noting that all the streets were named in this manner, with no reference to the region's own history. As part of an urban marketing strategy, symbolic images were created that incorporated the most recent colonial achievements and reflected the region's economic and landscape features. These images were specifically designed to embody the colonial identity.

– **Religious duality** – In the newly established city, significant emphasis was placed on the construction of a place of worship, with the church being the first notable building erected. Positioned prominently in the heart of the city, the Saints Simon & Jude Church, constructed in 1875 (as shown in Fig. 6), represented a symbolically significant edifice within a monumental architectural style. In contrast to its surroundings, this church was characterized by its gargantuan scale in relation to the city's Christian population, which at the time numbered only 704 individuals out of a total of 2122 (Safri, 2008).

The religious duality in the city engendered a power balance between the predominantly Muslim majority and the Christian minority populations. According to the national daily newspaper El-Moudjahed (2013), when the French authorities decided to construct a Christian place of worship, more specifically a church in the new city, the local population in Jijel responded by requesting representation for the Muslim faith as well. A petition was signed on July 29, 1871, and sent to the authorities in charge of the construction. Despite delays, the demand for Muslim representation was eventually accepted. This power balance between the different segments of the city's inhabitants is indicative of the quest for identity affirmation through religion.

– **Appropriation of local economy** – The city of Jijel has a longstanding local economy based on fishing, which can be traced back to antiquity. This tradition is a common feature of coastal cities, and is particularly prominent

FIG. 5 THE REPRESENTATIVENESS OF THE IMAGES



in Jijel, as evidenced by the frescoes depicting fishing scenes and various fish in the nearby Roman city of Djemila [34], which is situated 80 km to the south of Jijel and has an entrance faced in the direction of Jijel. Today, Djemila's museum houses numerous frescoes that detail fishing scenes, and this practice continues to be prevalent in the nearest city, Jijel.

The French colonial administration re-appropriated this economic function by introducing a common French practice. In French fishing ports, statues were erected to watch over the fishermen who went to sea. Given the region's potential for fishing and the existence of an ancient fishing practice, it was opportune for the French to develop this economic activity, along with all the practices associated with it, including the construction of a statue facing the sea to watch over the fishermen in accordance with the French tradition (Bennis, 2009).

The symbolic image of the fishing profession, as represented by a bronze statue of "a fisherman mending his net" (Fig. 7), remains a prominent feature of Jijel's urban landscape to this day. The statue was created by sculptor Guglielmo and cast by Thiébaut frères in 1888, and was originally placed at the entrance of the fishing port. It was presented at the 1888 exhibition and has since been relocated to the esplanade of the city hall headquarters. The statue depicts a figure of European descent (Fig. 7), and serves as a visual representation of the associated activity within a particular identifiable civilization.

– **Administrative power** – A significant accomplishment of Jijel city is evidenced by its city hall, as illustrated in figure 8. Situated at the confluence of the old and new parts of the city, as well as at the intersection of two of its main thoroughfares, it serves as a landmark within the urban landscape. Constructed in the 1930s by architects Bastélica and Guérineau, they are part of a generation of European architects, often born in Algeria and close to Peret and Le Corbusier, who wished to build Mediterranean architecture. Some have called them 'the Algerianists' according to Aleth Pierre (1994). The City Hall building was constructed during the 1930s, completing the symbols of the colonial city. This edifice stands apart from the surrounding urban fabric. Comprising a two-story block that houses administrative offices, it is crowned by a clock tower that rises to approximately 40 meters in height and features a sounding clock on each of its four sides. With its modern architectural style and prominent location at a city corner that is visible from all entry points, it plays a significant role in shaping the image of the city as a modern colonial centre. This underscores its importance as a noteworthy symbol of urban development and progress.

– **Coastal character of the city** – Due to its coastal location and its isolation from the rest of the country, the city has capitalized on these specificities to remain a popular urban holiday destination (as depicted in Fig. 9). These two aspects have been translated into architectural and urban achievements to create an identity for the city (Ben Jemia, 2014; Marchand, 2005; Meo, 2007; Galland, 1993). The uniqueness of the city is exemplified by the construction of a hotel on the beach, which serves the dual functions of accommodation and a casino, further enhancing its tourist appeal. The design of the hotel was undertaken by two architects, Mr. Dumoulin and Mr. de La Chapelle, who were based in Constantine. The construction of the hotel was carried out by contractors Staletti and Yotti, with work commencing in January 1936. This collection of achievements and symbols has been communicated through postcard images and has become a definitive representation of the city in all its facets. These postcards accurately capture the essential urban characteristics of the city and have helped to establish the city of Jijel's identity (Sechi, 2018).

The Symbolic Urban Image of Jijel and its Durability

The visuals disseminated through communication channels of the past, particularly post-

Fig. 6 Photo of Saints Simon & Jude Church

Fig. 7 Old and recent photos of the fisherman's statue

Fig. 8 Old photo of the town hall

Fig. 9 Postcard from the Casino Hotel

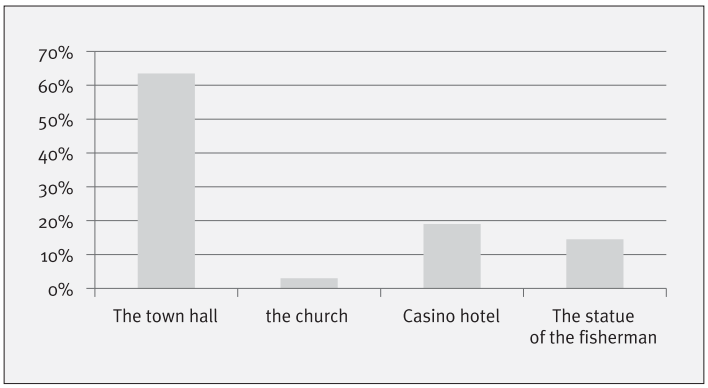


FIG. 10 THE OVERALL RESULT OF THE SURVEY

TABLE II TABLE OF SURVEY RESULTS

Urban images	Number	Percentage
The seat of the town hall	254	64%
The church	12	3%
The Casino Hotel	76	19%
The statue of the fisherman	58	15%
Total	**400**	**100%**

cards, are indicative of Jijel city and have contributed to its urban identity in the absence of historical records. The purpose of this study is to identify the most enduring and representative image of Jijel city, and to determine if it embodies the city's identity. [41,42,43]

To investigate this matter, we conducted a random survey of 400 individuals, divided equally between city residents and tourists from various regions of the country. The survey targeted 50% of respondents over 40 years of age and 50% under 40 years old. Our objective was to establish whether the most representative urban or architectural image, selected from the four images shortlisted in the first stage of the study, is the most durable representation of Jijel city. Respondents were requested to rank the images according to their perceived representativeness of the city.

– **The most representative urban image** – The findings from the survey, as presented in Table II and Fig. 10, provide insight into the prevailing image of Jijel among its population. Notably, the city hall emerges as the most representative image, with 64% of respondents ranking it as their top choice. The hotel casino follows with 19% placing it in second position, while 15% of respondents place the image of the fisherman in third position. The church "Saints Simon & Jules" is ranked last, with only 3% of respondents choosing it as the most representative image.

These results confirm that the urban image of Jijel is predominantly architectural, with the city hall being the most iconic building, according to both local and foreign populations. This finding suggests that the population places significant value on architecture. This is particularly noteworthy given the evident poverty of the city's architectural landscape, with few notable buildings beyond the city hall standing out as well-designed or protected.

– **Sustainability of the urban image** – To assess the sustainability of the representative urban image, we divided our surveyed population into two age groups: those over 40 years of age and those under 40 years. The latter group comprises individuals who did not experience the city of Jijel as it existed during the French period, as the city underwent substantial growth from the 1990s onwards, resulting in the loss of many of its architectural and urban landmarks.

Our survey results (Fig. 11) for these two age segments indicate that the architectural and urban image is perceived differently depending on age. Accordingly, we have divided the population into two categories: those over 40 years of age and those under 40 years of age. For each category, we have considered a proportion of the local population and the remainder from outside the city.

Among those over 40 years of age, the image conveying the city's heritage that resonates with both the local population and visitors is the city hall headquarters. Nearly 60% of respondents regard this image as representative of the city of Jijel. The local population

FIG. 11 REPRESENTATIVE IMAGE OF THE POPULATION OVER 40 YEARS OLD

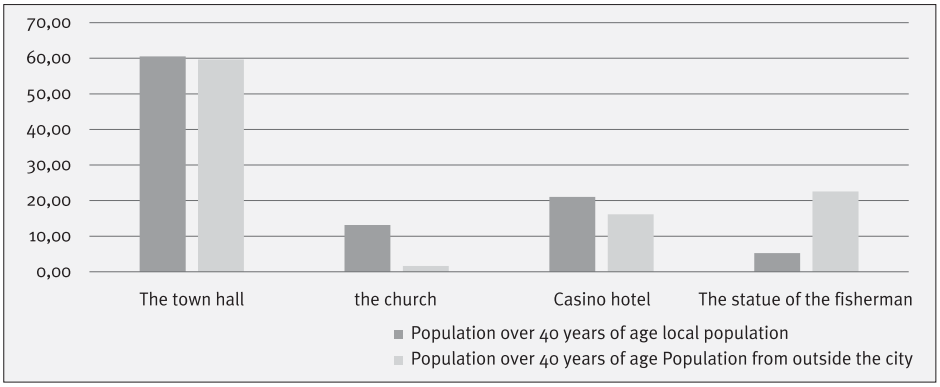
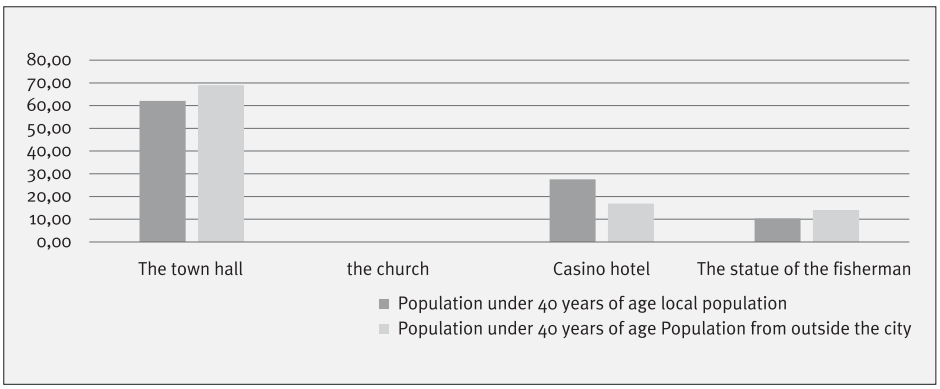


FIG. 12 THE REPRESENTATIVE IMAGE FOR THE POPULATION UNDER 40 YEARS OF AGE



also ranks the Hotel Casino image second, followed by the church and the statue of the fisherman, whereas visitors place the statue of the fisherman in second place, the Hotel Casino in third place, and the church last. This ranking is attributable to the church's fate, which was demolished in the 1990s and is now only a memory that is much more vivid among locals than unknown to foreigners.

For individuals under the age of 40, the primary symbol of the architectural heritage of Jijel is still the town hall building. This finding is particularly pronounced among visitors, as nearly 70% of respondents ranked it as their top choice (see Fig. 12).

Meanwhile, the Casino hotel ranked second, with 27% of locals and 17% of visitors selecting it. The fisherman statue was more popular with visitors, at 14%, than with locals, who selected it at a rate of 10%. The church was not included in the survey results for this age group, as it no longer exists and respondents were not familiar with it.

These results indicate that both local and visitor populations across the two age groups surveyed regard the city hall building as the most representative image of Jijel. Despite the lack of urban marketing via postcards for nearly four decades, this symbolic urban image has endured. Its longevity is not attributable to nostalgia or fleeting trends, but rather reflects the popular consensus among the city's inhabitants. Thus, until further notice, this urban image remains the defining and enduring representation of Jijel.

The significance of choosing this building as a representative image of the city lies in its neutrality. The building is a part of the modern architectural movement, which is a universal movement that does not reference any particular culture, identity, or civilization. In contrast, the "status of the sinner" is an element of French culture, and of the church of Saint-Simon and Jude, demolished during the 90s for ideological reasons. The population's preference for this building reflects their rejection of identity-based representations, a topic that continues to be debated. This raises the question of which aspects of colonial heritage are acceptable and appropriate for the population to appropriate.

Architectural Reading of the Urban Image of Jijel

Based on these findings, it can be concluded that the most emblematic urban symbol of Jijel city is the town hall building. Constructed in the 1930s as a representative example of modern architecture, this building has maintained its original purpose throughout the years. Its conservation has been a priority for local authorities who have regularly undertaken maintenance and restoration efforts. Furthermore, the longevity of Jijel's urban identity can be attributed to the building's function as a centre of power, along with its architectural elements that enable it to stand out in the urban landscape. These elements include: its location, being part of an architectural trend, and the monumentality of the clock tower.

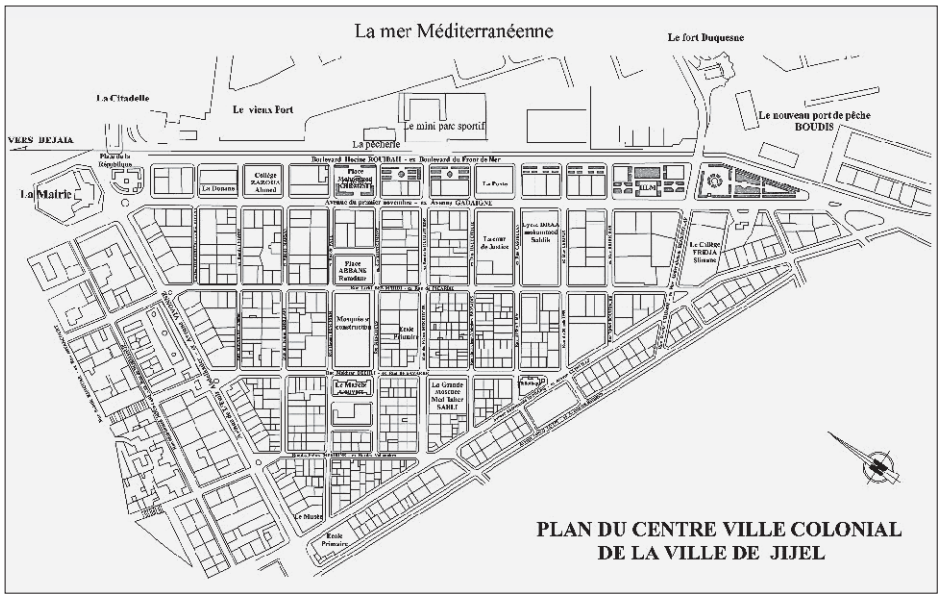


Fig. 13 Location of the town hall in the city

According to the results, the town hall building's strategic location at the intersection of two major avenues (Fig. 13) grants it high visibility from both city entrances, setting it apart from the surrounding architecture with its modern aesthetic and striking white colour that stands out against the skyline. Its uncluttered design, characterized by simple forms and uniform openings, is further enhanced by a 35-meter clock tower (Figs. 10, 11 and 12), emphasizing its unique status and visibility within the urban landscape.

