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Advances in Human Factors in Architecture, Sustainable Urban Planning and Infrastructure

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Preface

The discipline of human factors in architecture, sustainable urban planning and infrastructure provides a platform for addressing challenges in human factors and engineering research with the focus on sustainability in the built environment, applications of sustainability assessment, demonstrations and applications that contribute to competitiveness and well-being, quantification and assessment of sustainable infrastructure projects, and the environmental, human, social and economic dimensions of sustainable infrastructure. A thorough understanding of the characteristics of a wide range of people is essential in the development of sustainable infrastructure and systems, serves as valuable information to designers and helps ensure design will fit the targeted population of end users.

This book focuses on the advances in the human factors in architecture, sustainable urban planning and infrastructure, which are a critical aspect in the design of any human-centered technological system. The ideas and practical solutions described in the book are the outcome of dedicated research by academics and practitioners aiming to advance theory and practice in this dynamic and all-encompassing discipline.

A total of two main sections are presented in this book:

1. Ergonomics in Building and Architecture
2. Ergonomics in Urban Design

Each section contains research papers that have been reviewed by the members of the International Editorial Board. Our sincere thanks and appreciation to the board members as listed below:

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We hope that this book, which is the international state of the art in architecture, urban planning and sustainable infrastructure domain of human factors and ergonomics, will be a valuable source of theoretical and applied knowledge enabling human-centered design for global markets.

July 2021   Jerzy Charytonowicz
                                                                                                        Alicja Maciejko
                                                                                                    Christianne Falcão

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Ergonomics in Urban Design

Ergonomics in Building and Architecture

The Synthesis of the Arts and Its Influence on Modern Theatre Architecture

Paweł Amałowicz[(✉)]

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Abstract. The original idea of the synthesis of the arts dates back as far as ancient Greece, particularly to the archaic period, when art was syncretic. The notion of 'the synthesis of the arts' appeared in the modern era in the 19th century. The primary promoter of the synthesis of the arts at that time was Richard Wagner, who wanted to create a musical drama combining theatre, poetry, music, dance, painting and sculpture. This idea extended to architecture. A significant number of modern theatre buildings, influenced by the search for a synthesis of the arts, have changed the way in which the inner space is shaped. The way the theatre space affects the audience has also changed. The author would like to specify and examine those elements that have radically transformed the modern theatre space, and their introduction was possible due to the aforementioned search.

Keywords: Theatre architecture · The synthesis of the arts · Auditorium and stage

1 Introduction

In the ancient Greek theatre, the idea of correspondence, or more narrowly, synthesis of arts, that is co-occurrence of elements of various arts in one work, manifested itself. Ancient Greek performances were a cultural phenomenon consisting of works belonging to various arts: combining theatre (actor's play), literature (song, drama), dance (expressive gestures and steps of choristers), music (songs accompanied by instruments), architecture (built scenery), painting (decorations) [1]. In the Greek archaic period it was syncretism, which manifested itself in the *triune choreia*, i.e. an inseparable combination of sound (music), word, or rather singing (poetry), and movement (dance) based on rhythm. This term was used to describe the performances of the ancient choir, which were an organic combination of these three elements. From the name *choreia*[1] comes the prefix *choreo-*, referring to dance, but also the term chorus (gr. *chorós*), referring to music [2]. The aforementioned combination was also evidenced by the name *orchestra*, which comes from the Greek word '*orchesis*' meaning dance. The *orchestra* was the place in the theatre occupied by the singers, who

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[1] *Choreia* was a circle dance accompanied by singing.

also were dancers as well [3]. An altar in honour of Dionysus (*tymele*) was also placed there, and the place itself became a ritual space.

Apart from the process of integration of arts, i.e. their organic fusion 'both in terms of material and content', as it was the case in ancient Greek theatre, there also existed a kind of artistic influence of individual fields of art on one another [1]. In this sense, in the modern era, these interactions were realized by opera, which emerged in the Baroque. It is not certain whether artists consciously sought a synthesis of the arts at that time, but still, opera combined music (composition, i.e. sound), the word (sung libretto), theatre (staging and architecture) and painting (scenography). Attempts to revive the idea of an 'organic' synthesis of the arts were made more or less consciously in the 19th century, in the philosophical and aesthetic thought of Romanticism. This idea affected the way the theatre space was shaped.

2 Richard Wagner and His Idea of the 'Temple of the Arts'

The term the *Gesamtkunstwerk* - 'the total work of art' was developed by the German writer and philosopher K. F. E. Trahndorff in an essay in 1827. The nineteenth century concept of the *Gesamtkunstwerk* had deep evolutionary roots in religious practice across cultures, especially in Greater Dionysia of ancient Greece. The opera composer Richard Wagner used the term in two 1849 essays, and the word has become particularly associated with his aesthetic ideals [4]. It referred to a performance spectacle that synthesized multiple forms of the arts into a unified work. Wagner described his idea of the union of opera and drama, in which the individual arts are united to a common purpose. This idea extended to architecture, because Wagner's 'music dramas'[2] were to be performed in a newly constructed festival opera building, 'temple of the arts'[3]. According to Wagner, "*the artist feels complete satisfaction only when all the arts are combined together, because the essential aim of art is to strive to encompass everything*" [6]. Wagner owed his conception of drama to the Greeks, as he himself admitted [7]. He felt that from ancient times up to his days the arts had drifted further and further apart. The Baroque opera did combine different types of art, but for Wagner in a superficial way. He believed that the performances of Baroque opera were full of splendour, but far from the ideas that inspired the ancient tragedians. According to the symbolists, Wagner also recognised the culture-creating function of myth, claiming that "*only the Greek conception of the world was able to produce a true work of dramatic art, which was based on myths, and so it is necessary to return to them in order to find in people God, the hero, and finally man*" (Oper und Drama) [7]. Wagner desired the cohesion of the various arts 'within a single creative visionary work' [8] and a return to ancient drama not only in the sense of staging, but also of recreating a homogeneous theatrical space. Departing from traditional Baroque opera house auditorium, under Wagner's direction, a theatre building with an amphitheatrical auditorium modelled on

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[2] Wagner's idea of the union of opera and drama was later called 'music drama' despite of his disapproval of the term.

[3] Wagner's friend the architect Gotfried Semper wanted to realize the idea of community through the integration of 'artificially separated: architecture, performing arts and crafts' [5].

ancient theatre was designed and built in Bayreuth in 1876[4] [9, pp. 282–284]. Bayreuth Festspielhaus was the outstanding avant-garde theatre of the 19th century. It broke finally and irreversibly the domination of the baroque horseshoe-shaped auditorium. The auditorium of the Wagnerian Festspielhaus had no boxes and its task was to focus the audience's attention on the stage (Fig. 1). In contrast to the auditorium of the Baroque theatre, the audience could no longer see each other during the performance. Design of Festspielhaus was a revival of Greek classical auditorium form, seating, and geometry principles applied to a modern theatre building in a way that rationally solves auditorium sightlines and hearing conditions [9, p. 76]. According to Wagner's demands, every seat in the auditorium had to have an unobstructed view of the entire stage, without any obstacles [9, p. 76]. Wagner's striving for improvement of visual, musical and dramatic aspects of 'music drama' resulted in realistic redefinition of vertical and horizontal sightlines. For the first time the proper limits were placed on the side angles of view by eliminating all seating positions outside lateral viewing angles of 30º [9, p. 76] (Fig. 2). Also the orchestra pit was lowered and sunken below the level of the first row of seats. The rational shaping of the auditorium according to the Bayreuth Festspielhaus model was one of the first factors that transformed modern theatre halls.
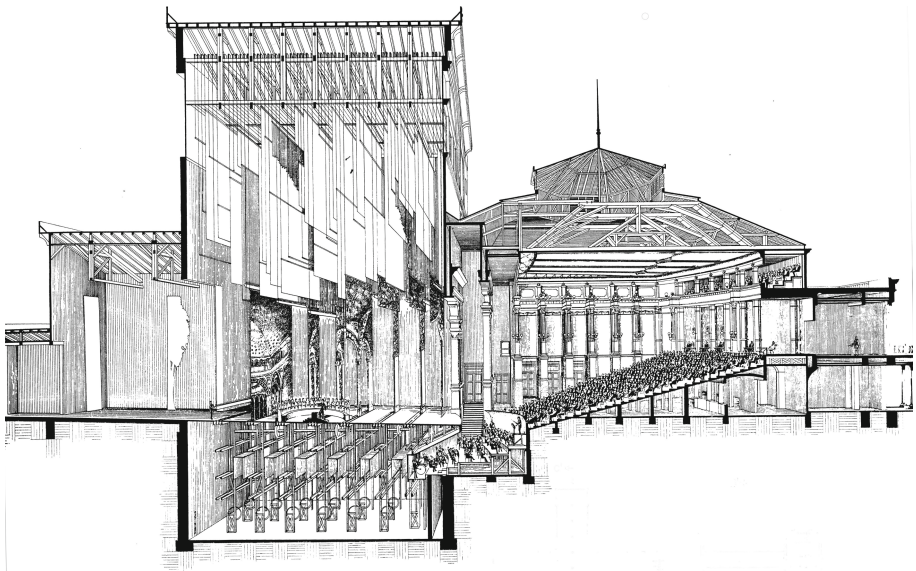
Fig. 1. Bayreuth Festspielhaus, Germany, longitudinal perspective section. Source: *Izenour, G. C.: Theater Design. McGraw-Hill, New York (1977)*

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[4] Festspielhaus in Bayreuth was designed by architect Otto Brückwald and theatre consultant Carl Brandt.
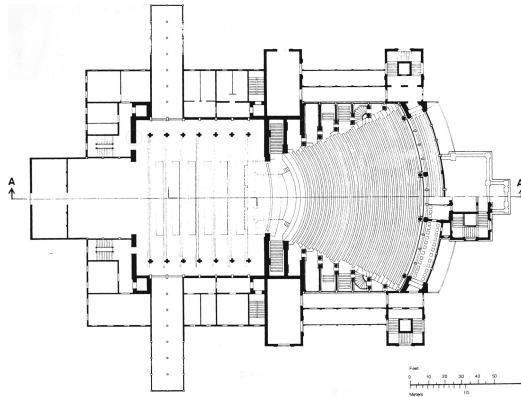
Fig. 2. Bayreuth Festspielhaus, plan. Source: *Izenour, G.C.: Theater Design. McGraw-Hill, New York (1977)*

3   The Great Theatre Reform

Wagner became the precursor of the Great Theatre Reform at the turn of the 19th and 20th centuries. In the late nineteenth century, innovative centres based on the painterly and illusionistic traditions of Italian theatre emerged. Some painters became permanently associated with theatres and were involved in reforming the theatre space[5]. They became the initiators of the 'theatre of staging' - a product of the First Reform - subordinated to the visual arts [10, p. 130]. The idea of returning to religious and culturally syncretic sources was rather taken up by theatres of the Second Reform. The search for synthesis in theatre in that period meant, on the one hand, the use of various means and possibilities of different disciplines in one work, often by a single artist-director, on the other hand a tendency to total impact on all the senses of the largest possible audience [5, p. 28]. Radical changes aiming at merging drama into one whole, subordinated to music, rhythm and stage movement with the use of light, with the involvement of the spectators as participants, were initiated by stage designer and theatre theoretician, Adolphe Appia. Appia tried to clean up the stage by removing unnecessary decorations and introduced three-dimensional scenery. He suggested such sculptural setting to closely link the actor to the stage. He also suggested that the theatrical space should be flexible and capable of transformation through lighting effects [11, p. 14]. Appia conceived settings which were the visual counterpart to Wagner's music and substituted abstract and symbolic forms for painted scenery [11, p. 14]. English director Edward Craig, on the other hand, stated that in the case of theatre, one cannot speak at all of a synthesis of arts, because in its essence theatre is

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[5] They were, for example, French painters such as Pierre Bonnard, Maurice Denis, Henri Toulouse-Lautrec. In Poland, for instance Stanisław Wyspiański and Andrzej Pronaszko [10, p. 127].

already a separate art, which uses many "materials": word, sound, rhythm, line, colour, solid and actor, that is, a collection of various neighbouring arts [12, p. 242].

The idea of a synthesis of the arts was based on the assumption that the arts derive from a single source. Its aim was to strengthen the impact of works of art on their audience and deepening their experience. In the theatre of the early twentieth century, attempts were made to achieve this through the unification of space. This was manifested primarily by the extension of the front stage towards the audience [10, p. 130]. These efforts were intended to strengthen the mutual relationship between spectators and actors. The theatre in Bayreuth had already a proscenium slightly protruding towards the auditorium. The famous building of the Great Reform - Grosses Schauspielhaus in Berlin (1919) - old circus remodeled in the Expressionist style by Hans Poelzig under the supervision of Max Reinhardt, a German stage director, combined a stage and an auditorium in one space (Fig. 3). A huge apron stage, extending to the central part of the hall, was surrounded on three sides by a semi-circular auditorium (Fig. 4). It became the main element of the theatre hall interior, which integrated the whole space. That design was a further development and outgrowth of Wagnerian *Gesamtkunstwerk* leading toward modern total theatre where Reinhardt combined drama, dance, music, and spectacle with the lensed spotlight on the stage [9, p. 90]. A homogenous performance space was created, which united the zones for artists and spectators. The Poelzig's and Reinhardt's project was another manifestation of the influence of the search for a universal language of art on the architecture of performance facilities.

The project called a Total Theatre (1926), designed by Walter Gropius, the architect, and Erwin Piscator, theatre director, was an attempt to solve a theatre hall on the basis of the multi-purpose form. Their unrealized design with a revolving auditorium and stage allowed for different configurations of the interiors in a spherical space composed of ring elements. The stage could be placed centrally, it could also extend strongly towards the audience or form a kind of proscenium stage. Piscator suggested that such a building may be used for diversity of purposes: "*for the presentation of drama, opera, film and dance; for choral and instrumental music, for sports events or assemblies*" [13, p. 12]. The multi-form space was another element that appeared in theatre facilities as a result of the Great Reform, and indirectly as a result of the idea of *Gesamtkunstwerk*.
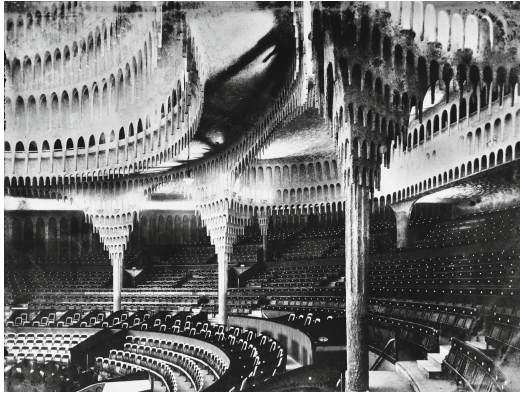
Fig. 3. Grosses Schauspielhaus, Berlin. Interior view. Source: https://commons.wikimedia.org; *Architekturmuseum der Technischen Universität Berlin Inv. Nr. F 1605.*
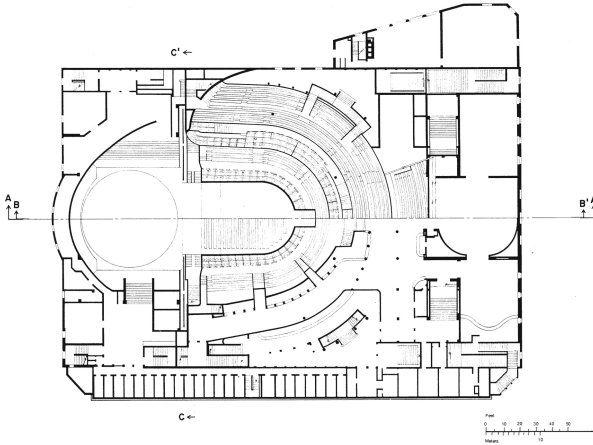
Fig. 4. Grosses Schauspielhaus, Berlin, plan. Source: *Izenour, G.C.: Theater Design. McGraw-Hill, New York (1977)*

4 Unified Theatre Space

A unified and homogeneous theatrical space could not have emerged in modern theatre without the concept of the open stage, which referred to the solutions of the performance area known from the theatres of ancient Greece and the Elizabethan era. The Festspielhaus in Bayreuth had a proscenium stage, appropriate for opera performances, but in the early 20th century theatres without a stage frame began to emerge[6]. The open

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[6] Théâtre du Vieux-Colombier in Paris (designed and rebuilt by L. Jouvet, according to the instructions of director J. Copeau in 1921) was an example of a theatre with an end stage - without a proscenium arch.

stage has been reinvented and brought back to life in Tyrone Guthrie's theatres, in the 1950s and 1960s. The first was realized at Stratford, Ontario in Canada, the second in Minneapolis, in the United States. Whereas Reinhardt at the Grosses Schauspielhaus in Berlin placed the actor in a large, overwhelming space, and Copeau, on the other hand, at the Théâtre du Vieux-Colombier in Paris greatly reduced the space, Guthrie was able to find the right proportions and scale for his theatres. He achieved success also because of his innovative solution of a stage – a platform without a proscenium arch - called the 'thrust stage'[7], and an auditorium modelled on ancient amphitheatres. Guthrie's stages directly inspired the development of open stages in Britain at Chichester (1962) and Sheffield (1972). The British theatre expert, Stephen Joseph, has defined this kind of stage as an 'open stage' form and distinguished it from the 'picture-frame' stage by a single characteristic. He wrote, "…*whereas the stage of the picture-frame theatre is in one* room *and the auditorium in another, these new forms of theatre have stage and auditorium in the same* room" [14, p. 15]. This arrangement of the auditorium and stage, which placed them in one 'room', made it possible to create a common space for artists and spectators. The result of presenting the performance on the proscenium stage was a 'picturization', i.e. the creation of a series of stage pictures behind the stage frame. A different effect was obtained in a theatre hall with an open stage that was surrounded on several sides by the audience. In this case, a three-dimensional perception of the show was achieved and a common and homogeneous space was created. This type of space has undergone many transformations in contemporary theatre. Some theatre halls were created not only devoid of clear divisions between the auditorium and the stage, but also devoid of any decorative elements. A return to the tradition of Shakespearean theatre architecture was also noticeable. This has consequently led to the creation of many different types of theatre halls. Various drama theatres were built in the second half of the 20th century and at the beginning of the 21st century: with a central stage (a theatre in the round), the aforementioned theatres in which the stage was extended so that the audience surrounds it on three sides (thrust stage theatres), theatres with the stage at one end and the audience seated in front facing it (end-stage theatres), and flexible or multi-form theatres (black box or studio theatres, courtyard theatres, etc.).

5   Summary and Conclusions

The question arises: was it possible, after Wagner's attempts, to combine different types of art in one common work? The architectural historian Nikolaus Pevsner stated that the lost spiritual contact between the arts was particularly notable throughout the twentieth-century, in spite of isolated attempts to solve the problem. He stated that soon after the turn of the 19th and 20th centuries, the paths of the various arts had diverged. Pevsner noted that architects and designers "*accepted social responsibilities, that architecture and design consequently became a service, and buildings were designed not only to satisfy the aesthetic wishes of their designers, but also to fulfil their practical purposes fully and enthusiastically. Painters and sculptors moved in exactly*

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[7] The stage was designed by Tanya Moiseiwitsch.

the opposite direction" [15, pp. 200–201]. Since the second half of the twentieth century, the equal functioning of different types of performances and, consequently, different theatrical spaces has become a fact. The diversity of these spaces seems to indicate that a new synthesis related to the theatre is unlikely to emerge. However, this diversity of forms of theatrical space is paradoxically an indirect result of the search for a synthesis of the arts. Probably the first effect of the search for a 'total work of art' was the rational shaping of the auditorium in the late 19th century theatre. Another, was the return to the origins, i.e. to the excellent solutions of antique theatres, both in term of the auditorium layout and the interrelation between the actor and the spectator and also rediscovery of the open stage. The next very important result of that search was the implementation of flexibility in stage and auditorium design in 20th century theatres, and last but not least, the unification of the whole theatrical space, i.e. the placing of the auditorium and the stage in a single room with no barriers separating the audience from the artists. These solutions helped to re-establish a proper mutual relationship between spectators and performers. It seems, therefore, that the influence of the search for a synthesis of the arts on the modern theatrical space was significant, although the effect achieved distinguished many parallel ways of shaping it. Thus, contrary to the expectations of nineteenth-century artists, the modern theatrical space manifested itself in a diversity rather than in a single, chosen and ideal form.

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The Multitude of Adaptive Reuse Solutions in Sustainable Revitalization of Historic Post-military Complexes

Marta M. Rudnicka-Bogusz[(✉)]

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Abstract. The preservation of historic barrack complexes is crucial to the narrative of the cultural landscape in historic garrison towns. However due to ever-changing warfare most of them are obsolete. After decommissioning these complexes pose a liability to the local authorities who try to dispose of them even at the price of putting them up for tender one building at a time. However, the value of military complexes is mostly in the typology: the standardization and the repeatable urban plan of barrack complexes – which at first glance identify a military complex. Partitioning distorts these features, rendering historic barracks useless as historic monuments and the bearers of local tradition. Luckily, barrack complexes can be revitalized in many ways. The article ponders upon some of the solutions and their suitability judged from the point of view of their legibility in the eyes of the viewers.