The clock tower, also referred to as the "belfry", is of a grandiose design and can be seen from various arterial routes in the city. This feature adds to the building's significance and monumentality (Figs. 13 and 14). The clock tower serves a functional purpose, in that it provides visual and auditory cues for the city's temporal organization. It marks the passage of time, and its ringing serves to regulate and coordinate the city's activity, appealing to the visual, temporal, and sensory senses.

It is unsurprising that the design for the "Djidjelli" town hall project was showcased in the 1936 Modern City exhibition in Algiers alongside other notable public buildings such as the Rivet sanatorium, Miliana hospi-

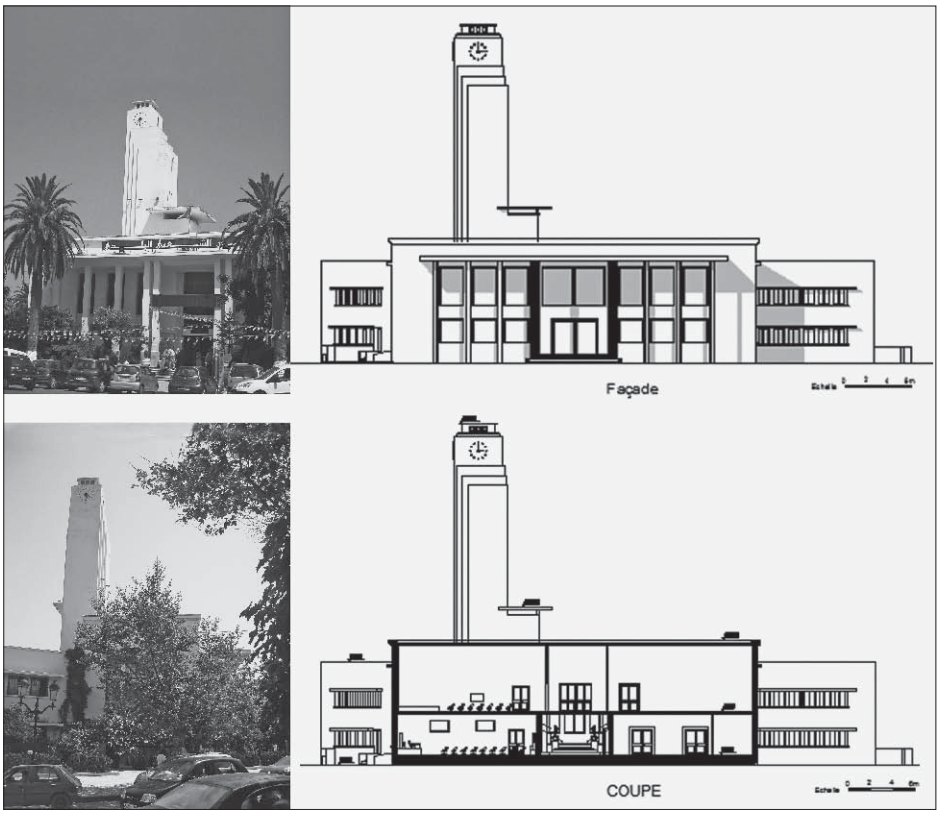


Fig. 14 The town hall

tal, Béni-Messous orphanage, Algiers and Diidjelli town halls, Philîppeville station, swimming pools, and schools. These structures were distinguished by their austere lines and striking white volumes (Benzerra et al., 2012). The General Commissioner's report on the exhibition was subsequently published in the May 1936 issue of the Architecture d'Aujourd'hui review.

Reading Urban Space and its Participation in the Production of the Urban Image

Spreading over an area of 34 hectares and following the shape of the flat land near the old city, the colonial city was organized according to a regular form based on the principle of route. Its proximity to the Mediterranean Sea and its seaside character have been materialized in the city plan and give an important place to the orientation of the roads and the implantation of the equipment. This is confirmed in the syntactic analysis carried out on the urban space and allows an understanding of the functioning of the colonial urban fabric to demonstrate the urban mechanisms and parameters that favour the emergence of city images.

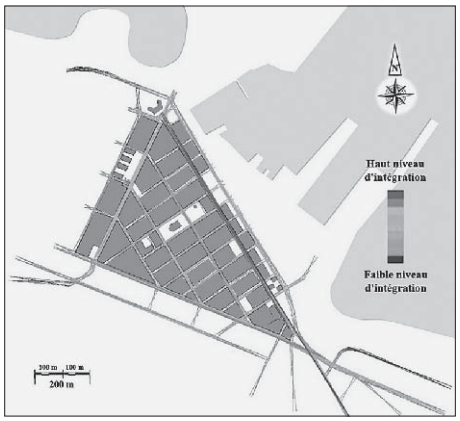
– **Urban attributes and syntactic evaluation of the urban entity built during the French occupation: An intelligible urban space** – The utilization of the all-line analysis technique in the reconstruction of Jijel after the flood of 1856 is considered a ground-breaking method for characterizing urban spaces. This approach involves identifying various aspects of urban organization that contribute to the development of a particular urban image.

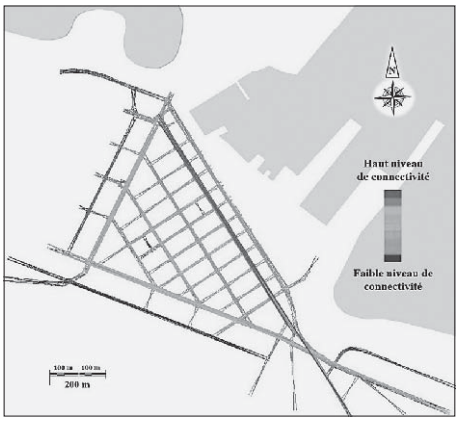
Primarily founded on the concept of axiality, urban syntactic analysis allows for the modelling of urban system configurations by applying topology and mathematical graph theory (Lathuillière, 1936; Lehmann, 2010; Mori & Christodoulou, 2012). By using specialized space syntax software such as "Dephtmap", the axial map of the urban system is revealed. Through syntactic simulations, this map discloses significant indicative values that relate to various urban attributes, such as system depth, connectivity, integration, and intelligibility (Hillier & Hanson, 1984). The obtained numerical results can be displayed in the form of graphs or maps, with colour gradients as an indicator of the different syntactic measures obtained (Hillier et al., 1993; Mokrane, 2011).

The application of the all-line analysis technique to the city of Jijel during the French period provides an effective diagnosis of the structure and spatial configuration of its urban system. This urban entity is primarily characterized by its regularity and formal simplicity, represented by a triangular shape, which confers good spatial legibility to the system.

– **Overall integration and depth of the urban system** – Considered as the most important property of the urban grid, integration is defined as the path requiring the minimum of directional changes, and crossing the maximum of nodes. It expresses the degree of spatial accessibility of a street relative to others in the same city (Lynch, 1960; Hillier, 1996; Attar & Saraoui, 2022). A well-integrated urban entity is one that tends to draw all the other urban spaces around it towards it (Obad Ščitaroci et al., 2019).

According to the results of the syntactic simulation, the map inherent to the global HH integration at radius n (Fig. 15), reveals a good integration in the whole urban system analysed, with an average value of 3.13 and an average depth of 2.11 steps. This average depth reflects a permeable and distributed grid urban system. However, the Avenue du 1er Novembre (ex Rue Cartegène) appears with a red color on the map, meaning that it is indeed the most integrated axis of the system with an integration value equivalent to 6.62, making this axis an important pedestrian and mechanical traffic area. With the Abdelhamid Ben Badis axis (ex Clerville Street)





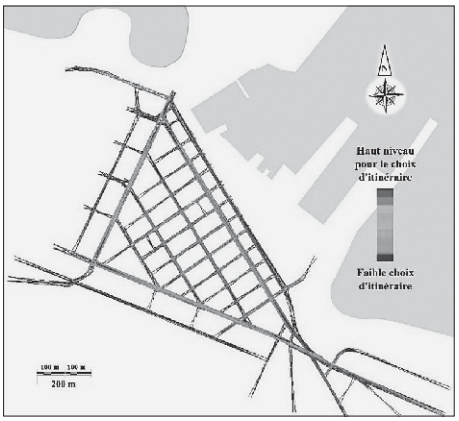


Fig. 15 Full integration (HH)

Fig. 16 Connectivity and route choice

Fig. 17 Choice of routes

and the Amir Abdelkader axis (ex Vivonne Street), a trunk road constituting the integrating core stands out in the urban system by its important integration values. This gives the system a good physical permeability on its entire perimeter.

– **Connectivity, permeability and route choice** – The connectivity map provides information on the urban axes belonging to the system that are best served by the road network through a cluster of colours going from the most connected in red to the least connected in blue (Fig. 16). Following the syntactic simulation carried out, an average connectivity of 8.73 per axis emerges, with a maximum value of 25 connections found on the axis of Avenue of November 1st (ex Avenue Gadaigne). As for the rest of the urban axes, the connectivity values were close, indicating an urban system that we can describe as multiple rings. The spatial configuration thus offers a considerable variety of routes for the benefit of pedestrian and mechanical mobility (Fig. 17), once again ensured by good permeability.

– **Intelligibility and legibility of the urban structure: Visual perspectives due to a good legibility of urban space** – Intelligibility is a second-level measure that summarizes the notion of legibility developed in the work of Kevin Lynch (Hatt, 2010; Malverti, 1988). An urban system is said to be intelligible when navigation within it is easy. In other words, intelligibility is a quality conferred on any urban space that enjoys good connectivity and good integration in its topological relationship with the other spaces of the urban system. It is therefore a measure detected from the relationship between integration and connectivity expressed in the form of a diagram. A correlation coefficient R2 from this ratio is calculated to determine the degree of intelligibility, if it is greater than 0.50, the resulting scatterplot will approach a 45° line and the system is said to be intelligible. If R2 is less than 0.50, the system is said to be unintelligible (Hillier, 1996)

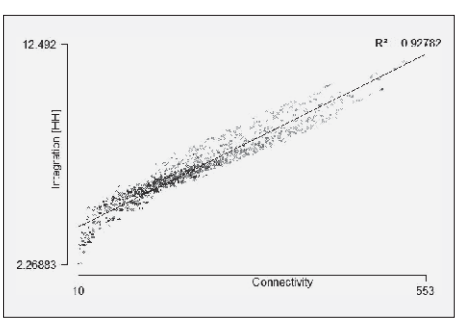
Regarding the overall intelligibility of the system in our case study, the graph (Fig. 18) reveals a correlation coefficient R2 of 0.927 with a cloud of points well grouped around the trend line, meaning that the system is very intelligible.

This being the case, the reading and analysis of the urban organization of the French city of Jijel reveals a very good legibility of the urban space. Indeed, the urban grid offers visitors and walkers deep urban perspectives. Oriented mainly towards the sea, the different avenues connected between them allow a strong legibility of the urban space and are connected mainly to the main Avenue of November 1st (ex Avenue Gadaigne).

Discussion

The city district as an asset for travel – The French city currently "downtown" of Jijel is distinguished by a well circumscribed urban organization and houses a set of facilities like the principle adopted in European cities where the city had five basic facilities necessary for an urban space which are: the city hall, the church, the courthouse, the school and the health centre; add to that other establishments according to the size of the city, such as: the police station, the theatre and the hospital. A variety of local shops such as the market, food and clothing stores, as well as service facilities (post office, banks) are located all along the streets and avenues. The arrangement of these structures and shops in the urban fabric allows for ease of movement and a very short travel time to move in its urban environment. Thus, the city designed as a city district whose living spaces are intertwined in the centre enables the creation of urban routes and promotes the notion of wandering. The short distances between homes and facilities, shops and services significantly encourage walking or cy-

Fig. 18 Global intelligibility graph



cling, which do not exceed 15 minutes. According to our syntactic analysis, it emerges that the integrating core in its triangular urban form offers a choice of high-level itineraries on the city's structuring axes, particularly on the main avenue (Avenue du 1er Novembre). This analysis shows us the proximity-distance relationships generated by the configuration of the circumscribed urban space.

The Avenue of November 1st (Ex Avenue Gadaigne) occupies an important place in the urban structure realized during the French period. It is the backbone of the city due to its legibility and connectivity and is an obligatory passage in the majority of route choices. At the end of this avenue, the headquarters of the town hall is erected. This modern style building, rising to more than 30 m from the ground, representing the administrative power and located on an urban axis that constitutes the backbone of the city is the representative urban image of the city of Jijel.

Conclusion

The French colonization of Jijel has bequeathed a significant legacy and heritage that faithfully reflects the city's urban and economic characters, which are those of a seaside and fishing town. However, the symbol of the administration, which comprises both the colonial and Algerian eras, is presently the seat of the city hall (formerly known as the city hotel), and it conveys the image of Jijel. Whether this work can be classified as Jijel's identity is still the subject of ongoing debate. The identity of an urban space should not be limited to the work itself but should also express a connection to a more distant past and the memory of places.

This image, although appreciated by the population and visitors, is a product of colonization and belongs to a neutral architectural register that does not reference any other identity, cultural, or civilizational parameters, but rather represents the renewal of the city and its modern aspect. The attachment of the population to this work, as evidenced by the survey results, reveals certain nostalgia and a default choice in the absence of other more identity-affirming works, representative of an era older than the colonial period. Additionally, the architectural work is part of a universal architectural movement known as "modern architecture" that transcends all civilizational, identity-based, and religious references.

In the 19th century, the city of Jijel, formerly known as Djidjelli, suffered a devastating fate. In 1856, a tidal wave struck, destroying over 80% of the old city. The authorities at the time, namely the French, requisitioned the old city to create a military zone and chose to construct a new city on a previously undeveloped plot of land adjacent to the old city. This allowed for an opportunity to express urbanism in a new way. The French-built city was designed to replicate small French cities, consisting of five main structures: the church, town hall, market, court, and dispensary, forming a triangular shape. Representative images of the colonial city of Jijel, selected through postcards both old and recent, reflect an association of these urban images with high places, architectural styles, and landscapes, rather than places of memory.

In the colonial urban marketing applied to the city of Jijel, references to the local economy, such as the status of fishermen and the hotel casino, can also be discerned. These representations remain faithful to the urban specificity and regional character of the city. Even today, they are still representative images of Jijel in the minds of its residents and visitors, demonstrating the longevity and effectiveness of urban marketing.

The city hall's headquarters building is the quintessential urban representation of Jijel. Its architectural style, belonging to the modern architectural movement, along with its central location on the city's main avenue

and function as administrative power, contribute to this image. This architectural style provides excellent visibility in a comprehensible urban space, making the image a symbol due to its architectural aspect, function as a seat of power, and visibility in the urban landscape.

It represents the city of Jijel's revitalization and full incorporation into the modern architecture movement, as it is the only architectural work in the city associated with this universal movement. The building's enduring popularity among the population since its inception has elevated its status to that of a heritage site.

French colonization played a significant role in the international recognition of urban identity in the Mediterranean basin as a distinct cultural space with a rich history. Jijel exemplifies this phenomenon. Under colonial influence, the city underwent significant transformations that shaped its urban and cultural landscape. Infrastructure improvements, such as the construction of modern buildings, roads, and port facilities, contributed to establishing Jijel as a regional economic hub, fostering trade and interactions with other Mediterranean cities. Concurrently, French colonial architecture left a distinctive imprint, with public buildings and residences that have left a lasting mark on the urban scenery. This presence also facilitated cultural exchanges between the local population, the colonizers, and other Mediterranean communities, giving rise to a unique urban identity for Jijel.

The architectural work's neutrality has ensured its durability. Thus, this urban image of the city of Jijel, created during the colonial period and subsequently appropriated, is not subject to debate on heritage, identity, and religious notions. Rather, it falls under the category of the legacy of a universal architectural movement, despite its association with French colonization, and of which some Algerian cities were platforms of expression.

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All authors have read and agreed to the published version of the manuscript.

Fig. 1 Paley Park – Privately Owned Public Space, Midtown Manhattan, New York City

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Urban Planning Criteria for Defining *Privately Owned Public Spaces (POPS)*

LAND OWNERSHIP
PUBLIC-PRIVATE NEGOTIATIONS
PUBLIC SPACE
URBAN DESIGN
URBAN PLANNING

This research is based on the systematic literature review related to the definition of Privately Owned Public Spaces (POPS). POPS arise as a bonus of the urban planning concession resulting from negotiations between private investors and city administration. The question arises whether, during their formation, the urbanistic criteria that ensure public space quality are sufficiently represented, or the superior private interest results in critical urban quality aspects. By comparatively analyzing the definitions' key features, nine specific POPS aspects have been identified and classified into two categories according to basic criteria: impact on investors and on broader urban contexts. The results show that a group of spatial criteria (usage impact, user's perception, connectivity, urbanity and socialization) have been neglected or ignored in defining POPS. Current definitions do not consider the importance of POPS influence in a wider urban context and POPS is not, in any way, controlled or connected to the comprehensive process of urban planning, which can lead to a neglect of the fundamental roles and quality of public space. Further studies should focus on analyzing the impact of POPS in a broader urban context as well as defining mandatory urban planning criteria for insuring the quality of public space.

Introduction

Urban space can be described as "a complex sphere of spatio-temporal claims and overlaps, where interior/exterior and public/private intersect in different ways", and where only seldom can one observe clear border lines between the public and private (Kärrholm, 2019). In a general context, the definition of open public spaces is usually linked to publicly owned land. Public spaces are one of the basic features of the quality of urban life, reflecting urban culture, encouraging social interaction and creating city identity. They should reflect equity, diversity, and justice for all (Fainstein, 2000) and be a collectively consumed good (Webster, 2007). UN-Habitat's Global Public Space Program, launched in 2012, supports cities to take action for safe, inclusive, and accessible public space for all (Rivera et al., 2018). New Urban Agenda from 2016, adopted by all member states of the United Nations, affirms the importance of public space as a key to creating more socially, economically and environmentally successful and sustainable cities (Elmlund et al., 2018). On the other hand, accelerated urbanization processes lead to numerous urban transformations that manifest themselves in various threats to and challenges for public spaces (Madanipour, 2005). They can be identified in an alarming decline in the quantity and quality of public space in many cities around the world (Haas, Mehaffy, 2019), which is often a result of the ubiquitous private investors' pressure for maximum utilization of city land. New trends which prioritize privatization, privacy and private sector involvement have had an impact on frequently changing traditional roles and appearance of public spaces (De Magalhaes, 2010; Schmidt, Németh, 2010).

One of the dominant trends in public space research is the one dedicated to the development of new practices focusing on ways to produce and manage public spaces with growing public-private partnerships and the profusion of modes of restriction and enclosure of all kinds (Haas, Olsson, 2014; Schwartzmann, 2022). The increasing demand for a public-private partnership for the creation and management of public spaces also stems from the current global direction of municipal budget levels (Németh, 2009: 2480). The financial dependence of municipalities on income generated by private developers can lead to planning that is responsive to property market interests rather than the city's strategic needs or the public interest (Katayoun Karampour, 2021). In such cases, urban management of the creation of public spaces, exposed to the private and public sectors negotiations, can often result in private interest prevailing over the public one. Many new types of public space, such as quasi-public spaces or hybrid spaces, variations of privately owned public spaces, have emerged in order to preserve and improve the distribution and share of public spaces as one of the fundamental urban qualities (Leclercq, Pojani, 2020; Lichtenbaum, Rosen, 2018: 3; Nissen, 2008: 1132). Also, "Tactical Urbanism" as short-term intervention on public spaces, is widely applied in many cities during the situation of COVID-19, such as: Milan (Italy), Warsaw (Poland), Barcelona (Spain), etc. (Cariello et al., 2021: 12; Castillo et al., 2022: 6; Herman, Drozda: 2021)

This research is focused on the urban quality of a specific form of such spaces called Privately Owned Public Space, or with acronym POPS (Fig. 2). Since the creation of POPS is not controlled by a comprehensive process of urban planning, potentially it can have a negative impact on urban quality. This research examines whether the criteria of urbanism, which should ensure the quality of public space, are sufficiently represented in POPS formation or whether the superior private interest may lead to some critical implementation aspects.

1 "Incentive zoning" also known as "Bonus Zoning" has its place in the legislation of New York, Santiago de Chile, Thailand, Taiwan, Tokyo, Vancouver etc. (Dimmer, 2013; Rahi et al., 2012).

2 International Symposium supported by the Center of Sustainable Urban Regeneration of the University of Tokyo elaborates the creation of POPS in cities such as: New York, Santiago, Seattle, Aachen, Hong Kong, Bangkok, Melbourne, Taipei, Tokyo, Yokohama (Dimmer, 2013).

POPS has its origins in the 1960s New York, where the possibility of creating public space on private lands emerged for the first time. It grew from a compromise between private and public sectors, in which private developers cede a part of their land for public use and in turn get the right to build additional square meters on the upper floors (NY City Planning). A similar mechanism of creating public spaces is applied in many countries of the world. Although it represents a potentially powerful mechanism for improving the share and distribution of public spaces in the city, its significance from the urban planning point of view has not been investigated so far.

The research is based on a systematic literature review (SLR) related to the definition of POPS in order to determine the most important planning, implementation and maintenance aspects and to determine whether they imply the urban planning criteria.

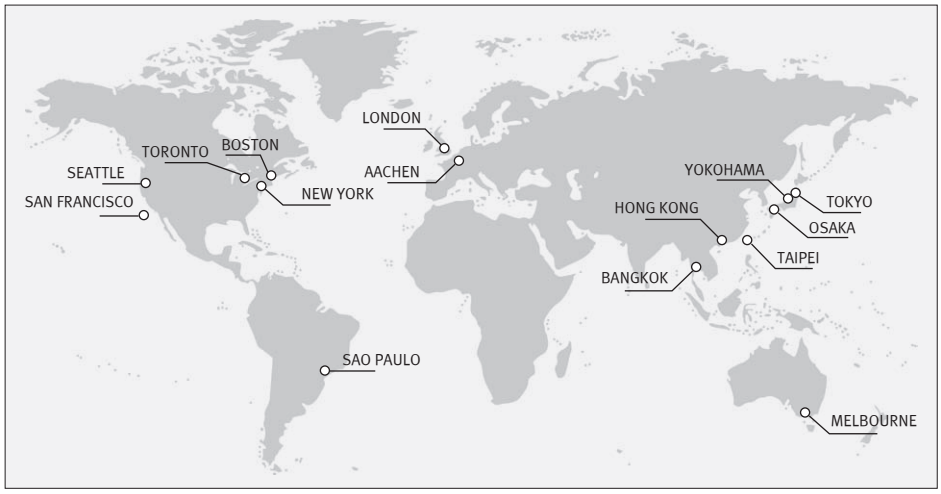
After many empirical studies of Privately Owned Public Spaces done by authors of different profiles, with the aim of systematizing the material, a research protocol has been created. First chapter explains data collection which drives from reliable sources such as: Springer, Science direct, Web of Science, Taylor & Francis, with a focus on the definitions given for POPS in different spheres. It continuous with the research process with the systematic division of inclusion and exclusion of the collected data. After inclusion, data analysis was done to extract the research results, continued with the quality of the evolution and the quality of the factors. Second chapter explaining the results of the findings, while the third chapter is the discussion ending with a conclusion.

By comparatively analyzing the definitions' key features, nine specific POPS aspects have been identified and classified into two categories according to basic criteria: their consequences and impact on investors and on broader urban contexts. Research objectives are divided in two parts. First, to determine the most common critical POPS definition aspects from the urban planning point of view. Second, to prove that POPS is primarily based on economic interests and is initiated by private interest on individual plots and not at the urban scale. The summary of included literature resulting from a systemic literature (SLR) has shown that there is still no common resolution that would determine a clear definition of what is meant by Privately Owned Public Spaces (POPS). The research attempting to define POPS has been mostly focused on the aspects of managing after the realization. The relation between urban planning and POPS so far remains an unexplored topic. Nowadays, definitions of POPS derive from two areas: from the public sector (city administration) and from scientists who study these spaces. The definitions gathered from these two areas have been analyzed with nine questions divided into two groups: those pertaining to matters of urban criteria (5 research questions) and those pertaining to the responsibilities of the private sector (4 research questions). It has been documented by this study that definitions do not take into account the importance of the impact of POPS in the wider urban context and they do not take into account the fact that POPS is not in any way controlled or linked to the comprehensive urban planning process, which represents an important area for future research.

Fig. 2 The possibility of urban design public spaces according to plot ownership

Fig. 3 Some of the cities that implement the process of creating public spaces in private lands

New York (USA)
San Francisco (USA)
Boston (USA)
Seattle (USA)
Aachen (Germany)
London (Great Britain)
Hong Kong (China)
Bangkok (Thailand)
Taipei (Taiwan)
Melbourne (Australia)
Toronto (Canada)
São Paulo (Brazil)
Tokyo (Japan)
Yokohama (Japan)
Osaka (Japan)



3 A characteristic of the Hong Kong model are POPS of a small surface area. Almost 70% of realized POPS are on the plot surface of 50 m² (Luk, 2009: 698).

4 The so-called 'Semba Building Line' (Dimmer, 2013).

5 *Greenspace Information for Greater London CIC* (GiGL) is the capital's environmental records Centre. They collate, manage and make available detailed information on London's wildlife, parks, nature reserves, gardens and other open spaces (https://data.london.gov.uk/publisher/gigl).

6 Based on Kayden's research the Advocates for Privately Owned Public Space (APOPS) partnership was founded aiming to monitor a little-known swatch of cherished public space such as the illegal privatization of originally formed POPS. Avaliable at: https://apops.mas.org/about/mission/ [Accessed: 30 July 2022].

7 The consultancy team, Rocco Design Architects Ltd., in collaboration with the School of Architecture, the Chinese University of Hong Kong, and Land Elite Surveyors Ltd., has been appointed by the Development Bureau of the HKSAR Government to undertake a consultancy study with the aim of drawing up a set of Design and Management Guidelines for public open space in private developments (POSPD) in Hong Kong.