Keywords: Barrack complexes · Sustainable regeneration · Social participation

1 Introduction

In garrison towns, historic barrack complexes constitute a significant element of the cultural landscape. They form the cultural capital, a carrier for the local tradition, a reminder of the role that the military played in the economic development of the local community. The advancement in military technology and the resulting restructuring of the army rendered numerous barrack complexes redundant. It was difficult for the State Treasury to reinvent such large complexes quickly when the within use adaptation became pointless. Vacant over long periods of time they decapitalized. The only way to preserve them after demilitarization was to sell them to private investors. Difficulties with the disposal of such vast complexes repeatedly led to their partitioning and the sale of their individual parts to various investors. Often the investors made adaptation decisions on their own, disregarding the rest of the complex and obliterating spatial relations between the components of the complex composition. Few of them take into consideration the actual scale and volume of the original buildings, arbitrarily expanding the cubic capacity of buildings they have been entrusted with to a point where the extension is a few times larger than the base. Such actions are particularly harmful with regard to military architecture, which is rarely characterized by the

outstanding aesthetic craftsmanship of individual buildings. Its value is the standard-ization and the repeatable urban plan of barrack complexes – which at first glance identify a military complex.

This is the case of the artillery barracks at Dmowskiego street in Wrocław which origins date back to the XVII century. The compound that accumulated its components over centuries to form a unique polygonal *manege* in the middle was partitioned and sold to various competing entrepreneurial entities. Each of them attained its own zoning plan according to which it formulated its land development plan – as a detached entity. At the border of such two plans a corner single story storage and maintenance building adhered to a newly-build nine-story apartment building featuring no historic components. The owner of the historic storage argued that the property was over-whelmed by its younger neighbor and negotiated an extension to the building with the Province Monument Conservation Office. The historic building is going to be pre-served and renovated and above it the investor plans to place four new stories sup-ported by communication shafts. Another developer regenerated a different stable and maintenance building in the complex by extending it by seven residential floors (Fig. 1).

Fig. 1. Visualization of the planned outbuilding expansion in the artillery barracks in Wrocław (©press materials ATC Development).

All these developments have been advanced to produce as many apartments as possible. After analyzing the fates of decommissioned military complexes it seems they are mainly used as brownfields for housing development. However the analysis of mix-use developments of post-military property leads to the conclusion, that these, even more so if carried out in cooperation with grassroots organizations, can be the most successful in keeping the *genius loci* of a place. Especially as commercial development

is the best suited to keeping up the original stylistics. This, of course, is largely dependent also on the size of the plot.

Fig. 2. The expansion of a stable in the artillery barracks in Wrocław (phot. aut.).

2 Case Studies: Six Categories of Revitalization Carried Out in Historical Military Compounds

In 2007, the rolling stock buildings in the barracks of the 15th Poznań Uhlans Regiment were adapted and refurbished for a mix-use development called City Park occupying 3,76 ha of post military plot. In the process historic two-story buildings from 1905 (the barracks, garages and warehouses) have been restored and converted into a hotel, services and commercial buildings and the inner *manege* and muster yard were built over. In the new building, apart from the apartments, there is a rooftop swimming pool with a wellness area. The new, five-story apartment building, architecturally refers the historical part of the complex thanks to the use of red brick, glass and steel [1]. The regeneration is pleasing to the eye, user-friendly, economically viable to the investor and certainly revives the area, fulfilling most the goals set for a successful revitalization. Yet, however glossy it wouldn't be it still doesn't satisfy one important criteria. It severs the spatial relations between the buildings in the complex destroying its original ambiance and scholastic value.

Wrzeszcz Barrack District in Gdańsk presents yet another approach to the subject. The original complex of Hussar Barracks (1903) occupied ca. 22 ha of land with the array of buildings comprising of headquarters, officer's and foot soldiers' dormitories, mess halls etc. placed around the border of the plot adjacent to main streets – and outbuildings placed behind them around the manages and muster yards. Since 2004 the post military complex has been adapted to mix-use development comprising of schools, shops and services occupying the former cavalry barracks, and complemented with a newly built residential district. The complex was redeveloped in three ways. In the east of the plot, the original array was preserved. Four renovated ex-dormitories encompassing an imposing muster yard were turned into office buildings. Nine regenerated historic buildings standing along the southern perimeter of the plot form the so called 'Culture Garrison'. A historic riding school was adapted for a brewery and a pub with a concert area. A former dormitory was turned into café-bookshop and an old mess hall was refurbished for two restaurants, a cooking and a dance school. Other historic dormitories were designated to house dormitories for students of a nearby campus, cohabitation initiatives and residential cooperatives [2]. A pre-informed visitor with enough knowledge could still find traces of the original ambience. However, much of the original typological features were lost with the razing of the outbuildings (stables and riding halls) and the development of the new-build that took up the space of *maneges* and drill grounds (Fig. 3).

Fig. 3. Wrzeszcz Barrack District merges the regenerated barracks with the new buildings which replaced the razed outbuildings (phot. aut.).

In the revitalization carried out in 2014 under the name *Koszary Park* in Olsztyn, new functions have been incorporated into the buildings in such a way as to preserve the legibility of the historical urban development and architectural form as much as possible. The Artillery Barracks (built 1887) consisted of two stables, a *manege* and a riding hall in the central building with a tower [3] taking up a plot of 0,75 ha. In the revitalization process, a conference room (on the ground floor) and a business incubator (on the first floor) were placed in the smaller stable. The larger stable was turned into a residential building and the riding school into a health and spa services area. The exteriors have been regenerated and the muster yards were left unbuilt thus maintaining the spatial relations and the *genius loci* along with them and the urban layout stayed unchanged bolstering the educational value of the regenerated complex. None of the historical buildings were demolished or altered. The only alterations were made to the interiors to adjust them to new functions.

Similarly, in the process of adaptation for a hotel, a post-military building in Góra Kalwaria dating back to 1863 has barely been changed apart from regeneration of the elevations and refurbishment of the interiors. The plot of 0,36 ha was not densified with any additional buildings allowing for unobscured view to the barrack building.

As shown above the smaller the scale the easier it is to keep the spatial relations and historic architectural design legible, especially if the new use for the complex is rather commercial than residential. At the same time we should consider the incentive behind the regeneration. While the abovementioned examples demonstrate various degrees of cultural and economic sustainability, the case of *Vauban Barracks* in Freiburg and *Bastide Niel* in Bordeaux exhibit a regeneration striving towards ecological and social sustainability respectively. They both started as a showcase of urban decay. *Niel* Barracks started operating in 1874. They were decommissioned in 2005 and when their decay started attracting squatters, skateboarders and graffiti taggers, the dishevelled property was designated for demolition. The significance of the site to the local cultural landscape prompted a grassroots organization in 2008 to purchase 1 ha out of 35 ha precinct of real estate with the intention of preserving this obscure landmark. By implementing sustainable business incubator strategy it turned this site from notorious to trendy [4]. Seeing the social significance of the site the state followed suit designating the whole area for regeneration. The district is set to become not only economically but also ecologically sustainable. All heating and electricity will come from renewable sources: geothermal and solar. The complex became a sort of farmers market catering to the needs of a local community with ecological products displayed on a fair and artistic events taking place periodically. The businesses form small boutiques that can be rented out short term and the buildings for the most part have been preserved in their unchanged state. The place has an unkempt feel and a raw potential in it, bearing witness to the collective history of the barracks from inception not only until decommission, but up until this day. Close collaboration of the local community and local government makes this regeneration sustainable both culturally, socially and eco-friendly [5].

In Freiburg the decommissioned 1930s barracks were recognized as an opportunity to create affordable living space in the city centre. When the City Council bought the property in 1994 from the Federal Government with the intention of developing a residential area squatters have already inhibited the vacated buildings. While initially

the municipality planned to demolish all buildings, after consulting social activists and student organizations six buildings were preserved for student housing. Some additional four barracks were converted into low-cost housing by a non-profit housing initiative. Two other buildings were turned into a district community center and a business incubator. To assure affordable maintenance the buildings were retrofitted with solar panels and thermally insulated. The neighborhood is bicycle friendly and has a tram connection; therefore the inner streets are for pedestrians only and engulfed in backyards cultivated for organic crops [6]. On the other hand, the urban plan of the barracks was irreversibly altered. Only 12 out of 28 army barracks were retained and most of them were restructured. The preservation efforts came from grassroots organizations and social activists with the aim of providing affordable housing in the downtown area (Fig. 4).

Fig. 4. *Bastide Niel* on a weekday: stalls, boutiques and cafes frequented by people (phot. aut.).

3   The Perception of Regenerated Post-military Complexes

Studying and documenting cases of post military complex regeneration the author distinguished six categories of revitalization carried out in historical military compounds: non-interference, revalorization, revalorization with expansion, revalorization with redevelopment, expansion and redevelopment. But at the centre of every regeneration there are the users, viewers, the local community. From them come the reasons

for the preservation of historic architecture: historical, artistic, scientific and intangible (such as emotional value; historical tradition value etc.). Monuments are a material trace of the past, they are the embodiment and evidence of some important idea, and they build our identity. They play an important role in shaping a friendly human environment by placing a man in a historical and cultural context that gives him a sense of belonging. This prompted the author to conduct a survey on the social reception of regenerated post military complexes. This survey showed that the respondents recognized the barracks by: the separation from the civic surrounding, a grid plan, quarters developed along the outer rim with repetitive buildings and a large maneuvering square in the middle, and a clear hierarchy of functional, modular buildings with ascetic decoration. These are the determinants of the cultural capital of these complexes and their preservation should be an absolute priority of any revalorization which, at the same time, cannot petrify it. The partitioning and lack of a coherent revitalizing policy lead to the dissolution of spatial relations between objects in the complexes, which in turn impairs the identification as military architecture. In the case of the far-reaching interventions as many as half of the respondents could not recognize the barrack complex after revalorization, which means the complexes have lost their ability to communicate the historiographic information imbedded in them, that was the reason for their preservation in the first place. However if the regeneration is not economically attractive enough the investor will not undertake it, the complex will deteriorate and the didactic value will be lost altogether.

Therefore, it is necessary to develop a modus operandi with the post-military heritage that would allow for the extension of its existence while fully preserving its spatial and dimensional features, but allowing for its adaptation. According to the survey mentioned above, this would be the way of adaptation most appreciated by the respondents. The respondents concluded that historic objects usually have aesthetic values and historiographic features that are easily comprehended by mass perception and reach non-specialized recipients, but the revitalization also benefits the society and the housing market. Moreover the respondents proposed that for a building to be a testimony to the architecture of a given period, the most important thing is its exterior. If the space is to be used well, the interior should be free for adaptation. These findings concur the way most investors approach the subject of barracks revalorization. Revitalization efforts are instigated not only by government agents and private investors, but also by grassroots organizations. The extent of interventions can be correlated with the agent involved leading to the conclusion, that the bottom up initiatives are the least extensive. However, the respondents asked to choose the most appropriate revalorization of the barrack complexes, overwhelmingly chose the most invasive example, distorting both the dimensions and style of the adapted buildings and spatial relations in the complex (vide Fig. 2) - perhaps tempted by the novelty. An extended survey however did not confirm these results with respondents clarifying that the main appeal of the extension was its freshness and pristineness.

4   Conclusion

Each element of urbanized space has its own history, which reveals in the existing layers, determining the possible scope of future transformations. Reading the identity of a place requires paying special attention not only to the existing traces of a historic narrative, but also the evolution of urban space in the present. With historic post-military complexes there are many ways of revitalization and revalorization. Their scope of transformation differs from non-intervention to complete redevelopment. It results from the planned new use, as some functions seem to require more aggressive transformations (housing) than other (services). Also the agent instigating the revalorization has a significant impact on the scope of the intervention, as grassroots initiative tend to be less invasive. There is a great role played by the local authorities, as the power to influence and control the change management through zoning plans and social consultation lies with them. These can be either change-oriented, resulting in extensive redevelopment or moderate – aiming to preserve as much of the original architecture and spatial relations as possible without petrification. Nonetheless it should always be stressed the user should be placed at the centre of every revitalization. According to the survey conducted by the author respondents expect the historic military complexes to be preserved rather then razed, with defining features (material, texture and tectonics) and spatial relations highlighted and preserved while new functions introduced in the interiors. This proves the need for a widespread consultation program for promoting both the awareness and the participation in the post-military complexes' revitalization process and for the ongoing revalorizations to address the actual needs of the society. The research project no. 2018/31/D/HS2/03383 was financed by the National Science Centre, Poland.

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Meaning of Senses in the Perception and Shaping of Architecture

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Abstract. Analyses of model facilities and interpretative records provide the guidelines for the research methods on design process via the assessment of form, function and architectural context. The assessment is a useful source of information on the quality of usable space perception. Verification of the nature and quality of an architectural form via an interpretative image opens up new perspectives of its analysis. This paper presents the perception and visual thinking via the parameter guidelines to arrive at the right means of space creation. Sensory perception and the sensory assessment method can facilitate the way we define architecture and play a significant role in the scientific discourse, which shows the importance of multidisciplinary cooperation of designers and academics. Only then can the potential of interrelations going beyond standard solutions be harnessed to our advantage. The research is based on the selected scientific publications, author's own experience and the case study.

Keywords: Interpretation · Sensory perception of architecture · Sense of identification

1 Introduction

A painting, being a visual record, is one of the most important forms of communication, conveying to the audience the author's values, ideas and emotions. Typically viewed as a product of artistic activity, it incorporates the individual expression of the author and traditional communications. It, moreover, lays the foundations for the research method initiated by Erwin Panofsky[1], an art historian and essayist, who found interpretative meaning of the contents coded in the strata of the works of art - paintings. Following his idea of interpretative iconology, one separates the prevailing theme of a work of art from the artistic composition of the whole painting. Historically, this method was used to gain information about the political, social, ideological and artistic

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[1] Erwin Panofsky (1892–1968), an art historian working in the 20th century, viewed as a co-creator of the iconology concept; developed the epistemological principle which has elevated art to the rank of objective knowledge on the condition that the iconological method is used. Its theoretical foundations were worked up in 1932 for the first time. E. Panofsky presented a three level model of art-historical understanding, which when modified has eventually made a long-term impact.

situation of a given epoch or region. The approach to a painting as to an independent being has been evolving for more than 30,000 years. As of the beginning of the 20th century art has been adopting a form of a laboratory, where the application of various forms of expressions binding distant disciplines with one common denominator has been possible. The status of a painting has dramatically changed from easel painting to abstract activities in public space. We must not forget the manifesto of Joseph Beuys[2] of the 1970s, in which he stated that "Everybody can be an artist and everything the artist creates" is a work of art. The digital revolution has also revolutionised the way a painting is perceived because it has enabled us to use new tools of artistic creation. As a result we are able to create images that reach us from all possible media types. In order to be able to perceive such images properly we need to develop adequate skills, where the graphically-oriented usability is deemed a top priority.

In design processes, where assessment of the designed visual communication is of key importance, nature and quality of the message imply successful reception of the transmitted information. Illustrations, typography, infographics, photography, film or cartoons lay the foundations for our daily visual communication. Other components of the group, i.e. press, books, posters, television, the Internet, multimedia presentations etc. are to a lesser extent based on artistic or aesthetic pre-requisites, as they largely stress that the message should successfully reach its target. Colour, compositional layout, legibility of ideas are all subordinated to the formation of the right image of the contents sold. The omnipresent advertisements and commercials designed to optimise the processes of marketing and sales can be also identified in the media that present the architect's visions expressed in the pictorial form, where - apart from marketing efficiency - another important issue arises, namely the design efficiency. This type of non-verbal communication allows for the mutual use of technological innovations and research results in multidisciplinary fields that in overall form a unique data cloud.

The research studies in the area of the quality of architectural space in the broad meaning thereof could focus more on the interrelations between sensuality and visuality of the image of architecture, as these are the active factors defining the nature of a given usable space. The image of space is perceived and verified through the processes of perception and depends on the understanding of the design, nature and quality of the pictorial representation thereof which integrates the data evoking various degrees of emotions and carrying substantive meaning[3].

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[2] Joseph Beuys (1921–1986), a German artist, art theorist, educator, activist, social and political reformer. He created sculptures and drawings, only to incorporate in them the later coined concept of supremacy of thought over an object (the 1940s and 1950s). In his works he used quickly perishable materials: oil, honey, felt, objects of daily use; he developed the theory of sculpture, structured as the transition from chaos to order and the theory of social sculpture. He was of the opinion that man shapes his environment by participating in historical events and being his life's artist. Sculpture was meant to have a therapeutic effect.

[3] The issue of design efficiency was presented in detail in the article *Świadomość i intuicja w procesie projektowym [Awareness and intuition in the design process],* published in Architektura wobec wyzwań zrównoważonego rozwoju [Architecture in view of sustainable development], Człowiek - Ekologia – Architektura, Volume 2, p. 179–189;

Collective work, edited by Anna Januchta-Szostak and Marzena Banach, The Faculty of Architecture, Poznan University of Technology, Poznań 2016, ISBN 978–83-7775–438-2.

2   Factors Underlying the Perception Processes

In accordance with "Słownik języka polskiego" [Lexicon of the Polish Language] [1], perception is a conscious reaction of sense organs to an external stimulus; impression". In accordance with M. Merleau-Ponty: "perception is always a collection cognitive processes initiated to ensure that man is contact with reality; it is an active interpretation of sensory data, which uses contextual clues and prior acquired knowledge" [own translation] [2]. Thus, supporting one's judgement with design experience, in full awareness of the needs of a future user and having carried out an in-depth analysis and verification of usable space, it seems fully justified to state that a painting can be one of the basic diagnostic factors. A painting is more than just a collection of various data or a plane for analytical observations, it is also an accumulation of impressions resulting from observations of reality and logical operations that underlie the creation of these impressions. "*It facilitates the reality perception […], at the same time creates the perception of space, thus it is used, literally, to make [objects] visible and to improve what the vision has arrived at* [own translation]" [3]. In many situations visual thinking largely based on modern visualisation systems VR proves more effective than the thinking of computer scientists based on algorithms [4].

In cognitive psychology vision plays a significant role in recording the images and makes the representations of the observed space meaningful. The process of visual perception, an analogous image of the external surroundings, is created in the human brain in response to the exteroceptive stimuli. As the information processed by neurons, these stimuli will induce the vision of an object, a phenomenon or a situation. However, sight is not a sole human sense. Its effective work is conditioned with the collaboration with the other senses. The symbiotic cooperation of the tactile sense, auditory sense and the neuroceptive experience of the world will initiate in the human nervous system the process of the external data downloading and processing. The autonomously working nervous system works as a detector of the surrounding world, which then identifies the findings and assesses the safety level of a person or a situation. If a person or space is not identified, the visual impression gets supplemented with the assessment of the context. At the neuroceptive level, the brain as a rule activates a number of neural processes that warn the man about a hypothetical danger or prepare him for what might follow to finally make him take the 'fight or flight' decision.

Should this process be transposed onto cognitive layers pertaining to the cognition of the architectural environment, we could arrive at the so-called preliminary identification data of how we perceive architecture at the sensual level [5]. We assume that the design visualisations and the already erected buildings can - for individual viewers- each time represent *the new*, i.e. the unknown space-phenomenon. The use of the neuroceptive identification in the process of perception of VR images or images of completed buildings can optimise the way we conduct comparative studies of given architectural forms in the context of their quality and perception.

However, how can we rely on the information that is a collection of subjective data? What are the factors underlying the basic differences in perception? The fact that

different individuals will largely differently perceive the world, in this architecture, is conditioned on a set of factors involved in the process of external perception, namely:

1. the surrounding context combined with external aura (rain, sun), seasons and day hour;
2. sex and age of the viewer/user;
3. emotional state of the viewer/user
4. affiliation to a given social group;
5. prevailing trends and popular directions dictating the way we live.

The body seems to feel (our neuroception) largely differently from what the head thinks. The perception mechanism would be simpler if it were correlated with the attention concentration and efficiency of human senses only. Such an assumption would support the statement that the information received by different people objectively represents the object seen and that similar level of attention concentration and efficiency of senses will translate into one and the same situation being perceived identically. In her research, Magdalena Ratalewska[4] [6] contradicts the foregoing statement, confirming that every individual will differently interpret, describe and memorise the situation/phenomenon observed. She, further, underlies the importance of the potential of evoking emotions and forming expectations that always accompany the processes of perception. The identified differences in the assessment made by various individuals do not preclude, however, the purposefulness of the proposed method.

3   Space, Image and Emotions or in Other Words the Imaged Architecture

The often used term the 'imaged architecture' is in other words a frame of reality, a selected section of a given fragment, typically embodied in the form of a photographic record, a sketch, a drawing, digital elaboration, visual communication, which represents a set of subjectively selected data. In the process of interpretation, it directs the attention of the viewer to the correlations and details inherent in respective spaces being their partial interpretative images. It, furthermore, defines the nature of a given facility, a complex of facilities via their formal structure triggering a given emotional response. Inspired with architectural space, the imaged architecture is assessed as an eloquent, moderate, balanced and optimistic expression thereof or as an expression otherwise narrowing down the interpretative range of the actual architectural facility, directing the viewer to the right cognitive and analytical track. A collection of interpretative images, or in other words a cycle of interpretative images, is composed of the data set that in the process of analysis may represent a source of objective information on the researched space. The assessment of the composition, means of expression, colour scheme, gesture of model interpretative images constitutes a specific medium

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[4] M. Ratalewska in her work *Spostrzeganie społeczne i jego znaczenie w procesie komunikacji międzyludzkiej* [2013] discusses the significance of the understanding of one's own perceptual processes in the context of establishing constructive relations with other people.

separating the main ideas of design intent. The fine language of expression opens up a wide interpretative range of architectural perception and, thus, predetermines its assessment. Subjected to a sensual interpretation, a selected object implies the transfer of its characteristic features into the nature of the artistic expression. An inclusive approach of art history towards other research disciplines to allow for a deeper reflection on theory of painting was postulated by Gottfried Boehm [7] in the article 'Pictorial/iconic turn'. He stressed that focusing on the image of architecture in the search for the interdependencies between a discipline of art and new coined definitions of architecture was fully grounded because it translated into better understanding and improvement of the living comfort of its users. The said iconic turn did happen at the turn of the 19th and 20th century.

Viewing a picture as a zone of a semantic recording of objective reality and adhering to the interpretative activity in the course of the processes of perception, it can be stated that empirical experience of architecture leads to a more precise analysis of the nature of the architectural space presented.

As an example of architectural facilities subjected to the interpretative analysis, we can refer to the penitentiary facility in Rawicz. The prison complex located in the centre of the town inhabited by 20 thousand people is an island of social isolation, visually exposed by an enclosing wall, in sharp contrast with beautiful green areas and open space of arable land spreading just behind the wall to be enjoyed by all those that are free. The contrast between the busy city life and the autonomous life of the prisoners in the detention centre longing for the life outside the wall is presented in the paintings entitled *Unopened* and *A Residential Unit*. Strong orange with fragments of rusted steel bars are intended to express the pain and scream of individual prisoners muffled with restrictions, deeply hidden to mitigate the penalty imposed. Architecture backs up emotions. If it is ruthless and equally rationed as bread and a uniform in the army, it does not stimulate any positive feelings. It then imposes rigid discipline. It is not "tailored to the individual needs". It only offers shelter for those either inside or outside of the prison. It is a facility with the doors closed to the daily world of routine hassle, spontaneous joy and love. Behind these doors and bars certain emotions remain hidden, which the impasto technique is to represent. Rust is meant to symbolise the personal burnout, emotional baggage and broken conscience. Toxic space in its painted expression also shows the design efficiency of the facility. The very nature of space dedicated to prisoners was prior intended to remind them of their guilt and to reinforce their feeling of subordination (Figs. 1 and 2).

Fig. 1. K. Słuchocka, Unopened, acrylic, steel, 130 cm × 50 cm

Fig. 2. K. Słuchocka, A Residential Unit, acrylic, steel, 130 cm × 40 cm

Perception of paintings and space underlies the definition of another type of space, namely identical space, which can viewed as the business card of the user, an external representation of his/her preferences as this space can be freely arranged by the user.

The metaphoric language of paintings voiced by a cycle of works entitled *Logical space* shows individual preferences as to a modern, simple and pure form. Like steel surgical tools, the paintings enforce certain top imposed order into the interior design they are part of. They refer to the privacy zone of a user, where he/she is free to express their own personality without trespassing the limits of someone else's freedom. Direct reception of space creates a certain emotional relation with the viewer, the quality of expression is preconditioned with the emotional state of the author and his/her attitude towards the architectural context. "Architecture has its own realm. It has a special physical relationship with life, it is an envelope and background for life which goes in and around it, a sensitive container of the rhythm of footsteps on the floor, for concentration of work and for silence of sleep" [9] (Figs. 3, 4, 5 and 6).

Fig. 3. K. Słuchocka, BiElles, acrylic, steel, MDF, 157 cm × 55 cm
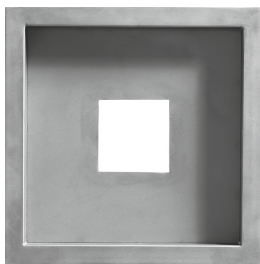
Fig. 4. K. Słuchocka Logical space 1, steel, 25 cm × 25 cm
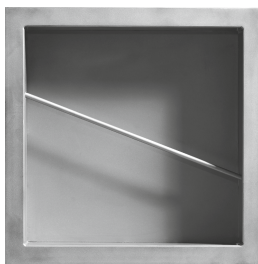
Fig. 5. K. Słuchocka, Logical space 2, steel, 25 cm × 25 cm
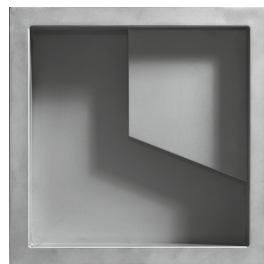
Fig. 6. K. Słuchocka, Logical space 3, steel, 25 cm × 25 cm

Whereas, the sensory and emotional perception of the Sydney Opera House building, erected in the modern expressionism style, will stand in contrast with the foregoing. Built in the years from 1959 to 1973, owing to its light structure and timeless shape of the form, it continues to be the object of admiration of the users. Compilation of steel, concrete and glass, like music and a woman, intertwine, inviting the audience inside the composition of vitality, symbiosis and glamour.

The painting entitled *BiElles* spins the story of transparent (user-friendly) spaces expressed through the combination of strongly expressive steel and lightness of whiteness of light. It also symbolises strong structural foundations underlying an ephemeral material creation of Jorn Utzon.

This architecture is intended to accommodate various users' tastes, their intended functions and different aspirations. The paths of the working staff and the visitors cross smoothly. The pictorial presentation of the building seems to be pleasing for the majority. It is an iconic design that also fosters the feeling of identity with the place.

4   Summary - Conclusions

The ideological structure of a painting is based on the correlations between space, its impact and the response triggered. Not every painting contains a full range of symbols, yet the ability to understand the sense of the interpretative image may result in an added value. Active participation in the activities of professional societies of artists and architects, reinforced with analytical relativism resulting from prior comparative research and studies will affect a widened range and options of perception of architecture. It offers new methods of perception of the factual context and can make us feel more familiar with the architectural facilities, which have been never encountered before. Design processes, supported with precision technologies and meticulously made calculations, can, in their final stage, appeal to the client - who most often is a capricious ordering party, prone to changing their decisions, and on top of that - a party that tends to pursue his/her unique and individual tastes. Owing to digital data, supported with visual thinking based on the image and the neuroceptive system of identification, we will in effect be able to work up a set of relevant design guidelines that stand a chance of meeting the expectations of the most demanding clients. The following quotation may confirm that what Juhani Pallasmaa said about direct contact with architecture is true: "Images of architecture contain an inherent suggestion of activities, a moment of an interactive meeting or "a promise of function and purpose [9]. Attempts to find a common denominator to efficiently combine the assets of an autonomous nervous system and subjective perception of the world will optimise the process of designing architecture resulting in improved living comfort of the users. This shall be understood as the resulting architecture will not only meet the physical human needs but also the Vitruvian Triad (rules of harmony).

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Interior Design and Decorations of a House No 83 in Kemer in Turkey

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Abstract. The article discusses the characteristics of functional solutions end wooden decorations of the house no. 83 in the village Kemer Mahallesi in Turkey. This is an original house with very interesting wooden construction, details, ornaments and interior furnishings. The article contains and inventory result, photos, schematic drawings of functional layout and architectural details. No analysis of the technical condition and structural layout is presented.

Keywords: Private space · Turkish house · Wooden ornaments · Interiors · Introversion architecture · Quality of life · Human factors

1 Introduction

House number 83 is located in the central part of Kemer village and is one of the most interesting buildings there. This is a residential building for a large family, has several separate bedrooms conected by gallery space and internal stairs. In the past it was connected to a servants building. It is important to make available to other researchers the inventory documentation of the house no 83, because it was found that all elements are still preserved almost in their original state. Very interesting are the construction of the walls, details of ceilings and the external gallery located on the first floor of the house, both for structural as well as decorative and architectural reasons (Figs. 1 and 2).

Fig. 1. Location of the village Kemer in mountain area. [1]. Plan of the village Kemer, location of the house no 83. Drawings: Alicja Maciejko [1].

Fig. 2. Entrance gate, from outside and from inside. The materials used are wall made of stone and wood, Photos: Alicja Maciejko, 2020, [3].

2   Research Problems

The authors of this article are not aware of any documents regarding house no. 83 and do not have technical and architectural documentation. This article is based only for individual measurement and photographs made in 2019 and 2020 by architect Alicja Maciejko. This is two story house separated from the street by internal courtyard, made of stone and wood (Figs. 3, 4 and 5).

Fig. 3. Construction of walls, view from the courtyard. Photos: Alicja Maciejko, 2020, [3].

Fig. 4. Entrance wall of the house from the courtyard. Photos: Alicja Maciejko, 2020, [3].

Fig. 5. The open gallery of the first floor from outside and inside. Photos: Alicja Maciejko, Interiors (2020) [2].

There are several objects of particular historical and cultural value in the village of Kemer. These are mainly residential buildings and commercial buildings, because in the past it was a settlement with a commercial character. The countryside is depopulated and many of these facilities are closed. When designing the design and drawing up the design documentation, it was stated that a detailed inventory of the building should be made to assess the technical condition of the house No. 83.

Depopulation and the disappearance of commercial functions is the most visible problem. As a result, buildings are neglected and their technical condition deteriorates very quickly. A necessary postulate is that the cultural landscape should be protected by conservation.

Most houses in Kemer are designed on a closed plan, with an internal courtyard. These courtyards have representative functions and are a place of work. Unfortunately, they are also neglected (Fig. 6).
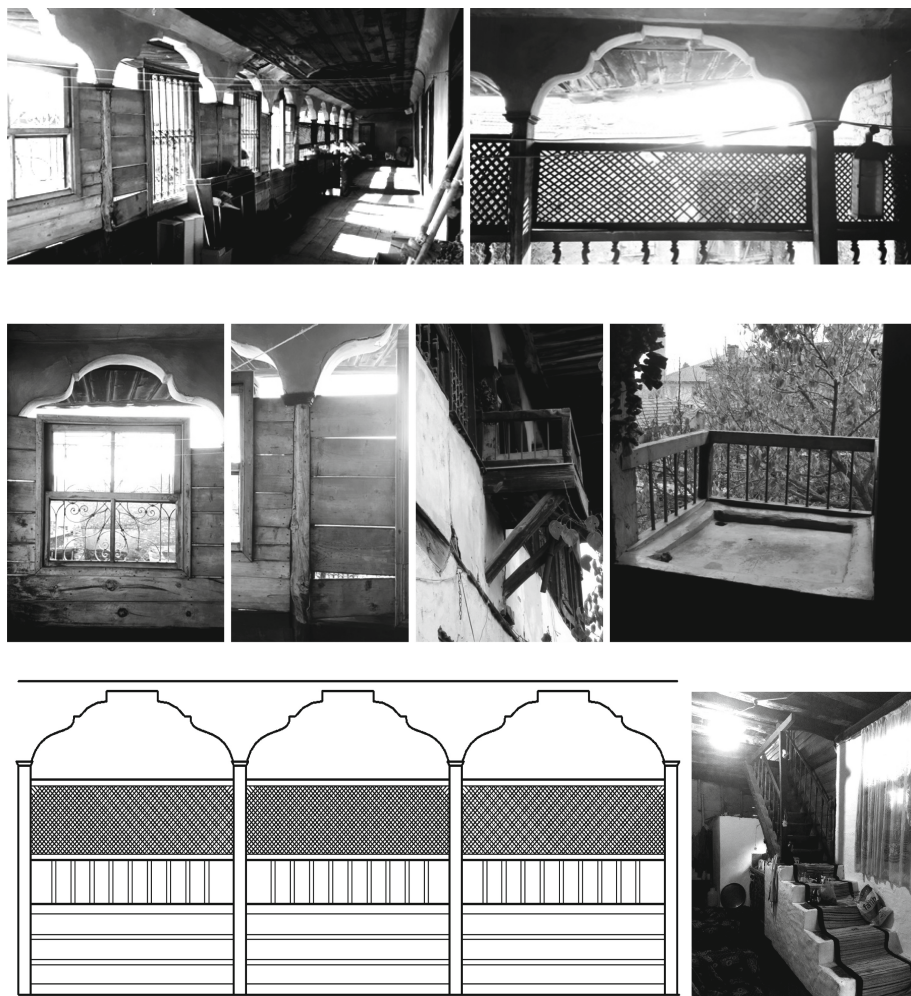
Fig. 6. Details of gallery and stairs. Photos: Alicja Maciejko, Interiors (2020) [2].

Living rooms are located on the first floor, utility rooms and kitchen facilities on the ground floor. The stairs are partly made of stone and plastered, and partly made of wooden structure. They lead to a covered gallery that stretches the entire length of the house. It is an external corridor and only from here is access to four living rooms. They are not connected to each other. Interestingly, the gallery is not insulated, it does not protect against the cold in winter, decorative panels and windows protect against the sun in summer. The rooms are heated by fireplaces. Each room has its own fireplace and washing area. The gallery is open to the inner courtyard. Very interesting is the wooden structure of the gallery with shading elements finished with plastered arches in

the Islamic style. The structures of ceilings and walls are mostly made of wood. The walls are plastered and painted in white and cobalt colors. The wooden entrance door has been painted green, the remaining wooden windows and doors are left in natural wood and varnished (Figs. 7, 8 and 9).
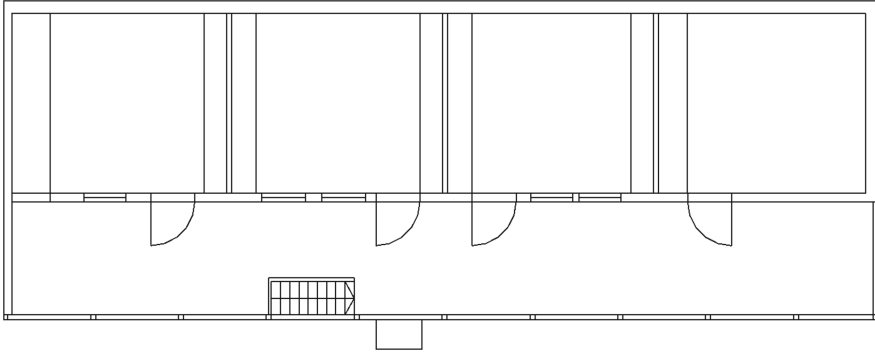
Fig. 7. The plan of the first floor. Drawing: Alicja Maciejko [1].
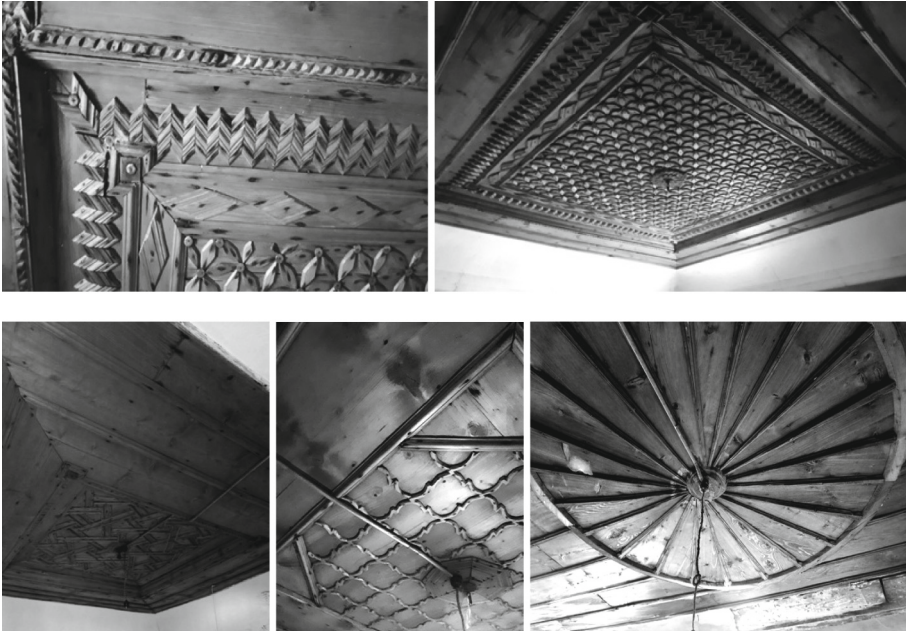
Fig. 8. Wooden ornaments of the ceilings. Photos: Alicja Maciejko, Interiors (2020) [2].

Fig. 9. Decorative walls and fireplaces. Interiors (2020). Photos: Alicja Maciejko [2].

3   Interiors

The functionality of the interior is based on the idea of integrating the furnishings with the architectural form. All the elements of furnishings such as shelves, mirrors, cabinets, lockers, ceilings decorated with wooden ornaments, blend in with the walls and are part of them. Beautiful traditional Turkish fabrics, embroidered by hand, are also a decorative element. In the case of house no. 83 the fabric elements are original. Doors and windows made of wood lead to the rooms from the outside gallery and are also decorative elements of the walls. The main idea of this design is roofed gallery at the first floor which is long corridor. There is many decorative elements there such as ornamental arch, wooden columns, perforated wood panels, walls and circle-shaped ornament in the center of the ceiling. The equipment of the rooms is almost the same. They have a square plan. On the wall from the side of the courtyard (entrance from gallery) in the second floor there are doors and windows and on the opposite side there

is a fireplaces and windows. At the middle of a curved selling there are square wooden decorations, different in every rooms. All rooms have long closets along the entire length of one of the walls. They are built-in to a depth of about 60–80 cm. They have wooden shelves and are covered with fabrics (Figs. 10 and 11).

Fig. 10. Wooden doors and windows. Interiors (2020). Photos: Alicja Maciejko [2].

Fig. 11. Structural beams and floor decking, ceiling, underside view. Interiors (2019). Photos: Alicja Maciejko [2]

4   Summary

The inventory indicated the following problems that should be solved. Revitalization of areas, designing, supplementing buildings, reconstruction and modernization should always take into account local problems, civilization changes, changes in the way and quality of life of inhabitants. Hence, it is impossible to close the house and turn it into a museum or open-air museum. For this, State interference would be necessary. However, in justified cases, it is necessary to assist the residents in showing the value of the

historical buildings, which they use. Especially if there are examples of such beautiful stylistically characteristic architectural details of the bygone culture and cannot be demolished or renovated by unprofessional ways.

Technical degradation is visible, wooden structures of windows and walls are replaced with plastic ones or closed with solid walls in an uncontrolled process, it should be stopped. Normal living in this area is uncomfortable, especially due to the low insulation of buildings. The village of Kemer could become a conservation, landscape and architectural protection zone as Turkey's cultural heritage. However, there is probably no greater chance of saving lives in this historical place as it was before, as it involves a global change in living conditions.

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Cohabitation in a Time of Emergency: 'During' Versus 'After' the Confinement

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Abstract. During the first confinement, imposed as a response to the health emergency, we lived on our albeit minimal balconies looking for sunlight, and we explored our buildings in search of community terraces or underused practicable roofs that gave us fresh air as well as a minimum of socialisation. Then, we wondered whether in the 'after', those spaces would have another (new) value. By extending the reflection to urban public spaces, we note that several cities belonging to 'developed countries' awake from the first confinement with the manifested intention of taking care of their inhabitants. Guided by the definitions of phases of collective human response to a major crisis, given by psychologists, we will analyse some expectations and actions until now implemented in cities. This paper is an invitation to broaden the collective imagination of urban public space, to continue to design it by using emergency periods as a testing ground.

Keywords: Urban cohabitation · Open public space · Taking action

1 Introduction: Waves

Experts warn us that, due to the pandemic health emergency, as individuals and as a community, we are subject to psychological shock. Crises (major disasters or pandemics) arouse collective emotions and people tend to go through certain stages together. To investigate the behaviours that we collectively live and to provide post-disaster mental health services to societies and organizations affected by a major crisis, psychologists state that both community and individual responses to a disaster tend to progress according to phases, represented graphically by curves (periods of high and low spirits) [1].

With the focus on how 'survivors' and the overall community respond to disaster and with a macro view of interacting factors that shape the collective response variation – human causation, probability of recurrence, among others – clinical psychologist Deborah DeWolfe describes a sequence consisting of: Warning or Threat Phase; Impact Phase; Rescue or Heroic Phase; Remedy or Honeymoon Phase; Inventory Phase; Disillusionment Phase, and Reconstruction or Recovery Phase [1].

In DeWolfe's Manual, highly referenced during this pandemic we grapple with, we find the idea of a wave (or waves/ups and downs) and its graphic representation (a

curve) that are a vivid presence in the imagination of our 'pandemic routine'. Media tell us about the first, the second and the third (so far) contagion curves, the waves of the epidemic infections. A wave reminds us of the force of nature, a danger which will be followed by a recovery.

As if we adapted and moved the in-response-to-disaster changes in human moods, described by psychologists, to the reflection on the city and its project, and bearing in mind that the periods of the pandemic are dilated compared to those of a natural disaster, this paper will use some of the phases' definitions suggested by DeWolfe.