Table I Scientific research selected for study after the systematization of the collected material

Nr.	Year Published	Author	Material type	Research area (city/state)	Scientific field of study	POPS aspects(s) researched
1	2000	Kayden, J.	Book	New York	Urban Planning	shape, accessibility, image, activities, sociability, comfort, ownership
2	2002	Irwin, E.	Article	Generally	Economy	economy value
3	2003	Madanipour, A.	Book	Generally	Urbanism	public and private spaces
4	2008	Smithsimon, G.	Article	New York	Urban Sociology	accessibility
5	2008	Németh, J.	Article	New York	Urban Planning	management
6	2008	Carmona, M. Magalhaes, C. Hammond, L.	Book	London	Urban Planning	management
7	2009	Luk, W.L.	Article	Hong Kong	Urbanism	policy and the spaces policy and the city
8	2011	Dimmer, Ch.	Article	New York, Hong Kong, Tokyo, Seattle, Bangkok, Taipei, Melbourne	Urban Planning	history, rules, management, usability
9	2011	Németh, J. Schmidt, S.	Article	New York	Regional Planning	ownership management
10	2011	Bates, L.J. Santerreb, E.S.	Article	Generally	Economy	economy value
11	2011	Miao, P.	Article	China	Urban Planning	gentrification
12	2011	Schmid, S. Németh, J. Botsford, E.	Article	New York	Regional Planning	control accessibility
13	2012	Dimmer, Ch.	Conference	Japan	Urban Planning	understanding of public space
14	2012	Rahi, G. Martynkiw, A. Hein, E.	Article	Vancouver	Geography	management
15	2012	Grobelšek, L.J.	Article	Slovenia	Urban Planning	public space connections
16	2013	Arvidson, A.R.	Article	Generally	Landscape	management
17	2013	Xing, N.	Ph.D. dissertation	Hong Kong	Urban Planning	history, rules, management, usability
18	2013	Yang, Y.	Ph.D. dissertation	Hong Kong	Urban Planning	policy
19	2014	Nasution, A.D. Zahrah, W.	Article	Generally	Sociology	quality of life – social
20	2014	Yoon, H. Srinivasan, S.	Article	New York	Urban Planning	planning
21	2014	Huang, T.S.	Ph.D. dissertation	New York	Urban Planning	design management
22	2015	Lin, H.Ch. Chao, T.Y.	Article	Taiwan	Urban Planning	rules, management
23	2015	Grobelšek, J.L.	Article	Slovenia	Urban Planning	management urban design guidelines
24	2015	Carmona, M.	Article	London	Urban Planning	shape, accessibility, image, activities, sociability, comfort, ownership
25	2017	Pratt, A.	Article	London	Economy	quasi-public spaces
26	2017	Oliveira, L. Pisani, M.A.J.	Article	New York	Urbanism	vertical impact
27	2017	Schindler, S.	Article	New York, San Francisco	Law	rules, value
28	2018	Carmona, M.	Article	London	Urban Planning	regeneration of public spaces, quality
29	2018	Rivera, C. et.al.	Article	Generally	Urban Planning	rules
30	2018	Lichtenbaum, S.L. Rosen, G.	Article	Israel	Geography	management
31	2018	Nissen, S.	Article	Generally	Sociology	hybrid character
32	2018	Huang, T.S. Franck, K.A.	Article	New York	Urban Planning	usability
33	2018	Yu, Y.	Article	Hong Kong	Law	urban policies
34	2020	Lee, D.	Article	Teheran-ro/Seoul	Management	usability
35	2020	Leclercq, E. Pojani, D.	Article	Liverpool	Urbanism	public safety
36	2020	Jian, I.Y. et al.	Article	Hong Kong	Real Estate	commodity, safety, information management, accessibility
37	2022	Lee, D.	Ph.D. dissertation	Seoul and Berlin	Urban Planning	generally

An Overview of the POPS Implementation in the World (1961-2021)

A considerable number of cities/countries implement the process of creating Public Spaces on Private Lands (Table I / Research area; Fig. 3). POPS take more specific forms when for the first time, in the year 1961, the city of New York introduced an innovative city management mechanism (model) of public spaces establishment by an inauguration of publicly used surfaces on private lands. The idea was initiated by the tendency to facilitate and advance the circulation of pedestrians in densely built ground level city areas and to raise the share of public space. This new type of areas, named "Privately Owned Public Space", abbreviated POPS (Kayden, 2000), was established by reducing the lot coverage (constructed area – total building percentages permitted for construction on the land), resulting from a compromise between city administration and the owner or developer of the plot. The private-public negotiations mechanism, based on legal regulations (Luk, 2009: 697), is the basic precondition of POPS formation, allowing the 'win-win' urban situation/conditions that both the city (its citizens) and private investors benefit from. It originates from the national planning/building legislation called "Incentive Zoning"[1] and enables an increase in the building's surface on upper floors (more so than allowed by current urban planning documents), focusing on the achievement of a specific goal/value in exchange, such as the creation of public space on the plot outside the building or in the interior (Fig. 4; Arvidson, 2013: 28; Smithsimon, 2008: 327; Oliveira, Pisani, 2017: 117; Schindler, 2017: 1117).

After introducing the POPS model in New York, many states/cities started to implement their own variation of a similar process.[2] This is clearly seen from the basic overview, such as the naming of these spaces. Not all countries use the same designation for these spaces. New York, London, Boston, Seattle, Toronto and Taiwan name them as Privately Owned Public Spaces, with the acronym POPS. In Hong Kong, we find these spaces with the name "Public Open Space in Private Development", with the acronym POSPD. In San Francisco, we find them with the term Privately Owned Public Open Space, with the acronym POPOS. In the city of Melbourne, unlike other cities, we find a designation Private Public Partnership, while in the city of Tokyo, we find these spaces with terms such as "Space Open to the Public", "Public Open Space" or "Open Space with Publicness", with the acronym POS. The terminology used to name it varies based on local urban planning policies and specificities, but the essence remains the same: the creation of public spaces on private land, under the management of the private sector (Dimmer, 2013).

The beginning of POPS implementation in Hong Kong in the 1960s (Yu, 2018: 3) was followed by an increase in its application in 1980s (Hong Kong Development Bureau, 2014: 5; Luk, 2009: 698) and was monitored by the city Development Bureau (Lands Department and the Buildings Department) responsible for compliance, land lease and other legal conditions, as well as POPS provision and maintenance (Hong Kong Development Bureau, 2014: 5).[3] Taipei implements public spaces on private land based on legal provisions of Comprehensive Design Systems (CDS) – a local variation of incentive zoning while Yokohama implements such areas through control instruments such as: the designation of the lowest possible Floor Area Ratio (FAR), citywide height control and Ur-

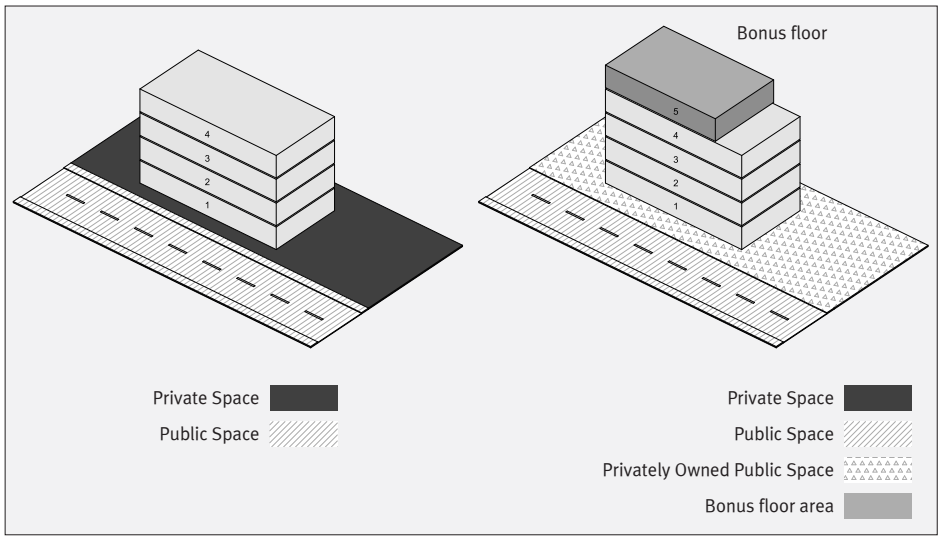


Fig. 4 A simulation scheme of the same building before and after the application of "Incentive Zoning"

8 The provision of POSPD primarily seeks to achieve better quality design, optimization of land use, better site planning, and/or synchronization of the availability of open space and the community needs arising from developments. With proper design and management, POSPD could contribute towards the provision of quality leisure and recreational space and improve Hong Kong's living environment.

9 Responsible for maintaining the privately owned public spaces is the *Seattle Department of Construction and Inspections* (SDCI).

10 "The reason was this notion of almost a free lunch. Cities and their budgets are, and were, increasingly squeezed. And this would be a good way to get public space for free, without the city allocating any of its land, or any of its money: 'Let's have the private sector provide all of these wonderful spaces.' And also, they were smaller spaces, scattered about – an archipelago in a city, as opposed to Central Park. In New York City, for example, if you aggregated all of these privately owned public spaces together, they would cover 10 percent of Central Park, but they're scattered throughout the city." Available at: https://www.wbur.org/hereandnow/2017/05/11/privately-owned-public-space [Accessed: 31 July 2022].

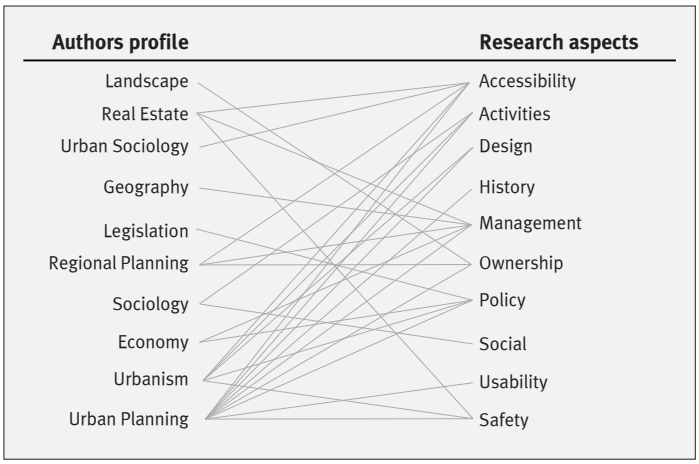


Fig. 5 POPS model: Liberty Plaza – Zuccotti Park, 1972, owned by Brookfield Financial Properties

Fig. 6 Authors profile and the research field focuses (research aspects) in POPS investigations

ban Environmental Design System. Osaka has implemented a process similar to creating POPS from as early as 1939, when landowners and the city government agreed to set a distance between the property line and the building. The space between the property line and the building line became one of the first privately owned public spaces in Japan, officially defined under Japanese law.[4] Melbourne uses different policy and legislation mechanisms and instruments for each public-private partnership tailored individually to meet the needs and requirements of the relative project (Dimmer, 2013).

Previous research indicates that the largest number of realized POPS is in NY's neighborhood Midtown Manhattan (Kayden, 2000, citied in: Schmidt et al, 2011: 272). So far there have been about 592 known POPS from which 389 were built in the period from 1961-2019 (New York Department of City Planning). From 1961 to 2000, we don't find many scientific studies on these spaces in New York. In Hong Kong, there are 336, and in London 58 known realized POPS (Hong Kong buildings department; GiGLE[5]). Most implemented POPS are located outside Europe. Apart from the example of London, such spaces are also mentioned in Israel, England (Liverpool), Germany (Aachen) (Dimmer, 2013, Carmona, 2015).

A Review of POPS Research

As this process of creating public spaces has been growing in different countries/cities, after the year 2000, many scholars from different scientific fields and countries have developed an interest for them, taking into account its various aspects and giving their contribution to the POPS definition (Lee, 2020: 3). This resulted in several cities being in the focus of case studies analyses, regardless of POPS research aspects. The most analyzed examples can be found in the cities with the largest number of realizations as led by city of NY with the largest number of research papers, followed by studies of the city of Hong Kong, Tokyo and of London. POPS are studied from the regional and urban planning, urbanism, environmental planning, landscape, design, economy, management, geography, sociology, security and legislation point of view (Table I, Fig. 6). Among all the research, the book by urban planner Jerold Kayden "Privately Owned Public Space – New York City Experience"[6] should be highlighted as one of the few comprehensive studies published in last two decades. His empirical summary of realized New York POPS encouraged, among others, a research of undesirable changes, monitoring, and promoting much needed reforms of POPS. Also, this book has inspired many authors of different profiles to study these spaces in their countries.

A comparative analysis of 37 relevant highly cited scientific sources published from 2000-2021, conducted for the purpose of this research, shows that the scientific profile of the authors does not always coincide with the field of study (research topic). POPS are studied more by urban planners / urbanists showing their interest in a broad range of topics from history of origins and design to urban policies and management, and covering 9/10 suggested research aspects (Fig. 6). Researchers from the Real Estate and Regional Planning fields are represented in POPS research on average (3/10), while scholars from the fields of Economy, Geography, Soci-

11 Advocates of Privately Owned Public Spaces (APOPS, organization founded by Professor Jerold Kayden) and The Municipal Art Society of New York (MASNYC), have joined forces and made APOPSIMAS to promote creative stewardship of the city's close to 600 privately owned public spaces (POPS).

12 The Tokyo POPS map is a visualization of 697 POPS in the Tokyo area based on official dana from the Tokyo Metropolitan Government. Concepted by: Dr. Christian Dimmer, University of Tokyo [accessed: 2 December 2022].

ology, Law, Urban Sociology, and Landscape design are least represented (Fig. 6).

From the urban planning point of view the interrelationship and influence of public and private space has always captured interest of researchers (Madanipour, 2003; Carmona et al., 2008). The roles of POPS were studied as the connection to other existing public spaces and as a pedestrian distance reduction that helps in balancing the distribution and connectivity of public spaces system of the whole city (Lin, Chao, 2015; Nasution, Zahrah, 2015: 151; Yoon, Srinivasan, 2015). They have been seen as an effective mechanism to engage different stakeholders in public space provision for cities undergoing radical change and facing high development pressures (Lee, 2022). POPS are also been recognized as a reflection of urban policies and a contribution to and influence on the diversity of urban culture (Xing, 2013; Yang, 2013; YU, 2018). In the context of urban planning, these spaces are also criticized (Carmona, 2010: 157). On the other hand, some planners emphasize the negative aspects of POPS, where these spaces are related to the results of political and legislative changes, focusing on the aspects of control and accessibility (Schmidt et al, 2011; Huang, 2014). Others have proposed a conceptual model that identifies the public as the interaction between the ownership, management and use and have evaluated the paradigms of spatial management in public and private ownership (Jian et al., 2020). From a sociological point of view, the focus is on whether such changes in the built environment of cities pose a threat to citizenship (Nissen, 2008) or they live up to expectations about the public space role and an adequate value it should provide to communities (Schindler, 2017). Economic research is preoccupied with questions of investment reconstruction, control of public space and its cultural uses in cities (Pratt, 2017), identifying effects of different types of open space on real estate prices (Irwin, 2002). POPS is criticized as an insufficient replacement for locally owned open public space (Bates, Santerre, 2001), which enables private developers to maximize profits at the cost of public life in the urban environment (Miao, 2011).