The aim is to highlight that we are still in the moment of reflecting and planning the 'during' in such a way that it can become a testing ground and experimentation for the 'after/post' pandemic time. We firmly believe that it is now ('during') – a period of time that lasted for more than one year – the time to take action also in the city project. The 'during' can be the most fruitful time, as a period of testing and attempting, without it being necessary that the realised urban interventions are fixed and definitive.

With these premises, we ask: how do these collective response variations to the health emergency affect the reflection on the city and its project? In living the city day after day, what are the needs that emerge and what are the answers that the city government takes the opportunity to put into practice?

A first answer leads us to say: between the ups and downs, something has been done, something will last, and more so, we should seize the opportunity to claim and realise.

2 'Impact Phase' + 'Rescue or Heroic Phase': Everything Will Be Fine

Following the suggestions of the above-mentioned Manual, during the 'Rescue or Heroic Phase' – which, in the case of COVID-19 pandemic coexists with the dilated 'Impact Phase' – survival and promoting safety are priorities. We learn that, for some, 'post-impact disorientation gives way to adrenaline induced rescue behaviour' ([1], p. 10) and 'altruism is prominent among both survivors and emergency responders' ([1], p. 11).

In this phase, we feel a collective need to identify heroes to rescue us from troubles. As a community, we express a common cry: 'everything will be fine', and we manifest support for healthcare personnel and people at the forefront dealing with the emergency and guaranteeing daily subsistence. Regarding the thinking and the project of the city, scholars, associations, and researchers raise a common call against many harmful consequences of human action on earth, hoping for repentance (and recovery) on all fronts. Altruism and optimism push us to stick up for cities attentive to topics such as: gender equality, ecological sensibility and biodiversity, sustainable mobility and energy transition, access to housing, and enhancement of proximity production and exchange, among others.

As architects and urban planners, we feel full of expectation to deal with crucial urban issues of pre-pandemic cities. We flank public bodies entrusted with the city's management and governance in promoting initiatives that touch on two main issues that had become the worries of pre-pandemic city life: (I) the access to

housing/regulation of short-term rental and (II) the decrease of urban driveway space for the benefit of pedestrians and soft mobility/extension of green public spaces.

(I) The first confinement in 2020 gave cities the opportunity to reshape their approach to the housing crisis. For the first time in years, Europe's hottest property markets and the tourism industry experience the absence of tourists. The huge losses in this sector and the need to give other use to buildings, previously only dedicated to welcoming tourists, lead cities to rethink short-term rentals and push hotel owners to differentiate the offer of accommodations.

By taking advantage of the absence of tourists, municipalities intervene in the regulation of short-term rentals. Already from May/June 2020, some cities ban vacation rentals in their central town (Amsterdam) or strike agreements with local universities to rent tourist flats to students (Venice). In England and Wales, after the government issued an 'everyone in' directive for councils to stop the spread of the disease, a big number of rough sleepers have been moved into hotels [2]. In addition, the local government promises to make homes to prevent rough sleepers, housed in emergency pandemic accommodation, from returning to the streets [3] (Fig. 1).

(II) By passing the usual long times of urban planning and often in line with the suggestions of the so-called 'Tactical Urbanism' [4], 'Temporary Urbanism'/public 'policy strategy on temporariness"[1], and 'Open Urbanism' – towards an 'Open City', as argued by Richard Sennett –, some cities amaze us by realising, in a very short time and taking advantage of confinement restrictions, fast interventions with a huge impact on urban mobility and city liveability. Here, temporary uses in public space are often intended as a way to revitalise and unlock a given space's latent potentialities [5].

As claimed in the manifesto 'Challenges, conflicts and opportunities for the City in times of COVID 19' [6] the public space seems to be able to become a catalyst for an improved urban cohabitation. In this line, during the maximum health emergency period and soon after, several cities take the opportunity to implement, experiment and test interventions planned for some time before – 'Open Squares' in Milan; examples of Parklets in Rotterdam and Paris; 'The Street is yours' in Lisbon; 'Superblocks' in Barcelona.

In addition, some cities temporarily adapt public spaces, usually intended for car circulation, for pedestrians by creating ad-hoc routes for the first phases of the confinement exit process – 'Safe Routes' in Barcelona [7]. Here, the use of bright colours on the asphalt (dictated from Tactical Urbanism) and explanatory signage highlight new uses for already existing public spaces. Both of them increase the perception of safety for pedestrians and cyclists (Fig. 2).

Nature is not confined! Because of the restrictions of inhabitant's mobility and the lack of maintenance, the urban green spaces grow and flourish, suggesting a revenge of nature (of vegetation) over urbanisation – the 'feral city'. The amazement and the charm are such that the bodies entrusted with the urban green maintenance question the possibility of leaving some of these green spaces free to grow. In Barcelona, the vegetation left free to grow, and sometimes to take over the asphalt, the greater

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[1] See [5]. The article approaches the definitions (and typologies) of 'Temporary Urbanism' as a practice and/or policy strategy on temporariness.

Fig. 1. 'Closed hotel/shelter for rough sleepers', Gran Via de les Corts Catalanes, May 2020, Barcelona (Spain). Source: author.

Fig. 2. 'Safe Routes' ('Itineraris segurs'): Via Laietana (*left*); Carrer Consell de Cent *(right)*, May 2020, Barcelona (Spain). Source: author.

presence of pollinating insects that have favoured the flowering process together with the presence of bird's nests push the City Council to require citizens to respect plants and nests as they are [8] (Fig. 3).

Fig. 3. 'Wild Balmes and wild Gran Via', Carrer de Balmes (*left*); Gran Via de les Corts Catalanes (*right),* May 2020, Barcelona (Spain). Source: author.

3 'Remedy or Honeymoon Phase': The New Normal

During the 'Impact Phase' and 'Rescue or Heroic Phase' we have gotten used to hearing the phrase 'new normal'. The phrase, as a kind of euphemism employed by central governments in referring to the immediate post-health emergency future, is a recurring expression that alludes to and hopes for a better future that would be visible to all. The 'new normal reality' is, first of all, perceived in heavily urbanised/densely populated areas, that is, in cities or conurbations.

During the weeks to months following the first confinement (the 'disaster' in the quoted Manual) we learn that 'Community bonding occurs as a result of sharing the catastrophic experience and the giving and receiving of community support. Survivors may experience a short lived sense of optimism that the help they will receive will make them whole again' ([1], p. 11).

Immediately after the first confinement, even if frightened by the delicate economic situation, Europeans do not give up summer holidays. More often than in the past, people choose destinations within the national borders and explore, perhaps for the first time in years, next-door surroundings. They take the opportunity to discover and visit cities, where they have perhaps always lived. It is clear that something has changed in the day-after-day of some cities, and something has been implemented to improve urban cohabitation; from dealing with access to the housing and tourism phenomena to the reduction of public space, which before was the exclusive domain of cars.

Some cities have rolled out legislation aimed at better regulating tourist flats or at obliging rental operators to register with the city. Some actions are aimed at allowing administrations to enforce a bylaw restricting short-term rentals to principal residences. In other cases – mostly where property markets and tourism industry played a key role in ushering in urban renewal and lifting the city out of financial crisis (such as in Portugal [9]) – the confinement restrictions give the opportunity to reshape the approach to the housing crisis.

In this line, we find the initiative 'Porto with Meaning' [10] – for the rental of affordable flats–, and the intent to convert some of Lisbon's tourist flats into affordable houses, by offering of renting landlords' properties to the city for a minimum of five years, at a fixed price, with tax benefits and possibility of prepayment of rents – 'Safe Income Program' [11]. In addition, some hotel accommodations have been converted into monthly rentals – also purchased to house some of the city's most vulnerable people – and warnings have been issued to landlords whose houses have been vacant for more than two years (in Barcelona).

On the public space front, the most usual intervention materialises in more room for pedestrian and soft mobility, and, later, in more room dedicated in boosting consumption for those commercial activities affected by the health restrictions. Firstly, after the first confinement during which we had observed our 'ghost towns' from the window, we experienced our cities largely pedestrianised or transformed into 'zone at 20 km/h' (Brussels) or 'City of 15 min' (Paris). Later, we enjoyed urban surfaces, which before were intended for car circulation or parking lots, together with vacant and underused open-air spaces with a new-acquired (sometimes temporary) use.

To compensate for the losses due to capacity reduction, several variants of 'parklets' (sidewalk extensions installed on parking lanes), increase the open-air space of bars and restaurants, whose activity is limited by the health emergency restrictions. Leisure and cultural activities, heavily penalised by the pandemic, sometimes find their extra-room in the enlarged open public space rescued from car circulation. At times, festivals, large event or drive-in find a place in urban or peri-urban underused and vacant spaces [12] (Fig. 4).

Fig. 4. 'Parklets adapted for bar services' (*left*); December 2020, Barcelona (Spain). 'Pedestrianisation and more space for bar and restaurants services' (*right*) - *A rua é sua*, October 2020, Lisbon (Portugal). Source: author.

4 'Inventory Phase' + 'Disillusionment Phase': Finals Considerations

As suggested by the Manual [1], we learn that: 'Over time, survivors begin to recognize the limits of available disaster assistance' and 'The unrealistic optimism initially experienced can give way to discouragement and fatigue'([1], p. 11). DeWolfe warns us that the 'Inventory Phase' will be followed by a 'Disillusionment Phase' where 'The larger community less impacted by the disaster has often returned to business as usual, which is typically discouraging and alienating for survivors.(…) Divisiveness and hostility among neighbours undermine community cohesion and support' ([1], p. 12).

Guided by the warnings of specialists, this paper has retraced the actions that, starting from the pandemic outbreak, should lead us to an improved urban cohabitation. In response to the questions posed in the introduction, we point out old (and new) urban needs, and answers that the city government takes the opportunity to put into practice on urban public spaces.

Although the focus of the paper is the action on urban public space, we advocate monitoring and regulation – by limiting the voluntary adhesion of private individuals in public policies on short-term rental front [13] – for all processes of urban policy. Furthermore, regarding the design of the urban public space, we note that something has been done – also towards a public awareness (I) –, something will last, and more so, we should seize the chance to claim and realise (II).

(I) *The first confinement and its exit process proved to be a testing time for rethinking urban public space.*

_These times certainly impelled public policies to implement actions aimed at the 'good of the city and its people' but, above all, they *triggered a change in the expectations of the inhabitants*, to what from now on cannot be theirs. On one hand, pedestrians and cyclists are more aware of their right to public space; on the other hand, drivers, taxis and some traders are on a war footing against pedestrianisation.

_In areas that before were exclusively for cars, the perception of pedestrian and bicycle safety has been heightened; consequently, the practice of outdoors socialisation has increased. The improved soft mobility flows, also due to incentives for the purchase of bicycles and electric motorcycles, led to a more public awareness of *public space (also paved/asphalted) as a space for all*. Nevertheless, the car –the safest means of transport during infectious diseases emergency – and, with the resumption of urban activities, the charging and discharging *(logistic) areas, are reaffirmed as weaknesses of the compact city*.

_It is now a shared opinion that the *streets that are least valued by the inhabitants are located mainly in logistics areas, with high vehicle traffic as well as little presence of vegetation* (see a recent experiment [14]).

_In urban public spaces where an add-on strategy (more/differentiated uses) has been put in place, the latter was often accompanied by *communication*– explaining what is done and for whose benefit. As a result, fast changes in urban spaces, especially in terms of car circulation, become luck and misfortune of some European mayors (i.e., in Paris and Barcelona).

_Interventions tested in urban public spaces as a way to overcome the health restriction phases, teach and can become a *guide to vacant open spaces, not necessarily public*, waiting for destination.

_Some 'Safe Routes'–won against car circulation for the benefit of the pedestrian, during the confinement–give way to *definitive change in urban mobility,* such as a reduced section of some roads through which cities can be speedily crossed [15].

(II) *By claiming and reaffirming urban coexistence/cohabitation policies that look at a mixture of uses and users as the founders of the city*, we should bear in mind some crucial points.

_Tactical or add-on strategies in public spaces should not exempt from *monitoring activities that gradually arise in the surroundings of the intervened areas*. To avoid gentrification/touristification and traffic congestion in nearby areas, the regulation of subsequent activities may be necessary.

_Interventions have to *take into consideration the whole conurbation* with special attention on urbanised areas with well-known problems of poor liveability, where we often find large vacant areas.

_In rethinking the supply logistics, we *should not lose all the public space won against cars* and given to restaurants and bars (for example). Following the recent 'European Biodiversity Strategy for 2030' entitled 'Bringing nature back into our lives' we should give more room to vegetation. This is to say, in urban spaces: not flower pots but green areas/from mineral to planted areas.

Even though specialists remind us that periods of high health emergency could be recurring, the cited Manual [1] suggests a last phase (or what expect us in the after-pandemic future): the 'Reconstruction or Recovery Phase'. From it we learn that: 'When people come to see meaning, personal growth, and opportunity from their disaster experience despite their losses and pain, they are well on the road to recovery ([1], p. 12).

In a previous contribution, for times when health emergency restrictions impose a confinement, we suggested to enlarge the domestic spaces beyond the walls of our houses [16]. Here, knowing how much open-air activities and lack of socialisation can be counterproductive to our well-being, we call for an 'activation of public space'. This goes beyond a mere flexibility of use and invites a progressive removal of asphalt surfaces. It also invites us to make the city a test of a (also temporary) nursery for vegetation adapted to (and characteristic of) urban environments. Cities attractive again, even in times of pandemics.

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Progression of Human Experience Integration in the Construction Industry

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Abstract. The construction industry is known to be particularly dependent on human involvement. Construction projects are usually unique and filled with varying degrees of uncertainties. These uncertainties pose risks that can be detrimental to the project's success. Human cognition and decision making are vital in surmounting these risks adequately. The quality of cognition and decision-making comes from the extensive experience of architectural, engineering and construction (AEC) professionals on different construction projects and processes. There have been various innovations developed to improve construction processes from design to construction. There have also been attempts to integrate this valuable human experience with available technologies to improve efficiency and eventually achieve desired levels of automation. This paper explores the various strides taken in integrating human experience with available construction technologies. The conclusion of this study examines the successes and failures in all endeavors concerning human experience integration in design, materials, safety, constructability, and other areas involved in the construction process.

Keywords: Cognition · Human experience · Integration · Construction

1 Introduction

Construction industry requires significant amounts of communication and collaboration between the parties involved. The architects, engineers, project managers, supervisors etc. must be in constant communication for the project to be delivered efficiently. Over the years, technology has advanced in improving collaboration and communication in construction through the introduction and application of Building information modelling (BIM), Artificial Intelligence (AI) and other developments. These innovations have improved the construction workflow to some acceptable extent but there is certainly more room for improvement. One aspect that is lagging is the integration of human experience with these available technologies. If we agree that construction is heavily dependent on human involvement, one can argue that the quality of human experience is vital to the construction process. Human experience however is not the easiest type of data to integrate with computing. This is primarily due to its predominantly qualitative nature which requires substantial coding in order to be assimilated and implemented by computers. Human experience in construction has been collected

through interviews, surveys, and direct observation but the challenge with this type of data is its scalability and spatial interpretation. This means every information of this sort requires significant time and energy and can be hardly generalized or iterated. For integration of human experience with modern technology, we need a systematic scalable feedback process which can be efficiently interpreted and executed in the computing world [1]. Despite the challenges involved in integration of data such as human experience, attempts have been made over time to achieve such a purpose. This paper makes a broad exploratory effort to analyze all attempts in integrating human experience with technologies in the construction industry.

2 Progression of Human Experience Integration in the Construction Industry

According to [2], human experience/expertise stems from the self-acquisition of skills and capabilities to improve one's effectiveness in defining an external reality. Sociologists for a long time have worked in understanding the entirety of the concept of human expertise. [3] supports the above definition by adding that human expertise provides the self-governing human with the knowledge to delineate, control and adapt to various possible events within their professional scope. The study of human expertise set the stage for enquiries into other possible forms of expertise and their possible usefulness in the grand scheme of improving human abilities. [4] on his work on expert systems initiated the development of "expert systems" which are simply rule-based computing programs designed to out-perform humans in terms of decision making and problem solving. The introduction of this idea was a good basis for the development of more sophisticated technologies in achieving this goal. [5] in comparing these expert systems with human expertise discovered a challenge these expert systems have. The limitation of these expert systems is in the fact that they are rule-based. The uniqueness of human expertise is the ability to rely on prior knowledge and adapt to relatively new real time situations. These expert systems can only perform within the confines of the algorithms upon which they were built.

[6] in his piece on "construction expertise and posthumanism" provided fictional examples on how these expert systems fall-short of actual human expertise on construction projects. One example explained how an automated brick-laying machine may not be able to discern the adequate textures and gradients outside the command fed into it while a human expert can adapt and make the necessary adjustments per the conditions present. A look at the timeline of the progression of human experience integration shows a steady increasing trend of the incorporation of three main apparatus: Expert Systems, Building Information Modelling (BIM) and machine learning. Eventually, BIM became all-encompassing as the idea of expert systems slowly disappeared. Since the introduction of expert systems by Feigenbaum, 1992, [7] sought to improve on this concept by introducing techniques to aid these expert systems minimize delays through efficient scheduling. The study created a model called the Isolated Delay Type (IDT) which can be used individually or integrated with Computerized Delay Claims Analysis (CDCA) systems. [8], developed a multi-attribute model with the Delphi technique which sought to improve the selection of procurement systems.

This was another variant of the integration of human expertise with systems in the construction industry. The study found that the Delphi technique was useful in detecting the right procurement system objectively. Another instance was the integration of human expertise for subcontractor selection by [9]. In this study, a knowledge based expert system was implemented to create a user-friendly interface for subcontractor selection. With time, BIM became more popular and integrated all these separate expert systems through add-ons and plugins. The evolution of BIM alone illustrates a steady attempt in integrating human expertise with construction computing software. BIM alone is still predominantly dependent on human manipulation and is not necessarily an independent decision-making process. Experts have begun to explore the extents of other technologies like machine-learning with deep learning and neural networks.

The human being has an insurmountable ability to apply general knowledge in problem-solving situations for specific cases. Where human ability falls short is in the analysis of large numbers of scenarios occurring simultaneously [10]. This is where computers fortunately come in where they excel in a process called induction which involves the use of machine learning to produce decision rules from prior decision examples. Currently, the application of machine learning is largely in constructability analysis, safety, and material property prediction. This has been achieved by coding a large amount of human expertise data into software programs to be applied on the field. [11] looked at the application of machine learning in injury prediction on construction projects. The study made significant progress in providing reliable probabilistic predictions on injury severity and outcomes of accidents on construction projects. [12] examined the integration of human expertise with machine learning technology to predict the compressive strength of materials and concluded that high levels of accuracy were achieved with the combination of neural networks and support vector machines (SVM's). The timeline in the following figure was created to summarize the progression of attempts in integrating human expertise in construction based on the reviewed articles (Fig. 1).
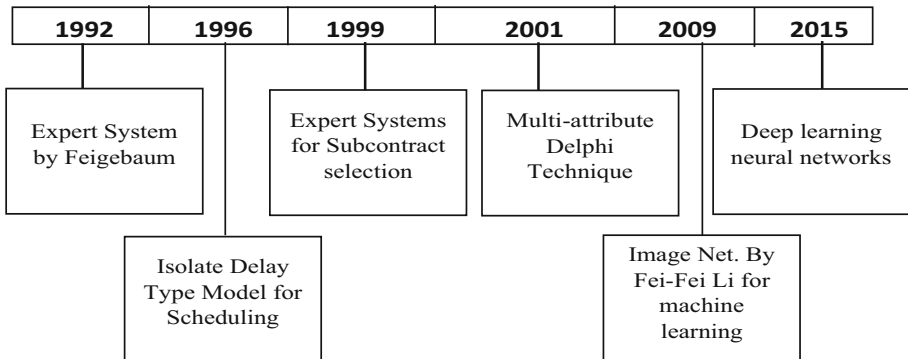
Fig. 1. Timeline of the milestone attempts at integrating human expertise in construction.

3   Methodology

This study adopted a predominantly meta-synthetic approach where multiple qualitative research studies were evaluated, and findings interpreted based on the subject of human experience integration in construction. This method was adopted because it fits the general inductive approach best suited for the type of data collected in this study (Fig. 2).
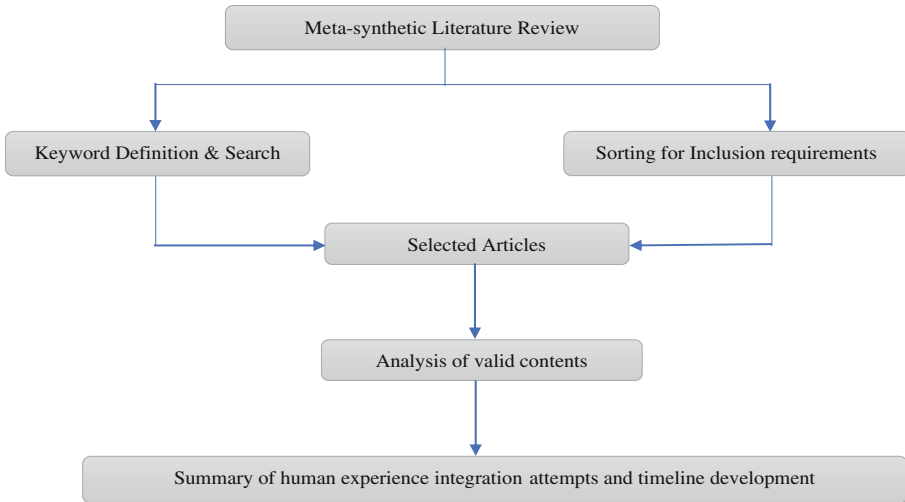
Fig. 2. Schematic representation of research methodology.

An inductive approach requires the condensation of raw textual data into summaries and establishing links between the evaluations and research objectives. Since this paper focuses on reviewing a broad range of prior work concerned with human experience and construction, the inductive research method with meta-synthesis was appropriate. Owing to the relative rarity of literature on this subject, the search was not limited to a specific period in order with the earliest selected study dating as far back as 1991. This was to ensure an exhaustive review process. Giving this, the requirements to qualify an article for selection were: 1. The articles must be peer reviewed, 2. The articles must contain specifics on human experience and construction 3. The selected articles should highlight methods attempted for the integration of human expertise in construction. The words "experience" and "expertise" were used interchangeably in the search string to ensure potentially all-inclusive search results. A timeline was designed to summarize the reviewed information for clearer perspective on the progression of human expertise integration. The chart below summarizes the search, selection and analysis process.

4   Results and Discussion

The review of all the works concerned with human expertise integration into construction only exposes the vast room for improvement. As it stands, all the methods have a common limitation: the versatility of the models developed. Most of the models created only cater for a tiny niche within an aspect of the construction process. Of course, this is a step in the right direction and with the rapid development of machine learning tools, we can hope for a more all-inclusive model that can closely mimic human expertise especially in discerning and decision making. It is highly impossible to achieve a fully autonomous construction industry due to the level of diversity and variations of risks spread across locations and trades in construction. From the timeline diagram, it can be realized that the most recent milestone in the integration of human expertise in construction was in 2015 with the emergence of advanced deep learning neural networks in machine learning. Currently, it seems that machine learning is where experts want to achieve substantial human expertise integration. The potential for this exists but not much progress has been achieved outside the vein of predicting construction outcomes. The perfection of predictability software can be further developed to incorporate automatic decision making to bring computers closer in mimicking human decision making.

5   Conclusion

Human expertise in construction is an asset of immense value and hence the efforts to integrate this significant data source with technologies in the industry must be lauded. Clearly, the emergence of machine learning has boosted the potential of significant human expertise integration. The integration of human experience in construction only serves to drastically reduce risks on project sites, improve decision making and improve overall efficiency of the construction process. It will be a challenging feat to achieve but with the rapid rate at which artificial intelligence and machine learning are being improved, we can hope to see such levels of integration in the foreseeable future. For now, human expertise remains at the core of the success of construction projects, but we must aim to lighten this burden by improving available technologies to mimic human abilities like decision making and adaptability.

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Possibilities for Utilizing Wooden Structures for Creating Contemporary Architectural Forms in the Context of Sustainable Development

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Abstract. The article presents a range of the possibilities of using glued laminated timber structures for modern and further applications. Are the prospects for this structural material related to its design features and to the extension of the span, or on the contrary, despite the fact that it is a material with excellent design features, its greatest advantage is its natural origin, which is in line with the global design trends of sustainable development. The article distinguishes the principles of shaping contemporary forms and structural systems against the background of issues related to sustainable design and the process of manufacturing large-size wooden elements. Visible trends on the one hand, the use of plastic properties of wood (large spans) and strength (multi-story buildings). The article seeks answers to the questions to what extent wooden construction is justified and attractive, what are the current possibilities of wooden construction and they are used, and what are the prospects for its development for shaping innovative forms of con-temporary architecture.

Keywords: Glulam constructions · Glued timber · Wooden architecture · Long spans constructions · Glued laminated timber · Quality of life · Human factors · Large span structures · Conceptual design · Timber girders

1 Introduction

Glued laminated timber is precisely defined in standards for design and production processes. In general, it can be assumed that glued laminated timber is one of the modern construction materials, next to steel and reinforced concrete, suitable for long span construction, pro-ecological construction and multi-story buildings. The article does not contain analyzes of the comparison of these technologies, nor is it intended to prove that glued laminated timber is the best construction material. When analyzing contemporary architecture, it seems that other construction materials are more technically appropriate to overcome much larger spans and, for example, steel structures, show more potential for innovative architectural forms and are more often used in the construction of contemporary buildings. This is especially true for the covers of stands, stadiums, domes and other public buildings. Glued laminated timber, however, is one

of the best construction materials that allows the creation of urbanized and free spaces in a human-friendly manner.

2   Glued Laminated Timber in Contemporary Applications

The use of glued timber as a supporting structure for prestigious architectural structures of large spans has led to the creation of innovative, distinctive and at the same time pro-ecological architecture, which has become a new quality compared to existing projects. This means that the use of wood in architecture is visually attractive, technically and economically justified, and suitable for large spans.

Shaping a structure made of glued laminated timber is governed by the following rules:

1) experimental treatment of wood as a construction material for large spans, despite the fact that the technology has operated for several decades,
2) strong connection with traditional wooden construction by duplicating the principles of constructing load-bearing systems and designing connectors,
3) exposing the load-bearing structure to emphasize the expression of the material and show the distribution of forces (Fig. 1).
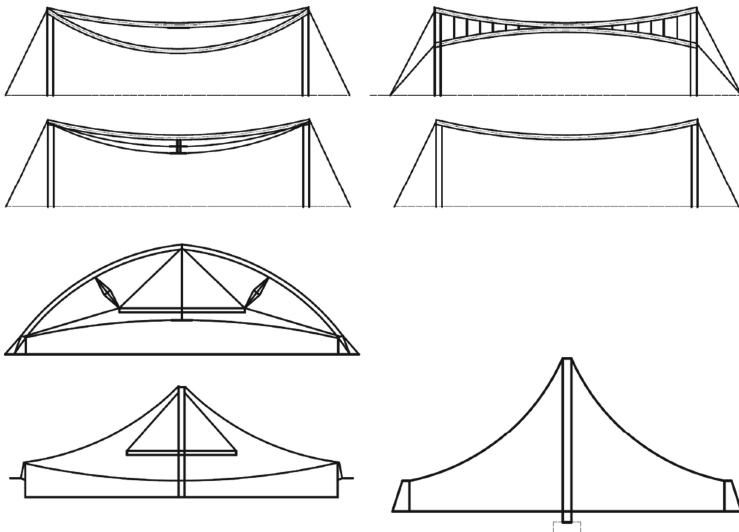
Fig. 1. Examples of glued laminated timber pendant roofs; single-span, single-curvature pendant roof scheme; single-span, double-curvature pendant roof scheme [1].

It turns out that a renewable and economical material – "soft" wood with still unused potential, is undergoing a metamorphosis. Technologies are emerging that open

up new possibilities. Construction elements made of wood and wood-based materials are still under development. The greatest potential concerns the use of reinforced wood, combined in hybrid systems with steel elements. These systems, combined in the form of spatial trusses, can cover spans up to 200 m. The analyzes of the existing solutions of contemporary forms of architecture of large spans made of glued laminated timber and the development possibilities in the field of structural systems [1] have shown that glued laminated timber is an attractive and flexible material for various applications. The use of wood in the latest and future architecture is technically and economically justified and appropriate for the realization of large spans and individual architectural forms connected with them. The prospects of possibilities for the shaping of glued laminated timber forms are based on increasing the properties of the load-bearing cross-section by reinforcing it with steel and composite elements in original two-curve arrangements, as well as on high-quality work of architecture, in which a glued-laminated timber construction was used, in terms of aesthetics, social, economic and environmental protection. The display of wood in the structure enables the created architectural forms to obtain expressive and aesthetic effects that go far beyond the purely technical and constructional character.

Structures made of glued laminated timber of large spans, as a result of industrial processing of natural wood into a construction material, suitable for covering large spans, have become a solution that meets all technical and construction requirements combined with high expression and aesthetics, which is a unique architectural value. This is due to such advantages as "naturalness", ease of design and interesting architectural effects, but also high precision of workmanship, safety of use, ease of installation and high fire resistance, chemical resistance, thermal and acoustic insulation (Fig. 2).
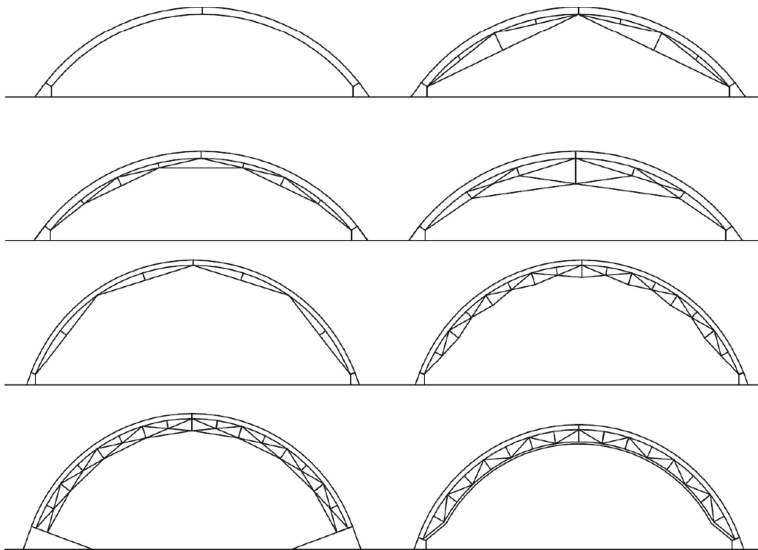
Fig. 2. Shape diagrams for space truss arch structures. Three-parted arches and domes with spans exceeding 100 m. Drawings: Alicja Maciejko [1].

In the 20th century, material technology created new possibilities for the architectural message. Contemporary architecture, which is largely subject to the dictates of new technologies and new building materials, thus aims at great lightness, transparency, ephemerality or even dematerialization. The most interesting forms of contemporary architecture give the impression of opposing the laws of gravity by striving for the greatest possible lightness, which is especially visible through the use of tension structures. Steel is replaced by aluminum and composite materials, monolithic structures turn into pneumatic ones, etc. There are covers made of tendons, fabrics, paper and translucent membranes. Walls, increasingly thinner and larger glass panes, sometimes constitute only a transparent layer, a rain curtain, which aims to expose the internal structure. Against this background, structural systems, more and more often spatial structures, are more expressive, sophisticated and exposed. The huge number of unique projects with innovative construction systems that have been developed in recent years shows that the search for new construction solutions to increase the attractiveness of architectural forms is a visible tendency of contemporary architecture (Fig. 3).
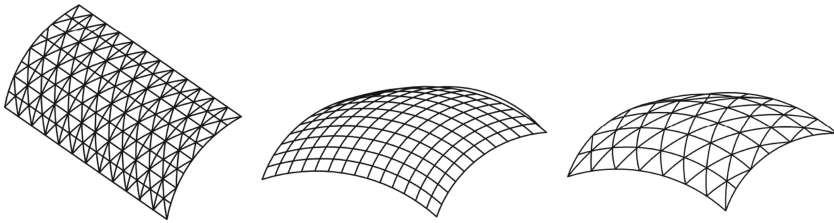
Fig. 3. Shape diagrams double-curved grids. Drawings: Alicja Maciejko [1].

3   New Forms in the Context of Sustainable Development

New forms that result from the creative and intuitive use of static solutions and are possible to build thanks to the latest technology and new materials are considered beautiful. This intuitive "perfection" that is referred to in relation to a well-designed structure often results from the static analysis of well-dimensioned load-bearing elements, from the design of the "skeleton" in the best possible arrangement with the maximum use of material possibilities. Such designed form is usually combined with material savings and lightness, clearly reflecting the system of forces and stresses. The widespread use of wood is related to the construction efficiency, consisting in lightness, wood strength and, at the same time, low cost of obtaining the raw material. With almost complete prefabrication of structural elements, individualization of objects is possible.

The problem of "constructing" an architecture is complex. Apart from the objective factors related to the structure - statics and function of the building, there are values created intuitively, according to W. Zalewski, [7] "appropriate to art". The individual structural elements - vertical, horizontal, straight and curvilinear, their arrangement,

density, size, slenderness, multiplanariness, degree of complexity - in their final shape reveal the acting forces, which is considered "beautiful". Design sensitivity and knowledge of technology, the use of logic resulting from technological conditions, simplicity and the so-called The "suitability" of the form has a huge impact on the aesthetic quality of architecture, especially in buildings with long spans. Showing a technically justified structure is interesting because the "skeleton" becomes a pretext for exposing the dynamics and distribution of forces. There is a combination of engineering art with a perceptible affiliation of these structures to the natural world. The symbolism of the operation of the forces of nature is intensified by the possibility of achieving extraordinary architectural effects by "composing" load-bearing structures that go beyond mechanics, using means observed and built by nature, created as a transformation of nature or the creation of the mind. Unusual objects are created, supported by the creators' intuition, consisting in processing the experience of the signs of nature. Apart from the elements organizing the structure in its material form, additional values overlap with its reception. The use of glued laminated timber makes it possible to incorporate large span architecture, previously perceived as purely engineering and technological, into the idea of environmentally friendly construction. The use of wood in long span buildings is also the architects' response to the progressive degradation of the environment and the depletion of the Earth's natural and energy resources. At the end of the 20th century, as a result of increasing environmental awareness, there was a need to use natural materials in construction, including to replace "dehumanized", too technological objects made of glass, steel and reinforced concrete. This awareness greatly contributed to the renaissance of wood construction. Architectural concepts that are usually ahead of construction reality emphasize ideas related to recycling and using the potential of natural materials to generate new forms. On the other hand, the need for contact with nature is growing. Thus, there is a growing tendency to create architectural works with the use of natural materials and their strength properties. Environmentally friendly architecture is seen as one of the leading trends. Ecology is no longer just about experimental or alternative energy buildings. The method of production and construction, utilization of the materials used, the degree of technology influence on changes in ecosystems and human condition are also important. Until a few decades ago, it seemed impossible for high-tech architecture to refer to wooden buildings that were previously associated with rural buildings, small religious and industrial buildings, etc. Now wood is used in a variety of forms, the constructions are both light and simple, as well as with sophisticated shapes and forms. In recent years, it has also been built of plywood, branches, bamboo and paper. Modern wood processing technology inspires new searches. It is the most modern because, apart from elevating technology as a superior feature, it shows: technology - yes, but in harmony with nature and human needs - for architecture.

4   Conclusions

Buildings made of wood use its potential in the form of flexibility in organic construction, high strength and lightness, beauty and nobility in symbolic and sacred buildings, elegance in prestigious buildings, naturalness in pro-ecological buildings,

warmth and good psychophysical parameters in housing construction, schools, kindergartens, etc. If any of these features is superior or determines the choice of technology, all others will complement it, making architecture unique "instruments". The use of wood on a large scale - creating forms of long-span objects - fits in the tendency of modern architecture to use highly processed technology in the creation of individualized innovative forms of public facilities in combination with additional ecological values.

The further development of long-span glulam construction for the realization of architectural forms in the 21st century is related to the following aspects:

I. Perspectives for increasing the spans:

1) At the present stage of modeling, execution and production of advanced modern technological solutions, spans up to 100 m are economical.
2) Achievement of spans of 160–180 m in modern curved glued laminated timber structures was a great technical achievement and broke the stereotype of using timber in long-span buildings, but it did not result - after several decades of use - the creation of another building with an even longer span.
3) With the use of reinforced cross-sections of load-bearing elements made of glued laminated timber and composite materials as well as hybrid systems, spans from 100 to 200 m are possible.

II. Perspectives for expanding the technical capabilities of the structural material:

1) Further research on the structural material in the direction of increasing the load-bearing capacity and reduction of cross-section dimensions of structural elements - reinforcing the cross-sections with composite elements, steel inserts and bars as well as carbon, glass and aramid fibers (FRP, SRG materials, etc.).
2) Further research to eliminate defects affecting the safety of the structure and in the direction of proper protection of the structure - increasing fire resistance, durability related to resistance to external factors, especially humidity and preventing failures - new solutions in the field of connection techniques, increase of load capacity and stability of nodal sections.
3) Efforts to exploit cheaper and lower quality raw material through new chemical methods of improving and increasing wood resistance.
4) Recent achievements in the field of genetic modification of plants suggest that it will be possible to obtain material for glulam construction structures from raw materials genetically devoid of previous defects.

III. Perspectives toward increasing the efficiency of structural systems and increasing the efficiency of connections:

1) The possibilities of the traditional, most commonly used flat beam-column systems are fully used.
2) Developments in the direction of increasing the use of hybrid, composite, and short-element structures to improve the economics of construction, transportation, and production due to reduced energy consumption as well as the ability to adapt elements to assembly conditions.
3) Increasing the use of double-curved roofs

4) Advancement in connection technology, from bolted connections, steel plate inserts used in support nodes to internal steel inserts to SFS and other glued-in fasteners.

5) Continued efforts at nodes to increase the efficiency of fasteners - research and introduction of new forms of complex connections into implementation, especially for mesh systems and spatial structures.

IV. Perspectives on architectural solutions:

1) Increasing requirements for safety of construction, reduction of energy consumption and use of renewable resources, durability of objects and other aspects not directly related to the construction of forms, but having a great influence on design decisions.

2) Further search for new forms under the influence of inspiration from statics, sculpture, rhythm, "fluid modeling" and nature.

3) Individualization of architectural forms.

4) Development towards pro-environmental design supported by governmental institutions and executive law.

Aesthetics depends on many other features of wood, also connected with its structure and symbolism. Modeling the architecture of glulam on the similarity of nature, gives the architectural form unprecedented expression and dynamics, as well as unusual impact on the user. The eternal need of architecture to exist as a work of art is fulfilled here.

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Humanistic Architecture - The Human Factor in the Perception and Creation of Educational Spaces

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Abstract. The article concerns the design of educational architecture taking into account the human factor. The key method during the design process should be the analysis of functional paths, taking into account the specific needs of all users and their preferred behaviour. The analysis of historical educational systems and their impact on the shaping of educational spaces shows that successive generations of children grow up in spaces that have minimally changed over time. The proposed method of analysing functional paths may be helpful when designing school spaces in terms of increasing their educational value.

Keywords: Humanistic architecture · Human factors in architecture · Educational spaces

1 Introduction

Humanistic architecture is a concept that covers all issues related to the influence of the human factor on architectural design. Architecture as applied art requires one to take into account the specific needs of the user; without this, the design process is incomplete. It is the presence of the human factor that makes a physical object more than just a conglomerate of building materials: someone's home, church or a public building. The sight of abandoned objects is usually sad, which is associated not only with the physical degradation of a given place, but also with lost opportunities, lost events that could have happened to such a place. Lifeless architecture is devoid of its main purpose. It is man who infuses buildings with extra meanings, somehow coding them in forms and functional systems. Looking at an architectural work, one can often discover its purpose by analysing the meanings inscribed in its body. This message also becomes a culture code, which is carried by the community and sets a standard of behaviour depending on the original meaning. Proper preservation and use of that code is an additional option for the designer when creating the project. Thanks to the patterns established in culture, it can influence the user's behaviour by applying specific formal and functional procedures. On the one hand, a user codes a certain meaning in the building shape by using a given space for his own purposes; on the other hand, a designer can use this code to transfer a given meaning to another space, triggering

specific behaviour of the user. This process may be of particular importance when designing spaces for young people.[1]

The requirements for architects usually go beyond adjusting the form of an object to the planned function and include issues related to the economic balance of the investment, its profitability, or impact on the external environment. Often, final users of a facility have no real influence on the space in which they will have to function. At the same time, it is the user who is going to bear all the consequences of poorly designed space - inadequately lit, non-ergonomic, or simply unfriendly or not corresponding to his aesthetic preferences. When designing spaces intended for education, architects should pay special attention of the users' needs. The analysis of activities undertaken to increase spatial awareness in children shows that while school age is the best period for shaping the aesthetic preferences of children, that question is often neglected. Research methods based on the analysis of selected educational objects and the interpretation of the user's influence on their shaping (conscious and subconscious) can successfully pave the way for a more conscious creation of this type of space in the future. This is particularly important in the face of the current epidemic threat, which has revealed the weakness of the system based on overcrowded classrooms and corridors gathering students during breaks in the inherently limited space.

2   Human Factor in Designing Educational Space

Research on architectural education undertaken at the Faculty of Architecture of the Poznan University of Technology includes a series of analyses of historical and contemporary solutions, as well as issues related to the perception of space and its impact on the user, and the possibility of using an architectural object as a 'teacher', both in the field of architectural education and general education.

Space as an Extra Teacher. According to Loris Malaguzzi's educational theory, the building becomes an additional teacher. Teaching takes place in a direct process - by showing how architecture works, or indirectly - by using appropriate formal measures and adapting functions.