Materials and Methods

The research is based on the systematic literature review (SLR), a comparative analysis and classification method of selected relevant sources

Research Question

The collected data will be examined with specific research questions:

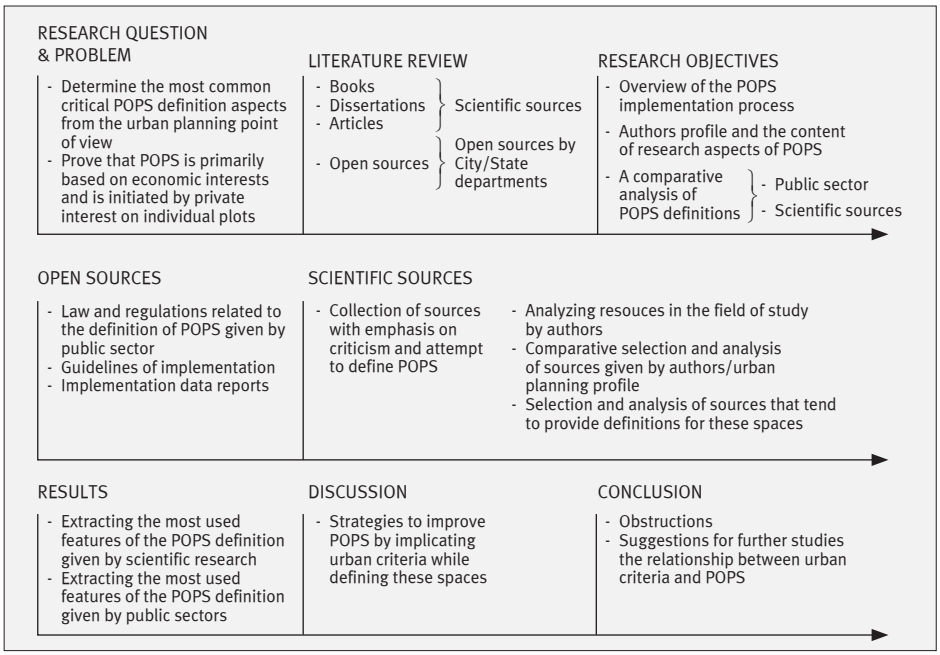


Fig. 7 Research framework

RSQ1 – Which scientific field and topics have been represented in POPS research so far?

RSQ2 – Which authors have tried to establish a clear definition of POPS?

RSQ3 – What are the most important/most common aspects of POPS definition?

RSQ4 – What are the most frequently mentioned critical aspects in the implementation and usage of POPS?

RSQ5 – Are urban planning criteria represented in defining POPS and how important are they?

By defining five research questions, a research framework has been created where the research objectives are divided into three phases. Founded results will be discussed around the research question and the protocol will end with conclusion (Fig. 7).

Research Process

The data search process is done manually with the collection of documents that are relevant to the topic. As relevant sources for the collection of documents, the following were chosen: Web of Science, Science Direct, Scimago and Taylor&Francis, known for empirical studies of the topic. The general search was done by selecting the material published from the year 2000-2022, and the research was done in the titles with the key word "Privately Owned Public Space" and the abbreviation POPS, as well as the research in the abstract with the same sentence and abbreviation (Fig. 8).

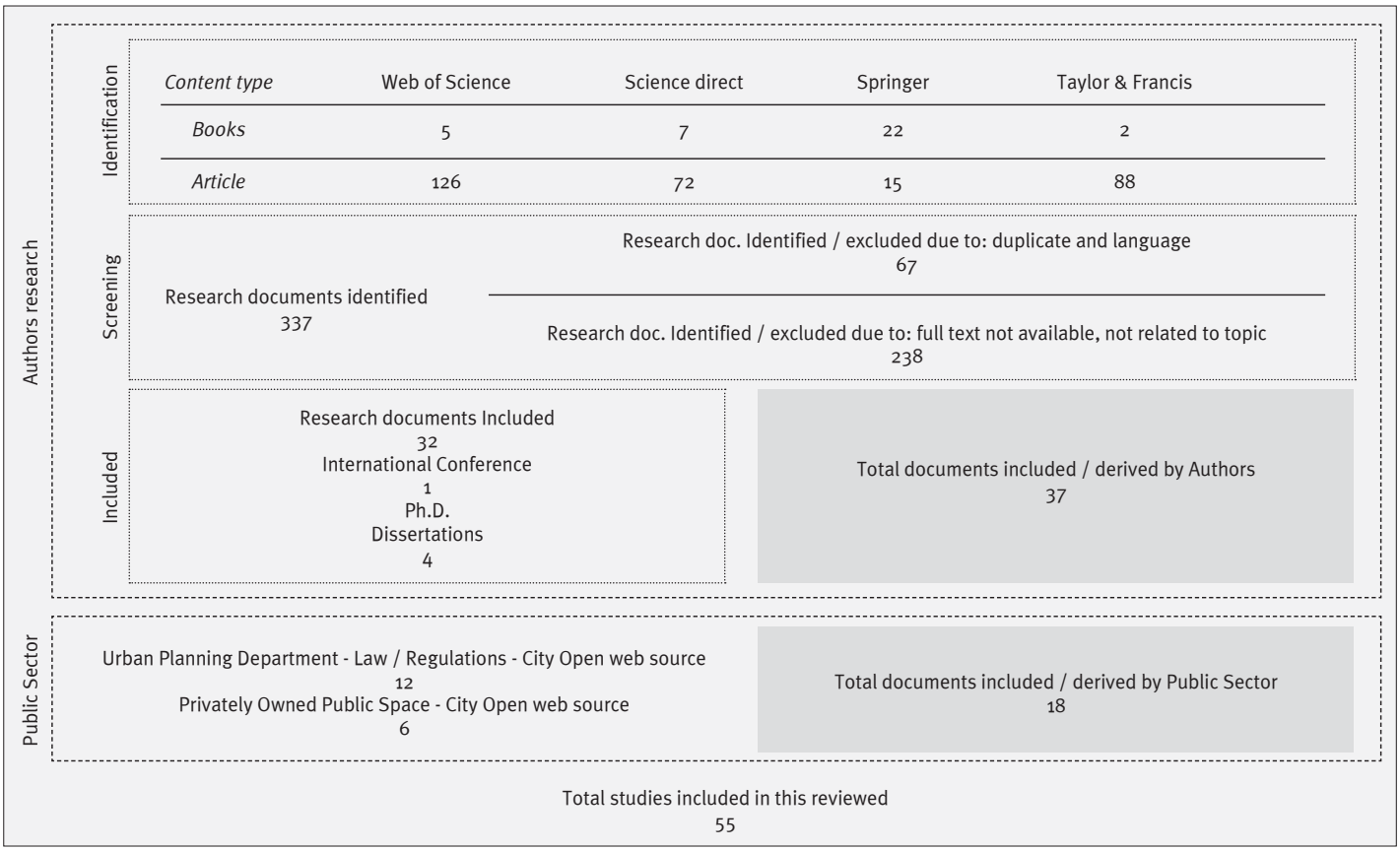


Fig. 8 Method of review

Data Collection

The collected documents are systematized by applying detailed criteria with exclude and include. In the first phase of exclusion, priority was given to documents in the English language. In the second phase of exclusion, documents that are not relevant to the research topic were excluded. Studies done in: International Conferences, Ph.D. Dissertations have been added to the remaining material. All the collected material has been re-systematized by including the documents that refer to the issues of POPS definition and urban planning. The documents framed by the authors (scientists) have been combined with the material provided by the public sector (Cities urban planning departments).

In total 37 selected scientific sources consisting of 3 books, 29 scientific articles, 1 conference proceeding and 4 Ph.D. dissertations published from the year 2000-2022 (Table I). Since the year 2000 a lot of POPS research was stimulated by the publication of the book of all of New York's POPS statistical data (Kayden, 2000). High priority for research is given to the sources that study POPS from the urban planning point of view, as well as those revealing critical aspects of POPS implementation. The selection of professional urban planning sources consists of three cities' open spatial databases from countries that provide concrete results through open platforms. The collected material includes: *statistical data* (number of POPS) of the implemented POPS, *legislation and regulations*, as well as *official instructions* for the implementation of POPS.

The main research (data analysis) is focused on having *A comparative analysis of the definitions,* established from various research and realization perspectives, demonstrates the most important aspects of POPS and investigates the representation/proportion of urban planning characteristics. The original part of the research, the comparative analyses of POPS definition aspects, was carried out based on two types of sources selected according to the following criteria:

a.) *The public sector* definitions are derived from open spatial databases of five selected cities from different continents, characterized by a significant share of POPS realizations (New York, Seattle, Hong Kong, London and Waterloo), and

b) *Scientific* sources, books, articles, conferences and Ph.D. dissertations, which directly refer to the POPS *definition,* were selected for the comparison.

By researching and comparatively analyzing the key words of eleven selected POPS definitions, the most common POPS (definition) aspects were identified and classified according to the impact and consequences on investors and the city (citizens).

Key Aspects of POPS – A Comparative Analysis of Definitions

From the conclusion that the POPS process is implemented in many cities/states and studied by authors of different profiles, the research continues with the analysis of the definitions given for these spaces. Variations in defining POPS can be observed from two perspectives:

1. Definitions derived from the public sector (city/state government urban policies).
2. Definitions established by scientific research.

These two definition scopes have been compared in order to investigate the extent to which urban characteristics are important in city management and/or in POPS formation and usage.

Definitions Derived from the City/State Government Urban Policies (Public Sector)

Valuable POPS research information derives from the open databases established by the cities developing and implementing POPS policies. Such bases provide concrete spatial data relevant to the topic and suggest locally adapted definition of POPS. Open databases are valuable research sources providing information such as: the historical background of creation and development, legal framework, procedural steps of an agreement between private and public sectors, application guidelines for plot owners or investors, obligatory features of a plot, the responsibilities and rights of private and public sectors after POPS realization. According to The Department of Urban Planning of New York, responsible for reviewing requests and managing POPS, they are defined as *spaces dedicated to public use and enjoyment, owned and maintained by private land owners in exchange for bonus floor area or waivers* (NY City Planning). The Development Bureau (DEVB) of Hong Kong, in the report on consultancy study on POPS from 2008[7], *defines these spaces as open space on private land within a private development and/or on government land adjoining a private development where the general public is entitled to access, use and enjoy such spaces under private management*[8] (Department of Building of Hong Kong, 2008: 2-3). London's environmental records Centre (GiGLE) gives a definition for POPS as *publicly accessible spaces which are provided and maintained by private developers, offices or residential building owners. They include city squares, atriums and small parks. The spaces provide several functional amenities for the public. They are free to enter and may be open 24 hours or have restricted access arrangements. Whilst the spaces look public, there are often constraints to use (GiGLE)*. The city of Waterloo in Canada considers POPS as *spaces which are accessible to the public while being privately owned and managed. They are typically negotiated with developers as part of the development application review process and are meant to complement, extend or integrate with public parks and plazas, not replace them. POPS can take many forms, including forecourts and front yards, courtyards, enhanced walk-ways, plazas and gardens* (City of Waterloo, 2019: 1). Seattle's Department of Construction and Inspections (SDCI[9]) in the USA defines POPS as *spaces created as a public benefit as part of a private development project, usually in exchange for certain project advantages allowed by City code* (Seattle Government).

Definitions Provided by Scholars

Definitions provided by scholars from different scientific fields impose questions of benefits for the city and the private sector, but more often they establish a critical attitude towards POPS implementation. Professor and urban planner Jerold Kayden defines them as *outdoor and indoor spaces where developers are allowed to build bigger buildings and, in return, to provide these privately owned public spaces. In such a process, cities are benefiting public spaces without allocating any of its land or money.* Because of this, the expansion of the implementation of this type of public spaces is always added value (Wbur, 2017).[10] Other urban planners define POPS as *one type of publicly accessible space which itself encompasses a wide range of sites, and it can be created under the original agreement with the local city government* (Németh, 2009: 2464; Huang, Franck, 2022: 2) or as *private spaces but open to users* (Grobelšek, 2012: 113). Silke Nissen offers his criticism and defines POPS, from the social point of view, as *public space created as a result of the laws of the areas where sometimes public spaces either change their character or are replaced by private spaces, where accessibility and usability are privately controlled* (Nissen, 2008: 1132). A critical view is also provided by Mathew Carmona, whereby he emphasizes: *In reality the very term 'privatization of public space' is itself hugely confusing because it assumes that once public spaces are becoming private in a sort of new*

TABLE II QUALITY EVALUATION OF SLRS (BOLD – INCLUDED PUBLICATION THAT MEETS THE EXPECTED CONDITIONS ›2.5/3 FOR THE FURTHER STUDY OF KEY ASPECTS OF POPS; REGULAR – EXCLUDED PUBLICATION THAT DOESN'T MEET THE EXPECTED CONDITIONS ‹2.5/3)

Nr.	Year Published	Author	Material type	Addresses the definition of POPS	POPS – urban planning	Criticizes POPS
1	2000	Kayden, J.	Book	+	+	+/-
2	2002	Irwin, E.	Article	-	+/-	+
3	2003	Madanipour, A.	Book	-	+/-	-
4	2008	Smithsimon, G.	Article	-	+	-
5	**2008**	**Németh, J.**	**Article**	**+**	**+**	**+/-**
6	2008	Carmona, M. et al.	Book	-	+/-	+/-
7	2009	Luk, W.L.	Article	-	+/-	-
8	2011	Dimmer, Ch.	Article	+/-	-	+
9	2011	Németh, J.; Schmidt, S.	Article	-	+/-	+/-
10	2011	Bates, L.J..; Santerre, R.E.	Article	-	+/-	-
11	2011	Miao, Pu	Article	-	+	+/-
12	2011	Schmidt, S. et al.	Article	+/-	+/-	+/-
13	2012	Dimmer, Ch.	Conference	+/-	+/-	+/-
14	2012	Schmid, S. Németh, J. Botsford, E.	Article	-	+	-
15	2012	Grobelšek, L.J.	Article	-	+	+
16	2013	Arvidson, A.R.	Article	-	+/-	-
17	2013	Xing, N.	Ph.D. dissert.	-	+/-	-
18	2013	Yang, Y.	Ph.D. dissert.	+/-	+/-	-
19	2014	Nasution, A.D.; Zahrah, W.	Article	+/-	-	-
20	2014	Yoon, H.; Srinivasan, S.	Article	+/-	-	+
21	2014	Huang, T.S.	Ph.D. dissert.	+/-	+/-	+/-
22	2015	Lin, H.Ch.; Chao, T.Y.	Article	+/-	+/-	+/-
23	**2015**	**Grobelšek, L.J.**	**Article**	**+**	**+**	**+/-**
24	**2015**	**Carmona, M.**	**Article**	**+**	**+**	**+/-**
25	2017	Pratt, A.	Article	+/-	-	+
26	2017	Oliveira, L.; Pisani, M.A.J.	Article	+/-	+/-	+/-
27	**2017**	**Schindler, S.**	**Article**	**+**	**+/-**	**+**
28	2018	Carmona, M.	Article	-	+	-
29	2018	Rivera, C. et al.	Article	-	+/-	+/-
30	2018	Lichtenbaum, S.L.; Rosen, G.	Article	-	+	-
31	**2018**	**Nissen, S.**	**Article**	**+**	**+/-**	**+**
32	2018	Huang, T.S.; Franck, K.A.	Article	-	+/-	+/-
33	2018	Yu, Y.	Article	+/-	-	+
34	2020	Lee, D.	Article	+/-	+/-	+/-
35	2020	Leclercq, E.; Pojani, D.	Article	+/-	+	+/-
36	2020	Jian, I.Y. et al.	Article	-	+/-	+/-
37	2022	Lee, D.	Ph.D. dissert.	+/-	+/-	+/-

wave of enclosures, this time urban (Carmona, 2017). The critical view of POPS is shared by Christian Dimmer who while studding Japan, emphasizes that this notion is misleading as public assets are given to private hands, thus diminishing the public realm (Dimmer, 2012: 84). Sarah Schindler, known for her studies in the field of legislation, in her research on the fulfilment of the expectations of San Francisco's POPS, defines them, somewhat with skepticism, as *spaces that are – at least in theory – open and accessible to the public, but they are owned and operated by private entities*. She is stressing the importance to recognize that the developer is getting something of value (construction permit) in exchange for the provision of public space (Schindler, 2017).