Using a functioning building as an educational example allows the user to explore the relationship between the interior and the exterior of the building, analyse technologies that make its functioning possible, and better understand the designer's decisions. Exposed installations, glazed roofs or visible cross-sections of partitions are an opportunity to have a glimpse at areas of the building that are normally hidden from view and inaccessible for architectural laymen. The building becomes a teaching phantom; just like a plastic model of the human body, it offers an insight into regions that usually remain unseen and allows one to understand the complex processes governing the object. The building designed by Sł. Rosolski, used since 2020 as the seat of the PUT Faculty of Architecture and Faculty of Engineering Management

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[1] The article is based on research carried out at the Faculty of Architecture of the Poznan University of Technology as part of the research project: *Mapping architectural space, history, theory, practice, contemporary times* (10/04/SBAD/0161).

[WAWIZ] is both an exemplification of the principles of 'reverse design' to create a building that practically consumes zero energy and an attempt to offer students of architecture a unique 'teaching aid'. The clear functional structure is supplemented by exposed internal systems marked in the manner that makes it possible to analyse them. The building's software gives real time information about the current conditions in the facility and the reaction of internal systems, such as heating, air conditioning and ventilation. The educational value of the WAWIZ building for students of architecture and persons interested in architectural design is doubtless. However, occasional visitors or users not professionally connected with architecture may find it more difficult to accept the building due to lack of standard interior finish (raw concrete, no suspended ceilings) which, paradoxically, may result in less understanding for modern architecture (Fig. 1).
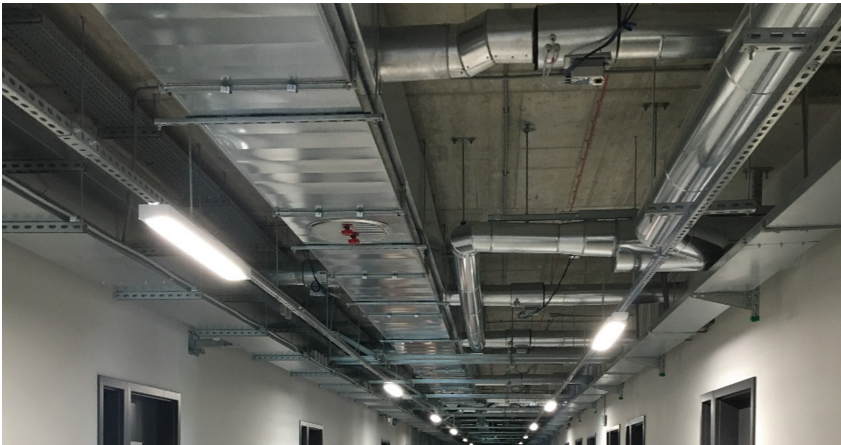
Fig. 1. The ceiling in the building of the Faculty of Architecture and Faculty of Engineering Management [WAWIZ], Poznan University of Technology, design by Sł. Rosolski. [Photo by B. Świt-Jankowska, 2021].

The concept of a building that plays the role of an additional teacher goes beyond the option of the 'model solution' that requires the user's active attention. Meanwhile, according to the 'teacher building' philosophy, the building educates its user indirectly; by its properly shaped form and function, it promotes preferred behaviour and limits undesired interactions [1]. Contemporary architectural design is focused on attaining the desired efficiency and profitability of the investment, which often leads to disregard for factors that go beyond the basic functional objectives. Designers make use of complex computer software to co-ordinate various trades and create multi-criterial simulations of fire evacuation of users or define the requirements related to throughput capacity of horizontal and vertical traffic routes. The question posed in the present research work is whether similar analytical methods could be employed for designing

users' behaviour in the building in the manner that also takes into account the psychological and sociological consequences of the adopted functional layout.

Coding the Space. The right coding of the designed space produces the desired educational effect. At the intentional level, coding takes place in two stages. The spatial order recorded in the designer's mind introduces the spatial order into the surrounding world; next, the author's intention 'imprinted' on the designed facility influences its surroundings and its users. The process may be applied subconsciously (the designer subconsciously uses the culture codes prevailing in specific circles) or consciously (the designer intentionally shapes the building so as to embed in it certain specific behaviour patterns) [4].

One of the key elements of the coding process at that level of complexity is the time of impact of a given structure (usually counted in centuries), the level of its structuring, tradition and transmission of certain values despite the changes occurring e.g. in applied structural solutions. Another outcome of coding of an architectural form may be the transfer of intentional meanings onto objects of a different function, which facilitates understanding and adds extra meaning [7]. The discovery of semiotics that exists in a certain cultural circle makes it possible to trigger the potentially desired user reactions and limit unaccepted behaviour [3].

For educational spaces, coding may play yet another special role; it may introduce students (i.e. main users of such spaces) to the system of meanings characteristic for a given culture code. Thus, an educational facility becomes an experimental field where a young person can test possibilities and limitations later to be copied in adult life. In that particular case, deciphering the code should be made easier and the teaching staff, properly prepared, should offer assistance in 'code reading'. An excellent example of this type of thinking is the typical school building plan in Reggio Emilia that uses the characteristic pattern of public space as the basis for its functional layout. This allows the school-micro-community (children, teachers, parents, personnel) to function in the manner that mirrors the functioning of the local community (Fig. 2).
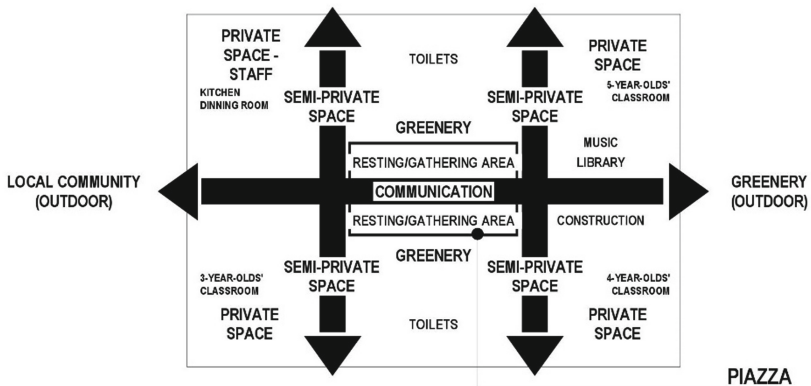
Fig. 2. The diagram of the functional layout of the typical school in Reggio Emilia. [B. Świt-Jankowska, 2021].

3 The Functional Path Analysis as a Designing Method

The proposed designing method that may be used for designing educational spaces with taking the human factor into account is the functional path analysis method. The method assumes in-depth analysis of the paths of all users of a facility[2] (divided into categories according to the functions performer by them) and the division of activities into preferred, neutral and undesired ones. Such a classification of activities is connected with the intended educational effect that exceeds basic requirements for a functional layout. Putting together the paths obtained from the analysis and their synthesis may enable the creation of a design at the level that takes the human factor into consideration. For more functionally complex projects, the analysis of varied actions of users should be aided with suitable software that would enable building various scenarios for the use of the designed object. At the most basic level, it should include the simulation of preferred behaviour and unwanted behaviour in order to find points of contact; the proper planning of such points will make it possible to minimize the probability of occurrence of undesired behaviour [6]. Similar simulations are carried out in architectural design for the analysis of functional systems focusing on evacuation routes, horizontal and vertical traffic within a building, or analysis of production lines in industrial or service facilities (Path Finder, Traffic Vision) – it would therefore be recommendable to consider an alternative use of such existing systems. Application of similar solutions to planning social behaviour in order to prevent potential problems connected with the functioning of various groups within the same space may give a more humanist perspective to architectural design, sometimes neglected in this era of design based on economic balance. The above-described proposals may be applied both to designing new buildings and to reconstruction of existing ones and should be correlated with the latest research in psychology, sociology and pedagogy [2]. Making architectural design open to thus understood 'human factor' is essential, particularly when designing educational spaces for the youngest users or for children and teenagers with various challenges (physical or mental disability, autism, Asperger, etc.).

Active Functional Scheme. The functional scheme that is most often used in the process of architectural design is based on the static linking of rooms with taking into account their direct and indirect formal links. Particular shapes, representing rooms or groups of rooms, are linked with lines forming a kind of graph. Adding arrows to the lines makes it possible to notice main traffic directions, but fails to grasp the dynamics of that process.

Such an analysis fails to ensure the full utilization of the possibilities offered by architecture that could potentially be applied in education. A more in-depth analysis of functional paths includes the analysis of behaviour of potential users, dividing it into undesired, neutral and preferred behaviour types. Overlaying of complicated paths in

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[2] The method is based on the statistical analysis of paths, which is a development of the model of multiple line regression. It allows for the causal interpretation of the analysed variables within a model that sometimes takes into account a considerable numer of variables explaining the variability of the dependent variable (criterion variable, explained variable) – forming the constructed model [8].

buildings with complex functions may be assisted by dedicated IT applications (just like it is done for analysing evacuation paths).

The proposed method stipulates a dynamic scheme that is based on flexible approach to space and links functional areas with preferred behaviour of users. In the basic version, each user type is represent in the drawing by a line (marking the passage) or a dot (marking a longer stop). Line thicknesses and the number of dots represent the number of people and graphically indicate accumulation or potential conflict areas. An option of creating computer simulations enables the use of the model in virtual reality and a dynamic analysis of time-related behaviour (time of day, season of the year, etc.), verifying and helping to find places that require extra attention from the architect. The utilization of the above-described method for designing educational spaces offers a chance to introduce additional perspectives to the process of shaping educational spaces not directly resulting from formal requirements (evacuation, number of persons per square meter, etc.). The process can be carried out at the urban planning level (analysis of a bigger complex), architectural level (functional analysis of a specific building or its fragment) or at the level of design of particular interiors (functional layout of a classroom, hall, common room). The active functional model could also prove useful after the end of the investment process by facilitating planned refurbishments or in case of non-standard events. It could also become an additional source of architectural education for the users (Fig. 3).

Fig. 3. Student work samples: the functional path analysis method on an urban scale. Dziekanowice, Poland. The reconstruction of a Greater Poland town. [Project made by K. Szumigała, A. Parzeńska, A Śledzik under the care of B. Świt-Jankowska, June 2020].

An important aspect of the functional paths analysis method is that it may be closely combined with the previously mentioned space coding. The use of culture codes that exist in a given community offers the designer an extra opportunity to introduce educational values – on the one hand it offers a tool for influencing user behaviour (that effect is more pronounced in older users who have already acquired the ability to decipher the semiotics characteristic for a given community) and on the other hand it allows younger users to get acquainted with solutions that they are going to face in adult life.

The solutions presented above may find application in educational activity following the concept of Loris Malaguzzi – space as an additional teacher – and in counteracting such unexpected phenomena as for instance the current Covid 19 pandemic. The pandemic has clearly revealed all the shortcomings of designs of educational spaces, classifying them as potential areas of virus spreading. Crowded corridors full of children, lack of control over mixing groups of students and teachers – those were the reasons why in most countries schools were closed and education moved to virtual space. However, we should not forget that school is not only the place of learning; it is also a physical space where users engage in various interactions, the educational value of which is priceless for the near future, as it may prove of utmost importance for the proper functioning of the society. At present, we protect ourselves against direct personal contacts and isolate children and the elderly. This is bound to have long-term consequences that we cannot fully diagnose today. Distant learning has already demonstrated that while physical school is not indispensable for gaining knowledge, it is essential for building social relations.

According to the above-presented approach, the educational space of the school is the focused, condensed version of the outer world, a mirror image of the local community. Endowing it with a form that recognizes and promotes socially benevolent solutions by using the existing culture codes creates a potential that may prove particularly useful in the post-pandemic world: the school that teaches its pupils how to function in society – perhaps anew, as the epidemics is going to leave a permanent mark on the generation of contemporary children and will pose many problems to be solved. In this context, the presented method of analysis of educational spaces may be an interesting and helpful tool. Many modern school buildings are designed correctly, yet without the use of functional links at the entire school community level. A single class or corridor, no matter how beautifully designed, will remain an exception without any greater significance [5].

4   Conclusion

The key method during the design process should be the analysis of functional paths, taking into account the specific needs of all users and their preferred behaviour. The analysis of historical educational systems and their impact on the shaping of educational spaces shows that successive generations of children grow up in spaces that have minimally changed over time. The form of the school class has not changed much since the earliest times, and school buildings are usually built according to a corridor scheme.

Treating the school building as an element supporting and complementing both architectural and general education may open the door to a completely new perspective on the education zone and contribute to increasing the spatial awareness of the society as a whole. Only an investor who is aware of his role as a person shaping the external environment and city space, with high aesthetic competences and extensive knowledge, guarantees the sustainable spatial development of the cities of the future.

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Sustainable Wastewater Management in South Australia

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Abstract. Inadequate wastewater management is a major source of water pollution, which poses a threat to human health, as well as to the natural environment. Thus, reducing wastewater is a major task in many countries. Sustainable wastewater management refers to a systematic solution that effectively manages the wastewater from different communities. Most countries establish wastewater discharge regulation, efficiency measures in wastewater treatment, green campaigns within the community, as well as other sustainable strategies. The aim of this research project was to investigate the current issues of wastewater and water management in South Australia, and to suggest strategies to improve the sustainability of wastewater management. We interviewed wastewater and water-management professionals, government authorities and residents, and found that the Australian government should adopt the Water Services Regulation Authority (Ofwat)'s climate change statement policy; this will achieve mitigation and adaptation to climate change, for better water-management outcomes. The methods for improving sustainable water uses in Australia involve developing more sustainable desalination plants and changing buildings' water plumbing system. Using appropriate technological innovations, policy instruments, and the sustainable reuse of wastewater, will create a solution for the Murray River, Northern Spencer Gulf and Metropolitan Coastal Waters of Adelaide. Future trends of wastewater development will mainly focus on the reuse of wastewater for non-potable purposes, reducing treated wastewater discharges to the natural environment, and embracing new technologies more systematically in the wastewater sewer system.

Keywords: Wastewater management · South Australia · Sustainability

1 Introduction

In recent years, the share of surface water from major water sources has fallen and this has put enormous pressure on water supplies for drinking, irrigation and other purposes [1]. Shrinking water resources and the increased cost of water have driven residents to conserve water [2]. At the same time, changes in water chemical properties, due to accumulation of excessive nutrients during biological, chemical and physical processes, are causing water quality problems.

Significant water quality deterioration causes the large-scale death of fish, and subsequently huge economic losses [3]. Therefore, wastewater control is crucial. This is due to continuing population growth and urbanisation as rapid industrialisation places pressure on water resources and increases unregulated or illegal discharges. When water is scarce, there is a direct impact on the biological diversity of the aquatic ecosystem, and disruption of daily life support and food production. Future water sources will be scarce for all aspects of life. Thus, wastewater management must be flexible to prevent a future water crisis. If wastewater production increases due to improper or poor management, it becomes a major source of pollution that can threaten human health and the environment [4].

2   Wastewater Management

Decentralised wastewater management is currently being considered as potentially a more sustainable option. This includes the collection, treatment and reuse of wastewater at or near its source. The improvement arising from newer decentralised technologies, compared to the decentralised privy vault-cesspool system of the 19th century, is the ability to integrate seamlessly and effectively with water-carriage waste removal [5]. In Singapore, the success of wastewater management is to a large extent due to the Singapore Green Plan 2012. Singapore's water scarcity concerns not only their rainfall, but also the limited amount of land. Thus, the Singapore Green Plan 2012 strongly emphasises "…supply and demand management, wastewater and stormwater management, efficiency and equity considerations, and institutional effectiveness and creating an enabling environment…", in order to protect and enhance the environment for future generations. Singapore relies on a separate sewerage system to "[collect] separately in a network of underground sewers that lead to a treatment plant, whereas stormwater and surface runoff are collected in open drains and channelled to rivers and reservoirs"[4]. This reduces pollutants in waterways, and ensures good quality water in the catchments.

In Western Australia (WA), On-Site Wastewater Treatment Systems (OWTS) are widely used to treat and dispose of wastewater in areas without centralised network-type sewerage. These largely isolated services are planned, provided and used in a variety of ways. OWTSs in WA are widely used as a means of disposing of and treating domestic wastewater in an urban area or other areas where no centralalised sewerage systems are available, according to the Australian Water Resources Council [6, 7].

3   Industry and Public Opinions

We interviewed wastewater and water management professionals, Environment Protection policy makers, and two resident groups. These three groups of people have provided the primary sources of information for this paper to obtain in-depth views of wastewater and stormwater management. Households were interviewed to understand SA residents' current water use behaviour. All these aim to improve sustainability of water use in Australia.

4   Findings

4.1   Professional Group

The responses from this group indicated that due to increased population, the solutions for an increased demand on water sources could include: using more sustainable desalination plants (such as newer forward osmosis technologies) to increase the water supply for major cities, as well as improving and upgrading the plumbing system for water supplies in major cities, as "this can help to supply more extra water sources for major cities by between 40 and 50%". In addition, "future buildings should be installed with two types of plumbing, which are for potable water and recycled water." The water plumbing system should be classified into recycled wastewater for garden irrigation, recycled stormwater for toilet flushing, potable water for drinking and showers, and harvested rainwater for other non-potable uses." In other words, the future water supply should be fit-for-purpose.

For high water consumption agricultural sectors, the responses included "the contamination is in the soil itself, due to irrigation by using treated wastewater sources."

With regard to water use efficiency, South Australian residents try to comply with the water conservation measures that are recommended by the government. For example, residents should not water the garden in the afternoon. Yet, they still use a high amount of water, for example, when Australian water usage is compared with other countries, "the SA residents consume more water than some other countries."

Regarding the solution to change residents' behaviour, it is suggested to "utilise public media sources, which include newspapers, TV programmes and other campaigns. This is because the public media is a fast means to change people's behaviour in using the water." In addition, the Environmental Protection Authority and SA Water should provide more campaigns and education programmes to teach people about water reduction measures."

In addition, both interviewees agreed that "the current wastewater treatment in SA is sufficient to protect the natural environment." The second interviewee mentioned: "the SA government invests more in recycled wastewater sources, compared with other states." The first interviewee stated that "our current wastewater treatment considers reusing the wastewater for irrigation of recreational areas in Adelaide." Thus, the reuse of wastewater reduces wastewater discharges into the natural environment. Regarding current knowledge and technology for reusing domestic wastewater, the interviewees had different opinions. The first interviewee agreed that "currently, knowledge and technology are sufficient, for domestic wastewater." However, according to the second interviewee, current practices are "a microscope of wastewater current knowledge and technology is still insufficient to solve the microbiological problem which is contained in domestic wastewater." In terms of reusing greywater for protecting the natural environment, both interviewees had the same opinion: reused greywater is applicable for toilet flushing and other non-potable uses, as "advanced technology of water treatment in SA can reduce the microbiology and salination in greywater."

The surveyed professionals mentioned that the "current policy of Australia is effectively in control of the wastewater production. The Australian government should

upgrade policy, including but not limited to adopting the Singapore New Water Policy and an innovative greywater recycling system to provide more water sources for Australia."

As there are still large amounts of treated wastewater with high nutrient content that are discharged to rivers, there is controversy with regard to whether Australia should look at reusing treated wastewater for human potable consumption. In addition, the future wastewater policies should introduce Water Sensitive Urban Design across Australia, given that SA is the only state that does not mandate this strategy.

4.2   Government Authority's Interviewee Group

In the survey, Government policy makers mentioned that "currently Australia is facing the problem of inaccessibility of water sources because of climate change, and the high nutrient load of treated wastewater being discharged into the sea, which causes the water sources to be polluted." And "the Australian government is lacking in strategic direction, technology use and financial funding for wastewater and water management."

Regarding the natural water condition of the Murray River, its degradation due to agricultural flood-irrigation drainage causes the drinking water source to become polluted. The first interviewee suggested several solutions to be carried out by government to overcome this problem via improving the land use, moving away from flood irrigation systems, creating a salt interception scheme and controlling agricultural irrigation. The second interviewee mentioned that the government can control flood irrigation drainage by changing the agricultural drainage discharge.

Wastewater management issues are related to may coastal areas, for example in Metropolitan Coastal Waters and the Northern Spencer Gulf, it is stated that there is a large volume of treated wastewater discharged from the plant to the natural environment (such as in Whyalla and Port Augusta). These treated wastewater discharges contain high nutrient and heavy metal loads that damage natural marine environments. Two potential solutions were mentioned include: 1) Integrate innovative technological wastewater treatment, which removes nutrients and other microbiological materials and 2) Reuse wastewater for non-potable activities (such as agricultural irrigation and toilet flushing). As there are many toxic components in wastewater sources that are not sufficiently treated in the plant, the government should focus more on legislation to control discharges.

It was also suggested that current wastewater and water treatment plants should upgrade the biological treatment technique called "Anammox", which reduces nutrient and other microbiological contaminants contained in wastewater. However, the second interviewee disagreed, as they saw no new development of wastewater and water treatment plants in Australia.

One of the respondents mentioned that the government should improve its water policies that focus on reusing wastewater sources. This suggestion may encounter a difficulty regarding the infrastructure cost of treatment and reuse plants, as upgraded and innovative wastewater treatment for reuse requires high capital investment by the government.

It was also mentioned that there is sometimes difficulty in obtaining funding from the government to implement sustainable wastewater and water policies. Future

development trends in wastewater and water management should focus on reusing the treated wastewater sources for non-potable uses, reducing treated wastewater discharged to the ocean or rivers and identify better solutions for water sustainability and reuse.