RESULTS

In order to give concrete results, 3 sub-chapters have been given, which include: the results of the search, the evaluation of the quality of SLR and quality factors.

Table III Key aspects of POPS in definition by the public sector

City	Definition source	Definition criteria								
		Urbanistic / spatial characteristics					Private sector / Responsibilities and rights			
		Public Function/Usage	Form/Type/Scale	Spatial character (Open space)	Accessibility	Wider urban impact	Private ownership or development	Private land ownership	Private management	Bonus for investors
New York	The Depart. of UP	+					+		+	+
Hong Kong	DB	+		+	+			+/-	+	
London	GiGLE	+/-	+		+/-				+	
Waterloo	City of Waterloo	+	+		+				+	+
Seattle	DCI	+								+

Table IV Key aspects of POPS in scholarly definition

Scientific research field	Authors	Definition criteria								
		Urbanistic / spatial characteristics					Private sector / Responsibilities and rights			
		Public Function/Usage	Form/Type/Scale	Spatial Character (Open Space)	Accessibility	Wider Urban Impact	Private Ownership or Development	Private Land Ownership	Private Management	Bonus for Investors
Urban planning	Kayden, J.	+	+				+		+	+
	Carmona, M.	+				+	+			
	Németh, J.; Huang, T.S.; Franck, K.A.	+	+							+/-
	Grobelšek, L.J.				+/-			+		
Sociology	Nissen, S.	+		+/-	+				+	
Law	Schindler, S.	+				+	+			+

Search Results

Looking at the systematic literature review (SLR) we see that, although urban planners are the most represented among researchers (22 of 37 selected sources; Fig. 6), only a small number of authors have studied the relationship between urban planning and POPS. That is all the more surprising as this aspect, as author Liljana Grobelšek points out in her study on POPS in Slovenia, should become a mandatory component of the land subdivision plan when drafting implementation plans such as town-planning schemes (Grobelšek, 2015: 31). Generally speaking, scientific research of POPS focuses mostly on the aspects of managing them after realization. Somewhat less, it focuses on accessibility, and then on usability and policy, while the aspect of the shape/spatial proportion/scale of the space or aspects of the wider urban impact, are poorly represented.

Quality Evaluation of SLRs

The study of the documents provided by the authors has been evaluated for quality using the following criteria: content bias (referred to studies that provide direct definitions for POPS and urban planning criteria), citation bias (referred to studies that have a high number of citations), location bias (referred to location of their study) and language bias (choosing the English language). The elimination of the risk for a detailed study of the definition of POPS spaces is done by focusing on: the definition given for these spaces, the publications that try to present the problem of the connection of POPS with urban planning and the documents that criticize these spaces. (Table II).

By comparative analyzing the key features POPS definitions (Subchapter 2.4.1. and 2.4.2.) provided both by public (city) sector and scholars from the field of urban planning legislation and sociology, eleven different aspects of POPS have been selected for research (Tables III and IV). They can be divided into two basic groups according to the impact and consequences on investors and the city (citizens). The POPS features relating to the private sector responsibilities and rights do not necessarily have physical repercussions on the formed public city surfaces. They relate to the categories of ownership, management and investors benefits. From the urban planning point of view, more intriguing are its spatial characteristics that have an impact on the way of use and users' perception of space. These are the features that can have implications for the wider city space in the context of physical connectivity (accessibility and communication), as well as the creation of recognizable urbanity of strengthened socialization.

Quality Factors

Comparing the POPS definitions in use by the public sector (Table III), it can be observed that there is a similarity in the highlighted POPS features/aspects where the focus falls on:

– public function and enjoyment (4,5/5)
– private management (4/5)
– mostly unlimited accessibility (3/5) and
– bonuses for the private sector (plot owners or developers) (3/5)

At the same time, the formal (design) characteristics of spaces, as well as their impact on the wider urban context, are neglected or ignored. POPS are perceived more from the as-

pect of ownership and economic benefits with an emphasis on the public-private agreement to increase public surfaces in the city in quantitative terms.

Although unexpectedly, comparing definitions by scholars (Table IV), considering that most of them are researchers from the field of urban planning, formal characteristics of spaces, as well as their impact on the wider urban context (functional structure of the city which implies urban planning), are the least researched topics in the spatial/urbanistic category. In scholarly definitions the focus falls on the following aspects:

– public function (5/6)
– mostly private ownership (3/6)
– bonus for investors (plot owners or developers) (2.5/6)
– form/type/scale and wider urban impact (2/6)

Discussion

This paper is aimed at determining the relationship between Privately Owned Public Spaces (POPS) and urban planning, with main focus analyzing the definitions proposed for these spaces by both the public sector (city management) and the scientists. The review, summary and comparative analyses of previous research from authors of different profiles shows that there is still no consensus which would determine a clear POPS definition. POPS are initially designed to increase the number and share of new urban public spaces, but while studding POPS in Slovenia, author Liljana Grobelšek emphasis that there are several situations in towns and cities where public spaces and POPS are not adequately organized (Grobelšek, 2015: 29) which can have negative impact on wider urban context.

Activity Developed since 2000 to 2022

With this study, we found that since 2000 there is a considerable number of researches on POPS, but in the requested field we found only 32 sources from authors who at least try to give definitions for these spaces and their connection with urban planning. Although both analyzed definition viewpoints emphasize the importance of public use/usage in the first place, it's surprising that city management (public sector) does not consider the importance of POPS influence in the wider urban context and that POPS is not, in any way, controlled or connected to the comprehensive process of urban planning. Critics mostly refer to space management, limited access, the economic aspect of the benefits from the private sector, security, etc. but we rarely find criticism of these spaces in terms of urban influence. Critical assessments of examples of POPS case study in the world show that the consequences of such a perception (definition) are fragmentary and that individual urban spaces are often open and accessible to the public only in theory, while they are mostly controlled and potentially neglected in maintenance by private entities (Schindler, 2017: 1097). The pandemic situation Covid-19 had an impact on proper use of POPS. An example are POPS in New York, where the Mayor Office of New York City created special protocol for POPS, changing the rules of: accessibility, usability etc. (NYC Planning: DCP Compliance Protocol).

What Research Topics are being Addressed?

Public spaces on private land (POPS) are a result of the compromise between the public and private sector, and that is why the starting points/incentives for their creation must be analyzed in two ways and at the same time: through benefits for the city (urbanistic point of view) and through benefits for the private sector (investor's point of view). For now, the above-mentioned benefits are seen primarily from the economic perspective. Public sector benefits free public space without involving financial means instead of investing in the high value of the property for expropriation to create public spaces. The private sector benefits from an additional surface area in construction (in upper floors). At the same time, the urban management mechanism of the public – private negotiation is regulated exclusively by law, yet not by urban planning documents.

Who is Leading the Research?

Regarding the requested topic, the largest number of definitions of POPS under the prism of the urban planner can be found in the United States of America, followed by Hong Kong and Japan. Perhaps not coincidentally, the largest number of POPS studies corresponds to the largest number of POPS conducted in one city, namely New York. From this success of the realization of POPS, more research questions have been resolved in many different spheres by different authors, but also by the public sector itself, changing their legislation and regulations for these spaces from time to time, such as the city of New York, which changed its legislation in 1968-1975 by including new type of spaces (New York Department of City Planning). Examples of specific open databases of POPS of the city of New York and Hong Kong, provide precise data such as: period of

realization, exact location on map, geometry of POPS, area, type of POPS, etc. These precise data results give wide possibilities of analyzing these spaces in different diabase. As a result of SLRs for study, we find that these spaces are being studied by authors profiles such as: urban planning, sociologists, geographers, lawyers, economists, management and real estate.

What are the Limitations of the Research?

Although some cities contain open sources with specific details about POPS, some issues still remain the challenge of further studies due to lack of data. The fact that some cities like London do not have an open source with graphic data for these spaces remains extremely surprising, even though there are 58 completed POPS. Likewise, the city of London does not provide data for each POPS in which year it was completed or a specific map of where the cadastral plot is located. Since this study is related to the definition of these spaces and their connection with urban planning, the presence of high-quality maps is essential. In addition to the city of New York, which contains a specific map of all POPS realized from 1961 until today, other cities contain maps that endanger the accuracy of the research. From the analysis of the studies done by the authors, authors such as Jerold Kayden (study for the city of New York by Advocates of Privately owned Public Spaces /APOPS/ and The Municipal Art Society of New York /MASNYC/) and Christian Dimmer (study for the city of Tokyo), have realized the collection of all POPS realized in these two cities and have created open databases (APOPS&MASNYC[11], Tokyo POPS map[12]).

Conclusions

Unlike previous research, this research puts the urbanistic criteria for the definition of Privately Owned Public Spaces (POPS) in the foreground. From the studied sources, we notice that there is a gap between POPS and Urban Planning. Both from the public sector sources and the scientific ones, we do not find specific urban planning criteria for defining/implementing POPS. The sources of materials for studies by the authors are the data from the websites of the cities, or different measurements for these spaces.

POPS have been studied by urban planners (urbanists) who emphasize the importance of the connection/interrelation of POPS with broader public space system. The field of their research interest has been more informed by studying the management, social and economic benefits and their design and not by comprehensive urban planning.

A similar deficiency was observed in the public sector dealing primarily with the POPS management. Cities do not provide concrete data which data can be used by scientists and their results contribute to increasing the quality of POPS in terms of urban planning. The statistics provided by the city do not imply results which would refer to the impact of these spaces on urban structure or quality. While defining these spaces, we find a small number of urban planning terms.

Therefore, the analysis of POPS in the context of their impact on urban structure and the definition of the urban criteria of POPS, remains an unexplored field, offering potential for further studies.

[Translated by Zejnulla Rexhepi]

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Sources of illustrations and tables

Fig. 1	Photo credits: Bojan Bilic, 5 August 2022
Fig. 2	Authors, 6 December 2022
Figs. 3, 4, 6-8	Authors
Fig. 5	Photo credits: APOPS and Jerold Kayden. Available at: https://apops.mas.org/pops/m010004/ [Permission from authors: 27 July 2022]
Tables I-IV	Authors

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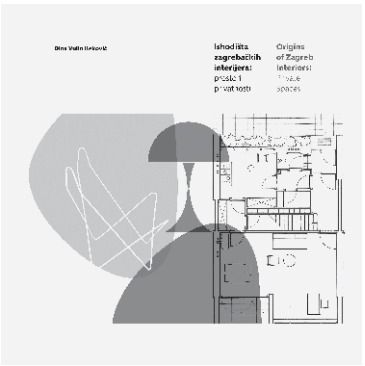
Vanja Brdar Mustapić, Lenko Pleština

Origins of Zagreb Interiors: Private Spaces

Ishodišta zagrebačkih interijera: prostori privatnosti

Dina Vulin Ileković
Author and editor-in chief



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The work was primarily conceived for required reading for the course Interior, part of the master's programme at the Architecture Faculty and taught without interruption since the year 1942. To date, there has been no systematic, integrated and expert work enabling parallel insights into achievements in this country and comparable architectural accomplishments elsewhere in Europe. The material of the course Interior, which the principal author has run since 2010, is now publicly accessible, facilitating a thoroughgoing overview of information relevant to a number of courses for students of Architecture Faculty and those of Design School.

With its artistic sensitivity and academic approach, the work *Origins of Zagreb Interiors: Private Spaces* offers a layered overview of Zagreb's outstanding interiors in the context of general architectural factors of the most intriguing period of the twentieth century. The use of ample records from the leading world and local archives and institutions provides "*parallel insights into local characteristics of private spaces as compared with those of the broader international context*". In the complex interrelations of the string "*architect – building – interior – use object*" we witness the incontestably impressive quality of Zagreb's architecture.

This bilingual volume consists of an introduction and nine chapters, on 160 pages with 285 illustrations, comprising photographs and original drawings as well as 56 bibliographical references. Used in the composition of the work was material from 45 separate sources, including world and local archives, museum institutions and private collections. In the alphabetical index of names, there are 296 authors whose material has been used in the work or who are mentioned in the text. Clearly and perspicuously conceived, written in a language of admirable stylistic competence, it also possesses an impressive visual identity so important for writing dealing with themes in design and architecture.

The first four and the ninth and final chapters are the sole work of author and editor Dina Vulin Ileković. Chapters about prominent individual Zagreb designers are the work of other writers, either singly or in collaboration. Chapter Four was co-written by Dina Vulin Ileković and Hela Vukadin-Doronjga and Chapter Five was composed by Ivana Haničar Buljan. The sixth and seventh chapters were written by the editor and Iva Ceraj, the latter of whom also wrote Chapter 8.

Thanks to extensive and thorough research, the book provides an extremely well-informed, substantial, layered and relevant presentation of the history of residential interiors in Zagreb from the end of the nineteenth century to the nineteen-seventies.

A multi-layered presentation with components that can be followed consistently in all chapters, an alternating rhythm of treatment of the work's building blocks, with accents on the most important personalities, examples and phenomena and the sublimation of ideas and viewpoints in the juxtaposed quotations are only some of the qualities and characteristics of the synthesising approach found in the work *Origins of Zagreb Interiors: Private Spaces*.

The writing is coupled with lavish illustrative material, expertly selected photographs of key works and examples for comparison. The comments adjoined to the illustrations allow a still more substantial analysis, understanding and contextualisation in time and space. Presented side by side with a selection of photographs from world and local archives and museums are privately owned pictures of Zagreb interiors, some of them, it is worth pointing out, shown for the first time. The selection of information conveyed is well-considered and logically structured, showing the subtle network of influences and collaboration of the actors on the scene, the development of tendencies, the application of principles in architecture and design and, finally, the employment of furnishing. In a theme as complex as this, which impinges on the domains of architecture, and art history as well as design history, it is fully justified to highlight a synoptic and interdisciplinary approach to the analysis of the interior, architecture on a large and a small scale.

As a logical consequence, furniture constitutes an integral part of some of the units, primarily the design of chairs, with an emphasis on the functional and formal aspects of its development. The intention is to point out that for architects this was a task as important as that of architectural design, and that it was, indeed, a professional challenge in which they developed ideas in consistence with their own idiom.

Such an approach is important for both a comprehensive understanding of architectural work and for reference to the fact that the design of interiors, furnishing and objects of applied art is part of the cultural identity and heritage, and particularly because it is most exposed to change and frequent devastation, as well as a lack of understanding of its importance for the history of art and culture.

What is more, in professional and academic writing, in the area of art history, architecture and design, interiors are a theme which is much less featured and in general addressed as part of some other discourse.

It is of great importance that the work is published in two languages, Croatian and English, enabling students from other countries to become acquainted with the superb achievements, the authenticity and distinctive features of Zagreb residential interiors in the context of international trends.

In January 2023 the book was listed among the best designed Croatian books for the international competition and exhibition *Best Book Design from all over the World* for the Leipzig Book Fair and for the exhibition *Book Art International* at the Frankfurt Book Fair. In March 2023 it was nominated for the Neven Šegvić Prize in the category of the work of journalism, criticism, scientific research or theory in the domain of architecture for 2022, while on March 21 the Zagreb University Senate adopted a decision assigning the manuscript *Origins of Zagreb Interiors: Private Spaces* the right to use the title Manualia Universitatis Studiorum Zagrabiensis.

[Translated by Graham McMaster]

Zoran Veršić, Stanka Ostojić

International Scientific Conference on Contemporary Glass Facades – Zagreb 2023

Međunarodna znanstvena konferencija o suvremenim staklenim fasadama – Zagreb 2023

Book of Conference Proceedings

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International Scientific Conference on Contemporary Glass Facades Zagreb 2023 was a part of the research project *Development of a double facade with hermetically sealed cavity (H-CCF)*, implemented by the private company KFK d.o.o. in cooperation with the University of Zagreb Faculty of Architecture as a scientific partner. The project is funded by the European Union from the European Regional Development Fund under the project code KK.01.2.1.02.0218. International Scientific Conference on Contemporary Glass Facades Zagreb 2023 was held in person on 23 May 2023 in the Antunović Hotel, Zagrebačka avenija 100 A, Zagreb, Croatia.

The project *Development of a double facade with hermetically sealed cavity H-CCF* started on February 21, 2020, and ends on August 21, 2023. The Faculty of Architecture as a research institution for research and development and the company KFK d.o.o. for research, development and innovation participated in the project. The Faculty of Architecture research team consisted of scientific project manager Zoran Veršić, Josip Galić, Ivona Cvitković, Marin Binički, Lucija Stepinac, Hrvoje Vukić, Mateja Nosil Mešić and Dora Petrac. The KFK d.o.o. team consisted of project manager Marijo Tomić, coordinator Ivica Kušević, Antonijo Zeljko and many others.

Glass facades, as transparent parts of the contemporary building envelope, represent the focus of research papers in the Book of Conference Proceedings. Glass facades directly affect the realization of visual, sound and microclimatic comfort of interior space. When designing a glazed facade, it is important to check all the advantages and disadvantages in order to optimize the final solution depending on the location and purpose of the building, orientation, regime of use, etc. Glass facades are characterized by their parameters (bearing structure, composition, type of glass, sun protection...) and should adapt to the conditions of the location and the requirements of the space they protect from external influences. The health and well-being of users and the quality of indoor environment are among the key categories affected by the performance of contemporary glass facades and assessed by the building's sustainability analysis throughout their entire life cycle. The four main parameters that define the key aspects of indoor environment quality are: indoor air quality, the degree of thermal comfort throughout the year, the quality of artificial and natural light (and the associated visual comfort) and the building's capacity to isolate occupants from internal and external noise sources. Glazed facades, with their characteristics, directly affect all the mentioned parameters and are very often the focus of scientific interest. Glazed facades are complex systems that require maintenance over a long period of time, and the long-term quality of the user's comfort in the space clearly depends on the facade solution.

Single and double (ventilated) skin facades do not represent a new element in architecture, but recently double skin facades with hermetically sealed cavities have been introduced. A new type of closed cavity facades (CCF) was researched in *Development of a double facade with hermetically sealed cavity (H-CCF) project*, in order to integrate benefits of both single and double (ventilated) skin facades: lower maintenance costs, larger depth to the outside, wind-protected sun blinds, reduced need to heat the inside of the building, lower cooling needs, no condensation risks, etc. The project originated from the observed market trends and inquiries from current and potential customers to make the current type of CCF independent of additional units (compressors, filters, air dryers, etc.). Existing facades with a closed cavity prevent condensation on the inner surfaces of the glass (in a closed cavity) by supplying prepared dry and purified air, requiring active maintenance and service. The project scientific research showed that the idea of an H-CCF facade with passive maintenance of dry air inside a closed cavity has its likely practical application and development potential.

The Conference was organized to present the development of the H-CCF facade and contemporary glass facades in general, primarily to exchange research experiences in this area and connect European researchers. This is the first Conference in Croatia organized by the University of Zagreb Faculty of Architecture on the topic of contemporary glass facades, and further development of this theme is expected in the future. Twenty authors in nine research groups have presented their papers and published them in the Book of Conference Proceedings. These papers present a valuable tool for understanding the state of the art of contemporary glass facades. Some of the research papers were written in collaboration with students. By getting involved in the research process, students become more aware of the role of the glazed facade in the life cycle of the building. Scientific conferences such as this one provide a great possibility to share knowledge between students, professors, researchers, practitioners and building industry.

The titles of the published papers within the Book of Conference Proceedings are: The Effect of Glass Facades: Users' Comfort; Closed Cavity Façades – the Experience; Multilayered Glass Facades; Evaluating Mechanical Properties of Laminated Glass Under Pure Shear Using 3D RVE Analysis; Investigating Heat Development in Shadow Box Facade Systems: A Mockup Test Approach; Visual and thermal comfort optimization through WWR concept: office spaces in Podgorica, Montenegro; Role of the transparent surfaces of the envelope in formation of the identity and functional transformation of the residential architecture from the early 20th century in Sarajevo; Efficiency and Durability of Glazing and Sun Protection - on Preschool Education Buildings in Croatia; Environmental Product Declaration for curtain wall façades.

These research topics witness the scope of published materials. Analyzing and comparing contemporary glass facades from different points of view enables researchers to gain valuable insight into different types of glass facades in the context of a specific location and purpose of the building.

The total value of the project is HRK 67,849,821.53 / € 9,005,218.86 and was co-funded by the European Union from the European Regional Development Fund.

Ivan Rogić

Reconstruction of the Historic Center of Zagreb after the Earthquake

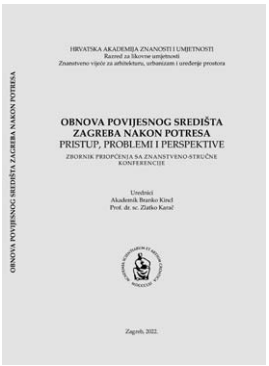
Approach, Problems and Perspectives

Proceedings of the scientific and professional conference

Obnova povijesnog središta Zagreba nakon potresa

Pristup, problemi i perspektive

Zbornik priopćenja sa znanstveno-stručne konferencije



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Even a 'diagonal' reading of this publication indirectly indicates the special organizational effort invested in the organization of the Conference (held in May 2021) and in the publication of the Proceedings itself. It includes 16 independent authors' papers, 4 texts of broader discussions, and 2 texts of shorter discussions, a total of 22 titles signed by 50 scientists and experts of various professions and professional vocations, ranging from, for example, architects, urban planners, art historians, civil engineers, surveyors, energy experts to economists, sociologists, designers, environmentalists...

In a particularly valuable appendix entitled: *15 Theses for a Better Reconstruction of Zagreb* (written under the editorial supervision of academic Branko Kincl and Prof. Zlatko Karać, Ph.D.), the claim under number 3 highlights the need for a "... holistic approach and interdisciplinarity". It is evident here that the organizers of the conference consider it to be one of the fundamental strongholds in the search for an optimal approach to post-earthquake reconstruction. If we keep this in mind, the presence of the aforementioned various and authoritative professions at the Conference looks completely natural. It is not useless to repeat what is written about this in the continuation of the 3rd thesis: "... the implementation of the renovation is mainly the task of the engineering professions (architects, urban planners, builders, surveyors, transport and energy experts), but the renovation strategy – which is still lacking in Zagreb – is an extremely interdisciplinary task that must include several complementary professions with indispensable competences in the cultural and social-humanistic domains (art historians, designers, urban sociologists, economists, demographers, lawyers, etc.)". A valid distinction between these two levels, as well as an understanding of their internal connection, is a key prerequisite for a successful renovation. According to semantic inertia, the term *reconstruction* would refer to the return of the 'old'. However, even a simple review of historical examples of urban reconstruction suggests that it is not just persistence on the monopoly of previous conditions and relationships, but a complicated dynamic where the old is established with the aid of the new, but also the new with the aid of the old. In order to bring this complicated dynamic to a practical level, it is necessary to distinguish the aforementioned two-stage nature of the restoration process as early as at the preventive level, when determining the basic foundations of the restoration approach. It has been shown on several occasions that neglecting one or the other level, strategic or implementation wise, leads to predictable pitfalls. Ignoring the implementation level leads to a barren bureaucratic maze, where everyone is to blame and no one is responsible. Ignoring the strategic level leads to temporary pragmatic solutions for which the word *simulacrum* is aptly used in contemporary sociology.

Contrary to various, often undeserved claims by the Croatian public, evaluations according to which the post-earthquake reconstruction, especially the reconstruction of the historic center of Zagreb, exceeds the available intellectual and professional abilities present in Croatian society, in this Collection it is argued in several places that in the period of Croatian modernity it can be easy to extract examples of proven restoration skill. Even the attitude of the city and national participants towards the earthquake in Zagreb in 1880 shows that several guidelines can be extracted from that attitude, relevant either at the implementation or at the strategic level. Examples of the reconstruction of Croatian settlements after the Second World War, among which the reconstruction of Zadar has a special symbolic status, and the reconstruction of Croatian settlements destroyed during the Serbian-Montenegrin aggression, among which the reconstruction of Vukovar has a special symbolic status, despite the special conditions of such reconstructions, demonstrate that Croations knew where and how to find competent experts and rational organizers. In these reconstructions, it became clear that it wasn't only about the construction of new buildings and new infrastructure networks, but also about the restoration of the social and cultural memory of the city and place. It is also noteworthy to mention the possibility of urban transformation, where a settlement that is not yet a city is established as a city through post-earthquake reconstruction. In this regard, the post-earthquake reconstruction of Makarska in 1962 is a notable example.

At the same time, welcome assistance from outside, such as, for example, financial support from the funds of the European Union, is not excluded. But everything lies, indirectly suggested by the texts in the Collection, on one's own abilities. In addition to "classic" sectors of reconstruction, such as construction, finance, infrastructure, housing, law, the Collection also discusses those that have, quite often, been neglected or relegated to the margins. First of all, this refers to the shaping of the development horizon, where the presence and effects of certain risks are rationally calculated. They can be of natural origin, such as an earthquake or flood, and they can also be of sociocultural origin (wars, invasions). Risk prevention imposes a number of new requirements and rules in the reconstruction process. As a sociologist, I am particularly close to emphasizing the importance of communication with citizens, reliance on civic participation and solidarity, and the importance of some symbolic landmarks of Zagreb. In the social imagination of the population they enable the strengthening of ideas about Zagreb as a space and a place of its own life attraction and identity. It is not useless here to recall the urban experiences visible in several, albeit unsystematic, testimonies of foreigners who have permanently moved to Zagreb. On the one side, there is security and good social relations. But on the other side, there is a pleasant city atmosphere. In the urgency of reconstruction, and there will certainly be some urgencies, it should not happen that the success of Zagreb's reconstruction is documented crosswise, by emphasizing the similarity with the imaginary, ubiquitously identical, city of globalization. That is something that the authors and editors of the Collection don't have any doubt about. It's the managers' turn and, unfortunately, the politicians'. I recommend this Collection to them.

[Translated by Tea Raše]

Lucija Kraus

Criteria for Evaluation of Urban and Architectural Development Opportunities for Osijek's Abandoned and Repurposed Industrial Area

Kriteriji za evaluaciju urbanističko-arhitektonskih mogućnosti razvoja napuštenih i prenamijenjenih industrijskih prostora u Osijeku

Lucija Kraus (née Lončar) born in 1989 in Osijek. She completed her Master studies in 2014 at the Faculty of Architecture in Zagreb. She is currently employed as a teaching and research assistant at the Faculty of Civil Engineering and Architecture Osijek.

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Date of public defense: January 20, 2023

The dissertation has 419 pages, 9 chapters, 6 figures, 27 charts, 13 tables, 162 bibliographic units and four appendices with two catalogues.

In today's Osijek there are large, abandoned and devastated industrial areas from the period 1856-1945. This research was motivated by the lack of clear, systematically organized evaluation criteria for these areas, defined from interdisciplinary and transdisciplinary points of view. The research first focuses on the systematization and classification of industrial and existing former industrial areas of Osijek from the period 1856-1945. The second focus is put on defining the criteria for the evaluation of urban architectural development possibilities of abandoned and repurposed industrial areas (NiPIP).

The researched areas are complex because over time they have changed to a significant extent, following the progress of technology. These areas always retain at least a part of their historical industrial identity, which is why it is not possible to unambiguously define it as an industrial heritage area, brownfield area, historical industrial area, industrial area, former industrial area, abandoned industrial area, repurposed industrial area, abandoned industrial area. Today's conceptual definition of area contains parts and/or combinations of all previously mentioned concepts. However, in the context of the original and longest-lasting purpose of that area, the area that this doctoral thesis deals with is an industrial area or a historical industrial area, which has changed due to the influence of time and the advancement of technology.