The improvement of policies in wastewater and water management are mainly focused on technical aspects such as reusing treated wastewater sources. Instead, it was suggested that the water and wastewater policies should be made more interpretable for the public. However, the difficulty of implementing these improvements is that the government requires external financial funding to be invested in water and wastewater management.

4.3   South Australian Residents' Group

Ten SA residents were interviewed to understand their water use impact and behaviour (Table 1). Table 2 shows that five interviewees mentioned that their water bill had increased in recent times, while only one recorded no increment in their water bill.

Table 1. South Australian Residents' Profile

Interviewee	Residence	South Australia
Interviewee A	Elizabeth	✓
Interviewee B	Adelaide Apartment Complex	✓
Interviewee C	Kingwood Hill Street	✓
Interviewee D	160 Rundle Mall	✓
Interviewee E	Carlew Street	✓
Interviewee F	North Terrace	✓
Interviewee G	Lynton	✓
Interviewee H	Rosslyn Park	✓
Interviewee I	Modbury Height	✓
Interviewee J	Torrensville	✓

Table 2. Amount of water bill and increment

Interviewee	Amount of water bill (per quarter)	Increment
Interviewee A	$250	Yes
Interviewee B	N/A	N/A
Interviewee C	N/A	N/A
Interviewee D	N/A	N/A
Interviewee E	$350	Yes
Interviewee F	N/A	N/A
Interviewee G	$600	Yes
Interviewee H	$400	Yes
Interviewee I	$400	Yes
Interviewee J	$240	No

Table 3 shows that seven interviewees did not reuse sink and basin wastewater. There were five interviewees who only ran the dishwater when it was fully loaded. Most interviewees took 5 to 10 min for showering. All interviewees closed water taps when brushing their teeth and shaving and adjusted their laundry water to match the load size. However, eight interviewees did not reuse their laundry water. Table 4 shows that five interviewees installed a water tank to collect stormwater for non-potable use. No interviewees preferred to water the garden during the afternoon period. Five interviewees-believed that stormwater quality is acceptable for non-potable reuse and five intervieweeswere willing to reuse their harvested stormwater. Table 5 shows the acceptable quality of storm water reused by South Australian residents. Only two interviewees have participated in the water efficiency campaign held by the SA government (Table 6).

Table 3. South Australian residents' water use behaviour and reuse of wastewater

Interviewee	Reusing sink or basin water	Running dishwasher only with full load	Minutes taken for shower	Close water taps during teeth brushing	Adjusting laundry water to match load size	Reusing the laundry water
A	No	Yes	5	Yes	Yes	No
B	No	N/A	15	Yes	Yes	No
C	No	N/A	5–12	Yes	Yes	No
D	No	N/A	15	Yes	Yes	No
E	No	Yes	5	Yes	Yes	No
F	N/A	No	3–5	Yes	N/A	N/A
G	N/A	N/A	20–40	Yes	Yes	No
H	No	Yes	5	Yes	Yes	No
I	No	Yes	5–7	Yes	Yes	No
J	Yes	Yes	10	Yes	Yes	Yes

Table 4. South Australian residents' behaviour in the period of garden watering

Interviewee	Stormwater collection tank	Period of garden watering		
		Morning	Afternoon	Evening
A	Yes	✓		
B	N/A	N/A	N/A	N/A
C	Yes	✓		✓
D	Yes			✓
E	N/A	N/A	N/A	N/A
F	No	✓		✓
G	No	✓		✓
H	No	✓		✓
I	Yes	✓		✓
J	Yes			✓

Table 5. Acceptable quality of stormwater reused by South Australian residents

Interviewee	Acceptable quality of stormwater	Stormwater reused
A	Acceptable	No
B	Acceptable	Yes
C	N/A	N/A
D	Acceptable	No
E	N/A	Yes
F	N/A	N/A
G	N/A	N/A
H	N/A	Yes
I	Acceptable	Yes
J	Acceptable	Yes

Table 6. South Australian residents' participation in government water efficiency campaigns

Interviewee	Participation in a water efficiency campaign in South Australia	Willing for children to participate in water efficiency campaigns	Water efficiency campaigns help people to reduce water consumption
A	No	No	Yes
B	N/A	N/A	N/A
C	No	N/A	No
D	No	N/A	Yes
E	No	No	Yes
F	No	N/A	Yes
G	No	N/A	N/A
H	Yes	No	No
I	Yes	Yes	Yes
J	No	N/A	Yes

5   Conclusion

Wastewater reuse has been impacted by many factors, such as the construction of desalination plants that increase the available water sources by between 40 and 50%. Future multi-pipe plumbing systems should be distinguished into four major types of water sources, which are recycled wastewater for garden irrigation, recycled stormwater for toilet flushing, drinking water, and a rainwater harvesting system for other non-potable uses. High water consumption in the agricultural sectors has been identified as a source of soil and groundwater pollution, due to irrigation using treated wastewater sources. In addition, the population of rural areas for agriculture will not produce much wastewater to pollute water sources, compared to highly populated urban areas.

It was found that SA residents generally comply with government recommended water restrictions and conservation measures. However, they still consume water at a higher rate than most other countries. The solution is to change behaviours by using media public sources, more campaigns and educational programmes about water consumption.

Furthermore, current wastewater reuse technology is still insufficient to solve all the microbiological contamination problems associated with domestic wastewater. In terms of reusing greywater to protect the natural environment, recent advances in water-treatment technologies in SA can reduce the microbiological content and salination for non-potable uses. Promoting the reuse of greywater will reduce the large amount of wastewater discharged to the natural environment.

Current policies for wastewater management are generally sufficient to control wastewater production but further improvement is required to upgrade the water policies in order to promote greywater recycling systems. However, there are still large amounts of treated wastewater needlessly discharged to receiving waters and therefore it is necessary to improve the wastewater treatment process and to provide a comprehensive explanation to the public regarding all types of water which can be "fit for purpose". The government should also mandate Water Sensitive Urban Design requirements to improve water management in SA.

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Hotel in Lisbon's Structural "Y" Between Human Factors and Gentrification

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Abstract. The hotel is one of the main constructs of contemporary landscape, and one of the phenomena that best summarizes some of the contradictions of present society, which is self-defined through two concepts that are interrelated in a dialectical and antagonistic way: Gentrification and Sustainability. The questions which the present work aims at answering are, not only how contemporary architectural hotel design has, in its different scales, been playing a determinant role in the gentrification of the center of Lisbon, but also how principles driven by the human factors/ergonomics discipline are determinant to support development, in an integrated way, namely in the three dimensions of sustainable development economic growth, social inclusion and environmental preservation, in line with the United Nations and European Union commitments towards a better future.

Keywords: Hotel in Lisbon · Gentrification · Human factors · Green hotel · Sustainability

1 Introduction

Tourism activity is currently regarded as the world's first industry [1] and one of the largest sources of income in Portugal, intensifying mass tourism.

The current situation of hotels in Portugal stands out as a means of responding to growing tourism demands. Its implementation focuses more heavily on the capital city of Lisbon or cities with a similar role. Those are under exponential pressure, without legal frameworks or hotel structures adequate and sufficient to meet the sustainability demands, resulting in an unprecedented density of hotels and short rental residential places. This creates new challenges to urban places and society. The hotel plays an active and sometimes decisive role in relation to other current issues and concerns, namely in the areas of housing, rehabilitation of the heritage, re-qualification of the landscape, intervention in the public space or (re)structuring of urban infrastructure.

The aim of this work is to study the stated dialectic, through the analysis centred in the structural Y of Lisbon, guided by ergonomic principles, based on a phenomenological reading. This approach is influenced by perceptive and cognitive schemes, rooted in the fields/force systems of the Gestalt methodology as applied to architecture.

Until the actual Pandemic, Lisbon was the fifth European city with the fastest growing number of international visitors, and the one that presented the higher level of growing tourism, with a higher density in the center of its metropolitan area [2].

The territorial structure of Lisbon is very much commanded by the city-center, mainly due to the concentration and agglomeration of tertiary functions, namely tourism, with a great polarizing effect, where the hyper-center created a hyper-periphery and the confined city became the distrusted urban scenario (Fig. 1).

Legend:
- Hotels
- Short-Rental residence
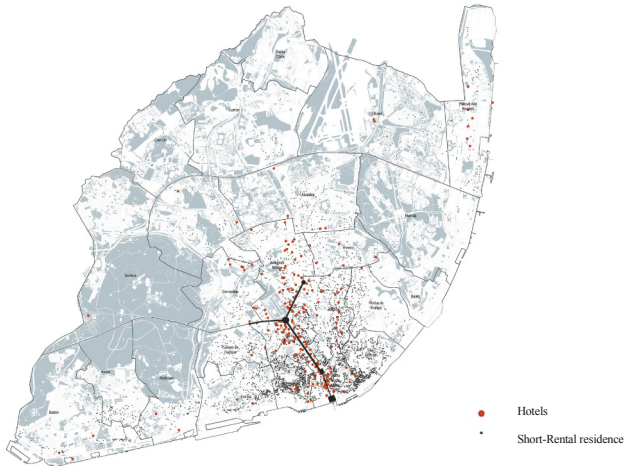
Fig. 1. Metropolitan area of Lisbon: hotels and short rental residences [2]

The structural Y of lisbon is a configuration based on the confluence of three axes on the urban center of Lisbon: Avenida da Liberdade, Avenida Fontes Pereira de Melo and Avenida Joaquim António de Aguiar. It also contemplated the extension of Avenida Da Liberdade, Baixa Pombalina, until Praça do Comércio (Terreiro do Paço) square, the origin of this arterial system, and its antechamber (Fig. 2).

Fig. 2. *The structural Y of Lisbon*: arterial system

The structural Y of Lisbon crosses the Parishes most affected by tourism activity: Santa Maria Maior, Misericórdia, Santo António and Avenidas Novas:

– Between 2009 and 2016, the number of international visitors staying overnight in the center of Lisbon grew 7.4%.
– From 2013 to 2014, the number of tourists grew by 63.7%, from 1.31 to 2.14 million.
– This accelerate growing did not stop until a year ago due to the conditionings that we are living under. Even though until 2018 the expectation was the implementation of more than 35 hotel units, as well as with the new Cruise Terminal allowing the entry of more than 617 thousand tourists in Lisbon was predicted [2].
– The upward and accelerated growth curve in the last two decades has its origins in different factors, of economic and political nature, such as the so-called "Arab Spring" the new income law, the beginning of "Gold visas", as well the decisions of the Troika and establishment of the various membership programs for foreigners in 2014 (Fig. 3).
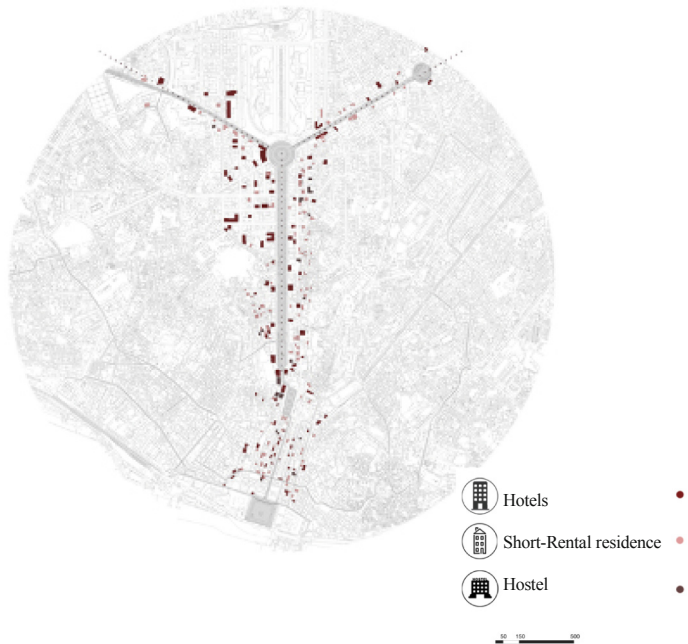
Fig. 3. *The structural Y of Lisbon*: hotels, hostels, short term rental residences

This arterial system was built in different phases, demonstrating a collective history, their different periods and intentions. The old downtown was destroyed by the earthquake of 1755 and Baixa Pombalina was built after, establishing a relationship between two squares: Praça do Comércio, (open to the river) to the south and Praça do Rossio to the north that confined to the Passeio Público, in 1780.

From the demolition of the walls that delimitated the Passeio Público, with the intention of expanding the city, the construction of Avenida da Liberdade was initiated in 1879 at the image Haussmaniana city of Paris, extending to the square Marquês de Pombal square. This Avenue, inaugurated in 1885, forks at Avenida Fontes Pereira de Melo and Avenida Joaquim António de Aguiar, which earthworks began in 1897.

Baixa Pombalina is the area where the highest density of hostels and short rental residences is located. If in the initial plan local commerce at the level of the ground floor was contemplated (as the taxonomy of the streets shows) and housing on the top two floors, nowadays these spaces are being appropriated by international service chains and by real estate companies leading to the displacement of the original local population to peripheral areas of the city.

In the Avenues, the construction of five-star hotels predominates, constituting architectural barriers that compromise their first intention of constituting a space, initially a sort of housing where nature and city met.

The few local families that are still settled in this arterial system have the tendency to transform their homes into a business of temporary stays. This transformation has led

to an innappropriate living of the city by local residents with their own identity, thus becoming a product of ephemeral and temporary consumption, like a globalized stage.

The transformations in the landscape - both cause and consequence of dominant or emerging ways of hotels, initially used as one of the main strategic axes for development, as an opportunity to enrich social, productive, architectural, urban and landscape fabrics that do not have the means to achieve it - paradoxically contributed to the exhaustion and impoverishment of natural, social and urban systems. The mono-cultivation of different typologies of hotels overlaps the existing structures, making buildings and pre-existences redundant, promoting the progressive gentrification, or thematization of the city that annuls its specificity (intrinsic values) as the destination of choice.

"Gentrification" - an expression initially used by Ruth Glass in 1964 and consolidated by Neil Smith in "The new urban frontiers: gentrification and the revanchista city" - is a process associated with economic and social changes. It reflects the appreciation of real estate, namely through tourism, with impacts on heritage, social segregation and the unsustainability of the lives of people with less economic power who reside there. The average values practiced in areas with greater tourist density reveal an immense effort for daily and occasional mobility. Exemplary of this is the central core of Lisbon, which has become a permanent congestion that fills and empties every day.

The experience of the city, in spite of the historical varieties, new spatiality and temporality associated with the conception of postmodern hyperspace, continues to establish its syntactic structure in tissue that weaves semantics between the built, and what is to be built and integrated. However, it is still perceived by citizens and tourists as the nucleus of the genetic code that being here and now, where the being situates him/herself, organizes their immediate surroundings based on their perceptions, cognitively identifies their position in the external world capable to be mapped, in which body and built environment are able to stand as a symbol and "analogue" [3].

According to T. Barata Salgueiro, and P. Guimarães, in Lisbon the implementation of hotels has been essentially associated with economic factors, in an accelerated postliberal logic, leading to progressive gentrification, the right to "polis" to a large number of inhabitants and increasing several conflicts, namely "cancellation of local characteristics versus global machine that standardizes the locus at the service of the market".

In order to avoid the increase of multiple phenomena of gentrification principles concerning the Human Factors/Ergonomics [4] discipline has been well addressed by various authors. It depicts an iterative process for hotel design activities such as users' involvement, their variability and diversity consideration in the different phases and cycles of the project and building, from project to post occupancy analysis and optimization.

The human-centred hotel building design methodology presents how a holistic approach of ergonomics is determined for a sustainable development, in order to assure corporate social responsibility based on global and local value creation.

We conceived a diagram using as a reference the study developed by Buthayna Eilouti, that illustrate how Environment, Building and the Human are taken in consideration in extended ergonomics. The referred diagram has the purpose of summarizing some principles that could meet both present and future needs of the Hotel typology, in accordance to our case study on the Structural Y in Lisbon, without distressing the ecosystem and the environment (Fig. 4).

Building/Environment interaction:
Reduce Density
Climate resilient infrastructures
Decarbonising the energy sector
Passive systems
Responsive Design
Improve global environmental standards
Rehabilitation
Re-use
(....)

Enviroment
Structural Y of Lisbon

Building
Hotel

Green Hotel
Lisbon

Environment/HF interaction:
Inclusive design
Preservation of resources
Restore biodiversity
Safety
Environmentally friendly
 technologies
Reduce Pollution
Landscape optimization
(...)

Human Factors (HF)
Tourists/Residents

Building /HF interaction:
Inclusive Design
Co-creation
Circular economy
Flexibility
Multi – use
Health
Functionality
Comfort
(...)

Fig. 4. *Structural Y of Lisbon*: green hotel

Through this approach we hope to contribute to what we denominate as the Green Hotel, which could be the basis for a new paradigm of this typology with the aim of achieving a more sustainable global and local development that could work as a trigger to face the uncertain future.

References

1. UNWTO, World Tourism Organisation, October 2018
2. According to statistics Portugal disseminates, INE, Instituto Nacional de Estátistica (2018)
3. Analogue, from ancient Greek is taken as analogous and According to Sartre, an equivalent of perception (such as a painting or a mental image) that is necessary for the process of imagination to take place
4. According to the International Ergonomics Association (IEA), Ergonomics is "the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to Design in order to optimize well-being and overall system performance"

The Pro-user Revolution in Design of Military Complexes in the Interwar Period

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Abstract. Imposing barrack complexes created before the outbreak of WWI represented the so-called "architecture of power". Their stylistics were mostly historicizing directed at influencing the local identity with the notion of the strength and unity of the state. However, since the 1920s, the Polish Army was also a part of national policies of modernization and the tool for showing the open-mindedness and forwardness of the newly freed state. New functional layout incorporated improvements introduced in the dwelling houses by the building cooperatives associated with the "Werkbund" movement or Warsaw Housing Cooperative (WSM). This is best seen on the example of new types of barracks for privates and housing complexes for officers and NCO's, which were to provide a healthy living environment and build proper attitudes of residents. For a brief interwar period, military architecture joined the architectural mainstream, shedding the historic costume in favor of advocating the modernization.

Keywords: Barrack complexes · Modernist architecture · Military cooperative

1 Living Conditions of the Military After WWI

After the end of the First World War and 123 years of partitions, Poland regained its independence. In the first period after the Republic of Poland re-emerged as an independent state in 1918, historical Polish barracks, as well as those that had been built by the partitioning powers, were used to house the numerous soldiers, who were engaged in military struggle. Insofar as the halls of German dormitory barracks were equipped with furnaces, each of their floors had toilets and there were washrooms in the cellars, the literature includes accounts of completely different conditions discovered in formerly Russian barracks that did not have washrooms and the heating output of their furnaces did not allow for heating resident halls [1]. Only the Riga Treaty of 1921 and the armistice it initiated allowed the Polish side to demobilise its army and reorganise it for peace time.

It appears that, during the period of rebuilding, the Ministry of Military Affairs of the newly-independent state saw it as a matter of honour to formulate a Polish canon of barrack buildings that would be independent of similarities to historical types. Attempts were made to create a new type of barracks - suitable to new concentration conditions and military unit structure, as well as new military tactics. In the foreword to a special issue of *Architektura i Budownictwo* journal from 1933, that was devoted to post-First-World-War military projects, barracks that had been built by the partitioning powers

were collectively described as 'brutal, soulless, created to shape the psyche of a thoughtless stickler' [2]. Up to 1932, military architecture in Poland did not have a set barracks type that would satisfy all functional, sanitary and technological requirements. This state of affairs detrimentally affected commissioned and non-commissioned officers for whom quarters of varying standard were rented out in different parts of garrison cities. Along with a reorganisation of the armed forces, military command had to provide barracks and housing to an enormous number of soldiers and officers. In 1925, the Armed Forces Peace-time Accommodations Act (Dz.U. 1925 no. 97 item 681) was enacted for this purpose. Decision-makers showed appreciation for the efforts of military personnel, establishing them as a separate social class and elevating them to the rank of the elite.

Particularly, officers were given special state privileges such as access to specialist healthcare and housing. When we think about military architecture, we typically imagine standardised urban blocks of historicising architecture: solid, austere and repetitive. However, due to the height of development of military architecture coinciding with the partition period, when newly-built military buildings of the Second Republic were considered, there were natural attempts to reject all standards established by historical barracks complexes. Barracks designs were always under the ideological control of decision-makers. This is why ambitious, Modernist barrack building designs were not the outcome of a lack of ideological control, but rather an encouragement to pursue a new style, that would fit an advanced and modernising country. They were to be means of modernisation for a state poorly developed due to years of occupation. The creative freedom of Modernism, that was experienced by designers, allowed them to fill the gap produced by years of severe partition-period cultural policies. All the changes that took place in military architecture can certainly be called a revolution. Modernism introduced the human factor to Polish designs of interwar barracks by providing hygiene, air, light and space to traditional military rigour.