Using the collected data, a critically systematized database of industrial and former industrial areas in Osijek from the period 1856-1945 has been created, and it is divided into two catalogues. The processed and collected data are systematized in catalogue units for urban complexes of abandoned and repurposed industrial areas (Catalogue 1, Annex I) and catalogue units for individual buildings of abandoned and repurposed industrial areas (Catalogue 2, Annex II). In addition to field research, the work combined: analytical and comparative methods, and the survey method, which was used in the analysis of criteria set from interdisciplinary and transdisciplinary points of view.

The research resulted in a typological classification of industrial and former industrial areas of Osijek that were created and/or established before 1945. The first step in this part of the research was related to the collection of literature, on the basis of which the mentioned areas were identified. Key photo documentation was collected through field research and quantitative and qualitative data on these areas were defined. The analysis and comparison of existing areas was made on the basis of a critically systematized database of industrial and former industrial areas of the city of Osijek from the period 1856-1945.

The research identified 53 industrial and former industrial areas in Osijek that were created before 1945. Today, 12 industrial or former industrial areas still exist in their entirety or in fragments. Industrial and former industrial areas of the city of Osijek, created from 1856 to 1945, considering their current state, can be typologically classified into abandoned, repurposed, and those with an active original purpose. However, the above-mentioned divisions can overlap, so the further observed areas can be divided according to the degree of representation of one type or another type of area. Abandoned areas are divided into completely abandoned, partially abandoned and minimally abandoned areas. Repurposed areas are divided into total or complete repurposing of areas, partial repurposing of areas and repurposing of buildings, depending on the share of repurposing. As for industrial areas, they can be with or without historical identity.

The basic criteria were created using the information gathered from the review of available literature, field research, Catalogue 1 and Catalogue 2 and are used to create a survey. The basic criteria are classified into five groups of criteria, and they consist of: the urban group of criteria with nine criteria, the conservation group of criteria (at the level of the urban complex and at the level of individual buildings) with 18 criteria, the architectural group of criteria with four criteria, the construction-technical group of criteria with five criteria and the cultural-identity group of criteria with five criteria. There is a total of 40 basic criteria for evaluating the urban-architectural development possibilities of abandoned and repurposed industrial areas in Osijek.

98 respondents from the fields of humanities, technical and social sciences took part in the survey to define the importance of certain groups of criteria and the criteria of urban-architectural opportunities for the development of abandoned and repurposed industrial areas from different interdisciplinary and transdisciplinary points of view.

Based on the results of the survey, the basic criteria were defined and quantified, resulting in significant or unavoidable criteria for the evaluation of the urban complex of NiPIP and the possibilities of its development are mostly criteria from the conservation group of criteria, namely the ambient value of NiPIP, the value of originality of NiPIP, the visual value of NiPIP, the value of rarity of NiPIP and the value representativeness of NiPIP as well as one criterion from the cultural-identity group of criteria (identity of place NiPIP). While the indispensable criteria for the evaluation of an individual building of a NiPIP and the possibilities of its development are mostly criteria from the construction-technical group of criteria, namely: feasibility of reconstruction of an individual NiPIP building, bearing capacity of an individual NiPIP building, basic requirements for an individual the NiPIP building. These significant criteria include the adaptability of an individual NiPIP building and value of the rarity of an individual NiPIP building.

The proposal of criteria for the evaluation of NiPIP of the city of Osijek, and the proposal of a model for the application of the mentioned criteria will enable a new approach to the research of Osijek and the education of various professions related to the development of Osijek. In addition, the results of field research and the conducted survey present a contribution to the integral evaluation of urban-architectural elements of former industrial areas as a contribution to the guidelines for the protection and restoration as well as the conversion of industrial heritage.

Ivo Vojnović

Reconstruction of the Original Appearance of the Perimeter Walls of Diocletian's Palace

Ivo Vojnović was born in 1959 in Split.
He is employed in the design office Ured Vojnovic, d.o.o. in Split as owner, director, and licensed architect.

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Date of public defense: March 7, 2023

The dissertation has 430 pages, 6 chapters,
418 illustrations, 118 drawings and a spatial representation,
printed in 2 volumes.

Rekonstrukcija izvornog izgleda perimetralnih zidova Dioklecijanove palače

Diocletian's palace is one of the most notable examples of late Roman architecture in the world, due to its original concept and the high level of preservation. In particular, the external view of the perimeter walls still gives the impression of the original appearance of the palace. It is a misfortune that out of sixteen towers only three corner-towers have been preserved. In the interior of the palace, the best preserved parts are the Emperor's Mausoleum, peristyle with prothyron, vestibule and the prostyle temple in the west temenos. The state of preservation is excellent in nearly 40 original vaulted substructures beneath the imperial apartments.

The southern front is the most prominent one and largely preserved. Square towers were projecting from the east and west end. The upper section of the wall had a series of openings, giving the whole south front an attractive appearance. The portic, i.e. the covered gallery along the whole southern front also had three loggias, two at each end of the front and one in the middle. Although they were not preserved anywhere on the south front, it is assumed that ornamented triangle pediments with bases curved into an arch (so-called Syrian gables) were surmounted on top of the loggias. Between the loggias, the portic was divided with two horizontal cornices. Engaged columns on the lower and simpler section held the upper, more lavishly decorated cornice. Semi-circular windows were located between the columns. At two positions in the portic, on the axis of the imperial dining room in the east and the great hall in the west, there were somewhat larger semi-circular windows with the top horizontal semi-circular cornice. In the thesis, it is proposed for the first time that Syrian gables were surmounted on these windows, although they were not preserved, nor were the gables on loggias. A Syrian gable of similar form was reconstructed on the gymnasium building in Sardis, Turkey. A similar gable is found on the prothyron of the Palace, well-preserved and with more decorations. Furthermore, the author proposes that there was no superstructure above the upper cornice of the portic, as assumed in the existing literature, but only a single-pitch roof leaning to the north wall of the portic. Based on the findings of a large number of slots on top of the cornice, with better stone carving details in these positions, the author concludes that there was a series of sculptures placed on the cornice, on the axis of each engaged column.

The south part of the Palace had an exclusive residential purpose, with an ornamental south façade facing the sun and the sea, reminescent of a Roman maritime villa. In contrast, the rest of the Palace was organised according to the rules of a Roman military camp, best represented by the fronts. The three gates on the east, north and west wall had defensive courtyards, protecting the entrances to the Palace.

Outer perimeter walls on the first floor level of the imperial apartments have relatively large arcades, with the top cornice. Based on the discovery of cut stone blocks with dimensions 59´59 cm which were protruding from the back sides of perimeter walls between the arcade arches, it was considered that lateral walls of the upper floor extended from these blocks. On several locations on the first floor level, the author discovered stacked stone blocks, finely cut on all sides. The conclusion is that these cut stone blocks were not used to join with the walls, but were most probably constructed as counterforts positioned on the inner side of perimeter walls, thus contributing to the stability of relatively thin and long walls with a number of arcade openings.

In many respects, the discovered pylons changed the previous conceptions about the appearance of the rooms constructed adjacent to the inner side of the perimeter walls. It was assumed until now that there had been another level above, also divided in cubicles and with the floor plan identical to the lower level. However, the discovery of a pylon on the outer front excludes existence of rooms and leads to the assumption that this wide and long space was used as integrated space which in fact served as guards' walkway. The purpose of the walkway, typical for all Roman city walls and fortifications, was to enable fast repositioning of soldiers between the towers. The arcades on the perimeter wall of the Diocletian's palace served as a defensive parapet. In addition, the author proposes that this wide walkway never had a roof, also disputing the existence of a building at the first floor level. This is substantiated by the fact that no remains of a Roman wall were ever found on the upper level.

The solid and functionally clear organisational structure of the Palace, with sixteen defensive towers flanking the perimeter walls has clear features of military architecture. It greatly resembles some military camps in the east part of the Roman Empire, principally in Egypt. The ground plan of the camp in Nag el-Hagar with very similar arrangement of towers along the perimeter walls most closely resembles the Diocletian's palace. The ground plan of Qasr Qarun (Dionysias), another military camp located in Egypt, also resembles the Palace in Split. There is another large military camp in Babylon, located in the district now known as Old Cairo, erected during Diocletian's reign. Similarities are found in the fortifications Qasr Bashir and Da'janiya in the desert of Jordan and the camp in Syrian Palmyra. All the mentioned fortifications were constructed under Diocletian's rule, therefore it is not surprising that they share features with the Palace in Split.

Finally, based on a number of details in the Diocletian's palace we can assume that the dominant influence on its construction came from the Middle East, i.e. the eastern part of the Roman Empire. Although there are considerable similarities with other examples of Roman military architecture, the spatial arrangement of the Palace in Split is unique and is not found anywhere else in the world. One possible reason is Diocletian's direct involvement in the project and all the facilities required for the Palace. Taking into consideration the strategic projects envisioned and implemented by Diocletian in a relatively short time period on the eastern frontier (limes), i.e. numerous fortifications from Palmyra to Upper Egypt along the Roman road named after the Emperor - Strata Diocletiana, and in view of his passion for constructing grand buildings, we can be pretty certain that the Emperor himself contributed to planning and designing the Palace.

Danijela Lovoković

Spatial Planning Criteria for Evaluating the Impact of Urban Architectural Competitions on Spatial Development of the City of Osijek

Prostorno planerski kriteriji za evaluaciju utjecaja urbanističko-arhitektonskih natječaja na prostorni razvoj grada Osijeka

Danijela Lovoković (1968, Osijek, Croatia) graduated from the Faculty of Architecture in Zagreb in 1993. She worked in architectural design, spatial planning and investment management in various companies and in local administration.

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Date of public defense: May 25, 2023

The dissertation has 286 pages, 12 chapters, 100 illustrations, 235 footnotes, 93 bibliographic units, 37 tables, 7 graphic and 35 internet sources.

The topic of the research is the influence of urban-architectural competitions (UAC) on planning, urban development, and image of the city of Osijek. The research was prompted by inappropriate changes on the territory of the Republic of Croatia, which are the result of political, social, and economic transition after Croatia's War of Independence. The integration and significance of UAC were analyzed from an urban point of view, and the research was conducted in the area of technical sciences, in the field of architecture and urban planning.

The research points to the importance and significance of the implementation of UAC as a planning tool for ensuring the quality and building culture and the control of qualitative changes in space. The goal is to establish urban criteria for evaluating the positive effect of UAC on spatial development. The significance of this research lies in the contribution to the knowledge about the evaluation of the impact of competitions on the city, which have not been comprehensively and systematically processed, thusfar, by integrally looking at the interrelationship between competition realizations and the image of the city of Osijek.

On the basis of available sources and archival material, an overview database on competitions in Osijek from 1834 to 2020 has been established. Sixty-three competitions were chronologically systematized and placed in the context of historical and socio-political circumstances, and three characteristic periods of implementation were determined. Through comparative analysis, correlation and classification of different characteristics of UAC, three categories of their characteristics were determined. Through the analysis of the interrelationship between individual features, space and perception of the city, twenty-one criteria for evaluating the competitions were determined and divided into two categories: a) organization and implementation criteria, and b) quantitative-qualitative urbanistic criteria.

The research established that the organization and implementation criteria are not relevant for the impact on spatial development. Based on the organization and implementation criteria, the basic types of competitions were determined according to the project task, the implementation of which in by-laws and professional regulations can improve the procedure for the implementation of UAC.

Through the synthesis of quantitative and qualitative criteria, the competitions' multiple contributions to the spatial development of Osijek were evaluated and confirmed. Quantitative criteria were used to determine the impact of the number, representation and concentration of competitions in the city area, as well as the coverage of the city by the areas of realized competitions. Qualitative criteria determined the positive impact of the competition on the planning documentation, on the perception of residents and on the image of the city.

The contribution of competitions to the spatial development of Osijek in a quantitative sense can be seen in the share of completed competitions (68.3%), of which as much as 70% have an urban character. In terms of concentration and surface area, the realized competitions achieved, a particularly significant impact on the area of Gornji Grad (62% of the administrative area of the city district).

Based on qualitative criteria, the impact of competitions on planning documentation was determined together with the impact of the competition on the perception of residents and on the image of the city.

The period between 1994 and 2003 showed a positive impact of competitions on spatial planning documentation, when three detailed plans and two urban development plans were drawn up and adopted in Osijek based on urban planning competitions. Their contribution was determined in the change of traffic flows, the affirmation and presentation of the cultural-historical heritage, the creation of new public spaces and the establishment of new city amenities.

The contribution of competitions in the perception of the city is proven based on the views of the residents who, among the historical and contemporary buildings for which the city is recognized, best evaluate the buildings and structures created on the basis of UAC. It was also confirmed that a large proportion (96.94%) of the surveyed residents of Osijek agree with the statement that the realization of the competitions improves the quality of life and the impression of the city.

Thirty-one UACs were implemented in the places recommended for improving the image of the city from 2001, which achieved qualitative progress in the area that was once considered to be among the most pronounced urban problems.

The influence on the formation of the elements of the *image of the city* is also visible in the concentration of realized competitons in certain parts of the city that contribute to the improvement, recognition and legibility of the *area* (city center, university campus, recreation – Gradski vrt). The clarity of the *edges* was achieved by shaping the space along the river, the contents along the bypass, and the railway line by forming new entrances to the city. The system of city *nodes*, places of gathering and frequent use is completed with fifteen organized public open spaces. Landmarks are controlled by competitions in order to preserve the characteristic image and silhouette of the city and to create recognizable points such as memorials.

The evaluation of Osijek's squares revealed a significantly higher level of met quality criteria for realizations based on competitions.

The scientific contributions of the research are in the established overview database of all competitons in Osijek, which until now has not been comprehensively and systematically analyzed from a spatial and urban planning point of view; in the definition and categorization of criteria for the analysis and evaluation of UAC, which have not been unambiguously determined until now; in the establishment of an integral methodological procedure for objective and urbanistically based evaluation of the impact of UAC on urban development, applicable in other urban environments too. The professional contribution is the suggested guidelines for improving the procedure for the implementation of UAC, applicable at state level when improving the legal framework, professional regulations and spatial planning documentation.

PROSTOR

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