2   In Search of a Healthy and Economic Barrack Complex

The first newly-erected barracks of the Second Republic saw the application of a pattern based on a type of German barracks. It was a two-company dormitory building (for ca. 200 soldiers, officers and non-commissioned officers) with a single-side hallway along the entire building and two side stairwells in the side wings. It differed from the historical pattern only in the asceticism of its facades, which (although not strictly Modernist yet) did not have parapets, window casings or ornamentation. These buildings, despite having dormitory halls with a floor area ranging between 40 and 60 m^2 and hallways with a width of 2.5 m, did not provide a sufficient hygienic standard. The halls, extending 7 m deep into the building, were daylit only from one side and heated using corner-placed furnaces. They also suffered from high construction costs, 30% of which were hallways [3], that were criticised for sanitary reasons [4]. The widely used hallway-type layout, that allowed for the placement of bedrooms along one of the walls, was criticised because all the privates assigned to a given floor came into contact with each other in the corridor e.g. during reviews. The hallway was

also criticised as a source of night-time noise. Most importantly, the placement of the soldiers' bedrooms did not provide cross-ventilation and two-sided daylighting.

To lower construction cost, a Design Bureau was created in the Construction Department of the Ministry of Military Affairs. It was to develop pattern-based designs of new buildings, intended to be hygienic, purposeful in their functional layout and featuring cost-effective structural solutions based on standardised building components. The internal spaces of these buildings were to have 'furnishings that are modern in every sense'. The purposefulness of the buildings' structural systems and the ergonomics of dwelling layouts became the overarching principle, which meant that space was to be used efficiently with aesthetics being taken into account at all times. In this respect, it can be said that interwar military architecture saw a revolution comparable to that of the modernist building reform movement, that brought the development of subsidized public housing estates.

The Construction Department of the Ministry of Military Affairs made attempts to create a standardised and repetitive barrack complex. In 1928, the Design Bureau of the Construction Department of the MMA developed a new, experimental design of a hygienic and healthy barracks. The starting point for its design was the assumption that small, thirteen-bed resident halls (i.e. for one squad) offered the greatest degree of hygiene. They were to be well-insolated and cross-ventilated. The principle that military buildings were to mainly look imposing in terms of scale and grandeur was abandoned, and hygiene and the health of the enlisted was placed first (Fig. 1).
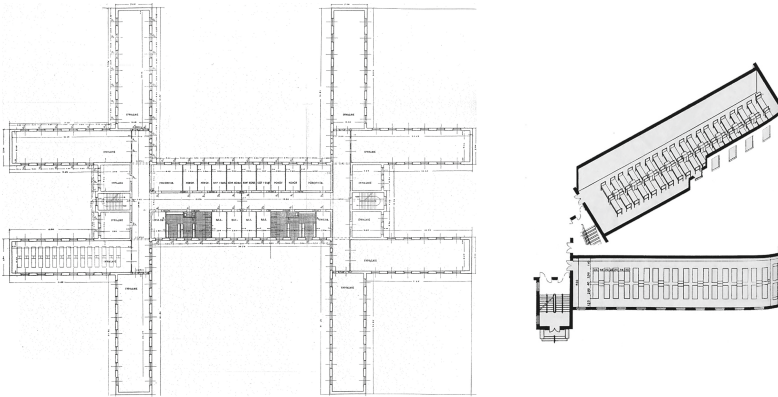
Fig. 1. The ground floor of the prototype 'hall-less' barracks (reproduction from [4]).

The proposal for the barracks for the Rybnik battalion was the first to be designed following the new principles. The design used a 'hallway-less' solution. However, it was not based on halls in enfilade, but instead on a multiple-wing layout, in which eight bedroom sections extended from a three-bay main body that housed an administrative section, washrooms and non-commissioned officers' accommodations. It was abutted on two sides by stairwells and short transverse hallways from which four single-bay resident halls could be accessed. Every floor could house two companies (each

occupied four resident halls), and the entire building could house a battalion. The new layout was not inferior to the hallway-type pattern in terms of accommodation capacity. The dormitory hall floor areas were calculated so that they could house two squads each (twenty-six soldiers), assuming enough spare room to fit an additional six beds. The beds were placed 1.25 m away from the wall, leaving 40 cm between headboards and 60–80 cm of walking space between beds. Additional space was provided by eliminating furnaces, which were replaced by central heating. This layout enabled cross-ventilation and daylighting the dormitory halls along their longer sides. The attics were to feature spaces for reserve personnel.

Considerable attention was focused on the impact of the barracks' functioning during unfavourable weather conditions. Due to numerous days with heavy rain, the custom of placing the mess hall in a separate building was disqualified [4]. The basement of the building's main body was assigned as the location of the battalion kitchen, while the side wings featured dining spaces and lecture halls. If the need arose, they could be used as gathering points and for uniform inspections. Despite fears of odours spreading to upper floors, this layout eliminated the danger of the uniforms becoming damp and the soldiers getting a cold, as well as the unsightly and unhygienic eventuality of dirtying the floor of the dining room with mud. The semi-basement, its floor located 1 m below ground level, offered the same daylighting and cross-ventilation as the freestanding building. However, the placement of the dining room in the basement provided a better indoor microclimate: it was warm in winter and cool during summer. However, this layout generated higher maintenance costs due to heating dormitory halls that had two exterior walls (Fig. 2).
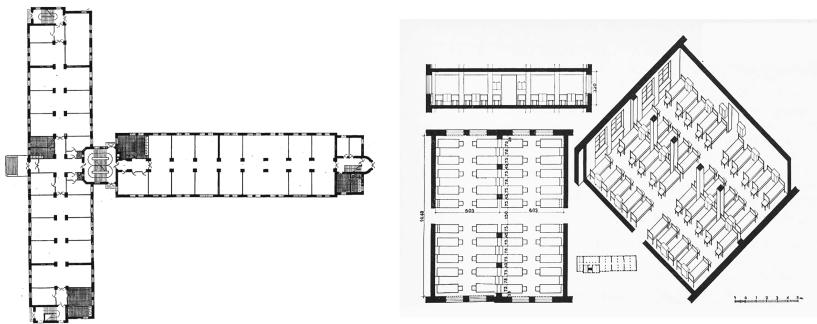
Fig. 2. A draft of the spatial disposition of a dormitory in an enfilade (reproduction from [3]).

This system was well-suited for application in smaller complexes. However, due to the demand for accommodation, military command decided to search for a pattern that would allow for the simultaneous housing of a larger number of soldiers and opening a separate kitchen and mess hall for issuing meals to an entire regiment at once. Before the construction of the new 'hallway-less' pattern of barracks was abandoned, three complexes of such buildings were built in the years 1929/30, based on designs prepared by the Design Bureau of the Construction Department of the MMA.

The primary downside of the pattern-based design system was that its overarching concept did not account for the fact that the army is a living organisation, that constantly changes depending on training systems and currently applied military tactics, and as such cannot be confined to an inflexible, typified solution. Buildings that satisfied every possible need, despite the intent to make them cost-effective, were in actuality too expensive, as adapting them to the local terrain, climate and soil strength necessitated their redesign. The patterns greatly restricted those tasked with the redesign and made it difficult for them to find the cheapest and most suitable design solutions. The adaptation to local conditions, unaccounted for in bills of costs, resulted in additional works despite the generally high precision of the calculations for the design patterns [3].

The subsequent barracks and multi-family housing buildings were designed via competitions and commissions, with the participation of the period's most illustrious architects defining new trajectories in architecture. One of the first architectural competitions for a standardized commissioned officers' house in 1928 concluded with the first prize being awarded to Bohdan Lachert [5] and the activity report for the Military Accommodations Fund was written by Jan Maurycy (Marek) Leykam. Military complexes, similarly to workers' housing, acted as testing grounds for new solutions in multi-family architecture: providing dwellings that were highly cost-effective while also meeting all the standards of contemporaneous hygienic housing.

The growing housing crisis forced the Construction Department to pursue cheaper solutions, which would allow proper cross-ventilation and daylighting, but that could also house greater numbers of servicemen in a single hall. With no intention of returning to the hallway-type design, the Construction Department of the MMA decided to introduce small modifications to the original multi-wing plan, based on using single-bay enfilade (walk-through) bilaterally daylight halls that abutted day room. This pattern was seen as the most suitable from the standpoint of a compromise between the health benefits of the design solutions and their cost-effectiveness. Each section with beds had a length of 648 cm and a width of 603 cm. Between them there was a walking space with a width of 150 cm, resulting in a bay width of 1,446 cm with a clearance height of 320 cm. The hall had room for forty beds for servicemen. In addition, the dormitory buildings housed: a day room, washrooms with toilets (one toilet bowl per twenty-five people), rooms for unmarried non-commissioned officers, storage space, offices, lecture halls and dining rooms. By commission of the MMA CD, Bruno Zborowski designed two such buildings. The first was a battalion barracks building built in Rembertów. The building comprised of two blocks linked by a stairwell so as to form a T-shaped plan. Each wing was composed of six halls for soldiers that ended in a short hallway near the distal stairwell, a room for non-commissioned officers and a storage space. The crossing hall located centrally between the wings provided access to day rooms and washrooms, as well as a stairwell. A third, transverse wing was placed at the back of the building, along the axis of the main entrance. In the second barracks pattern that had walk-through halls (for a squadron), the central double-bay block was designed analogously, with single-bay wings added on both sides. The wings had long, transversally oriented halls insolated on one side through a semidetached passageway. The building had a U-shaped outline formed by its three wings [6].

This solution had the strengths and weakness of both systems. When analysing the ergonomics of enfilade soldier dormitory halls, the designers accounted for daylighting, cross-ventilation and intimacy. Walk-through halls, while allowing for proper supervision by personnel of superior military rank, housed twice as many servicemen, offering cross-ventilation and bilateral daylighting. The placement of the building with bilaterally daylit halls was independent of its orientation relative to the cardinal directions: even if one fenestrated wall faced north, the other was daylit from the south. Their main weakness was that it was easier for pathogens to be transmitted between squads during an epidemic. Despite certain defects, this type of barracks became the official standard during the interwar period.

3 New Residential Architecture for Commissioned and Non-commissioned Officers

After 1927, married commissioned and non-commissioned officers were provided accommodations in houses and housing complexes of the Military Accommodations Fund (Fundusz Kwaterunku Wojskowego, FKW). The FKW was established in 1927 (Dz.U. 1927 no. 37 item 333) and tasked with building housing for the members of the Polish Armed Forces. The FKW's buildings were designed to be cost-effective while being equipped with state of the art sanitation technology. The FKW was to build only block housing, with buildings having the maximum possible height allowed in regulation plans of the relevant locality or district: of two, three, four or five storeys - if equipped with lifts. The basic dwelling unit that the FKW built was a small single-aspect apartment. They were cheap and many of them could be designed within a single segment. However, these new apartments, even if they could not be cross-ventilated, were of a higher standard than those offered in tenement houses. Wherever possible, sections with single-aspect apartments (four around a single landing) were accompanied by buildings with semi-double (three apartments around a single landing) and double-aspect, cross-ventilated apartments. One of the major principles was the use of a laboratory kitchen, which allowed two separate rooms to be fitted into a section, which residents saw as a better solution than a live-in kitchen and a room. Their preferences were studied via surveys. Despite small budgets, there were attempts at comprehensively arranging the site using street and garden furniture: fences, sports facilities for children, flower beds, patches of trees and bushes.

The new doctrine was put in place in 1932 along with the construction of officers' housing by the FKW in the block between present-day Koszykowa, L. Krzywickiego and Nowowiejska streets, and Niepodległości Avenue in Warsaw. They represent a functionalist approach to housing design using repetitive segments. Two architectural competitions were held to determine the best urban design solution. The first competition, which was hosted in the years 1931–33, resulted in the residential building on the corner of Topolowa and Koszykowa Street, built to a design by Romuald Gutt and Józef Jankowski. The jury of the second competition selected a design by Jan Reda [7]. The design was realised in the years 1932–35 at the corner of Nowowiejska and Sucha streets. These were some of the largest construction projects by the FKW. Both complexes were characterised by a high density. The complex at Koszykowa Street

featured 164 apartments in thirteen segments that were six to seven storeys high, while the complex at Sucha Street featured ninety-three apartments in nine segments that were five to six storeys high.

Despite the different years in which the two projects were built, they had many common features: corner vertical accents and a stepped corner composition. The facades at Koszykowa Street were finished with cement blocks, while those at Sucha Street: with clinker. Both complexes display the same functionalist approach. The new style of design manifested itself in rectilinear masses devoid of any ornamental detail, featuring balconies facing urban interiors. The apartment layout was also designed to provide comfort to residents. Every section only had two double-aspect apartments with either three or four rooms. Due to their location, the buildings were composed of both east-west and north-south segments, which is why the apartment layout was not strictly dependent on insolation, but was instead functionally zoned. Bathrooms, kitchens and the helps' quarters that abutted them were placed directly near the entrance. Kitchens were designed to have the smallest possible dimensions and were suitable only for cooking and preparing meals. Most apartments in the Koszykowa Street complex had a floor area of between 89 and 115 m^2, while those at Sucha Street had between 83 and 96 m^2. The buildings were equipped with lifts because of their height, which significantly improved their standard (Fig. 3).
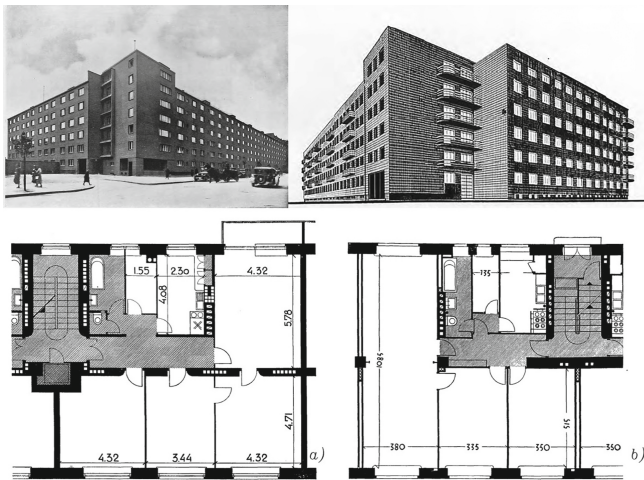
Fig. 3. A juxtaposition of the two houses in block at Koszykowa (reproduction from [7]).

The standards formulated during the initial years of the FKW's operation were maintained over the Fund's later activity. It actively operated all over the Republic, building housing for commissioned and non-commissioned officers in Warsaw, Gdynia, Kielce and other cities. Over time, the designs of housing complexes started to follow the principle of hygienic insolation along the north-south axis, with internal courtyards in the tradition of garden-cities, which provided residents with a semi-private space for integration. Contrary to Prussian models, commissioned and non-

commissioned officers were no longer a tool meant to supervise servicemen and as such no longer had to be accommodated with them at barracks. It was a prestigious duty to provide them with healthy and comfortable apartments in the vicinity of the dwellings of other high-ranking military personnel, suitable to their rank and station, and which facilitated camaraderie between them.

During the initial period of its operation, the Military Accommodations Fund limited itself to only building housing for military personnel. The success of these development projects caused the FKW to also engage in building military utility buildings, such as the Office Navy Directorate in Warsaw at Wawelska Street, built to a design by Rudolf Świerczyński. Due to the high effectiveness of the FKW's real estate development operations, state institutions such as the Supreme Chamber of State Control, the Ministry of the Treasury and the Ministry of Justice also commissioned it to build their respective headquarters.

4   Conclusion

During the interwar period, the Army Command and representatives of the state administration focused a great deal of their attention on the matter of military accommodation, which was not only an economic matter to the officer cadres, but also, and perhaps most importantly, of hygiene and morality. By following the currents of the time, it was believed that healthy and hygienic housing produced a better human being, affecting not only their health, but also their morale. Two institutions established for this purpose undertook the task of developing a new pattern of cost-effective, hygienic and beautiful accommodations: the Construction Department of the Ministry of Military Affairs and the Military Accommodations Fund. Improvements in the new type of dwellings and barracks were twofold: safe and healthy material solutions and the improved design of floor plans and building layouts. Architectural competitions - popularised primarily among young architects in cooperation with the Association of Polish Architects - were organised to achieve this goal: one called for the design of a small apartment, while another for the rational design of the ancillary section of a dwelling [6]. This aided in formulating floor area, cross-ventilation and insolation standards that were hygienic and economically accessible to military personnel. Designers took great care to ensure fire safety and to reduce the necessity of future repairs, which is why the FKW's projects became the first in the Second Republic of Poland to feature reinforced concrete flat-roofs instead of timbered ones. All of these factors contributed to the perception of military architecture, historically associated with standardisation and crudeness, to become a byword for progress, spatial order and healthy architecture in the Second Republic of Poland.

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Architectural Design After the Information Revolution

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Abstract. The article presents authors' observations on contemporary architecture responding to social, economical and cultural changes related to the information revolution. The research is based on original case studies and experiences by renowned Studio Konior. According to the authors, the examples presented meet the needs, aspirations and express longing of the information society to create smart, multi-functional spaces for culture, education, connecting communities through interests and providing them with space of encounter. At the same time they underlining the historical value of space, supporting the social sense of identity. Presented projects introduce high-quality contemporary design through the adaptation of local historical space; connecting through avant-garde design to the global contemporary poetics.

Keywords: Information society · Adaptation · Culture · Education

1 Introduction

The development of the information society causes a situation in which the generation, distribution, use, and integration of information is an important factor of social and economic development. It has many references, covering the economy, politics, culture, science, education, and customs. Many terms associated with this concept have become a common use: knowledge-based economy, telematic society, network society, post-industrial society. The concepts of digital citizens and information exclusion are known.

It is widely believed that the production and distribution of knowledge is an essential element of competitive advantage in the economy and politics. One of the first scientists to notice the relationship between information and the economy was the economist Fritz Machlup [7], who in the 1930s began researching the impact of patents on the competitiveness of production in the USA. His book, published in 1962, gave rise to a rapid development of research in the field of the influence of knowledge on economic, cultural, and civilization development.

The impact of knowledge, technology, and information on economic development, military techniques, politics and economics has been published in many scientific studies. The basic synthesis of this problem is already a classic work by Alvin Toffler

entitled "Third Wave" [9]. On the other hand, the scope of the influence of construction technologies and information on architecture is still the subject of discussion. The problem is not so much related to the design workshop, where new technologies have set methodological standards, but above all to defining the place of architecture in the space created by the information society. There is no clear answer whether and to what extent information and multimedia technologies contribute to the improvement of architecture. Is the progress in this area just a marketing activity, or does it actually meet the expectations of users? This ambiguity is due to the dual role of architecture.

Architecture consists of artistic values and technical values. Architecture as an area related to intuition, talent, and creation - just like poetry, painting does not succumb to technological progress easily, only metamorphoses occur here, resulting from the spiritual and emotional needs of recipients.

Architecture, understood in technical and economic terms, and thus as a use value, is obviously subject to innovation, a clear progress, just like other areas of our life. It is worth noting that changes take place quickly here, and just as quickly new "novelties" are no longer of interest.

While there is no doubt in Jean-François Lyotard's assertion that "knowledge has become the main driving force of production in the last decades", such a thesis in relation to architecture is debatable. As Walter Benjamin rightly observes [3], instead of creatively stimulating and interpreting technological progress, architecture seeks with increasing difficulty the possibility of adapting to this progress.

The rules of composition, colors, rhythm, articulation, reference to the context do not necessarily have to be conditioned by the efficiency of information flow and new technologies. On the other hand, the creative activity of many architects relates to the needs of the modern society of knowledge.

In this context, the following problems can be noted:

– The problem of transferring social, productive, cultural, and economic functions from real to virtual spaces. This problem is pointed out by Ewa Rewers in her work "Post-polis. Introduction to the philosophy of the postmodern city" [8]. This phenomenon has been exacerbated by the COVID-19 pandemic.
– The problem of the disappearance of local identity and social ties, superseded by strong individual experiences related to active participation in the virtual space of the Internet, escapes from real interpersonal contacts. This issue, as a characteristic consequence of "information culture" is the subject of research by Siegfried Kracauer [5].
– The problem of superficial aestheticization of architecture resulting from dependence on the media image. Replacing the creation of an architectural composition with "architectural stylization" - not related to the function and structure of the object, but only to the fashion created by the media in the global network. Interesting observations related to the surface aesthetics of the computer-designed environment, reminiscent of "icing", are contained in Wolfgang Welsch's work entitled "Aesthetics beyond aesthetics" [10].

According to the authors, these problems are most clearly manifested in the fields related to culture and education (architecture of schools, museums, cultural centers) and housing (housing architecture).

According to the authors, the examples presented below defend themselves against the phenomena mentioned. The authors selected the projects and realizations of Studio Konior, which, in their opinion, meet the needs, aspirations and longings characteristic for the society after information revolution:

- underlining the historical value of space, supporting the social sense of identity, roots and connection
- creation of smart, multi-functional and flexible spaces for culture, education, events, connecting communities through interests, knowledge and providing with space for encounters
- introducing high-quality contemporary design through the adaptation of local historical space - connecting it to the global contemporary stylistics.

2   Case Studies Analysis - Adaptation of Space of Historical Value to Support and Celebrate Culture, Education and Local Heritage

Coal mine bathhouse in Zabrze, Poland
Coal mine bathhouse in the town of Zabrze, Poland was built in 1890. The building served the miners as a social base and consisted of a bathhouse and a cloakroom with characteristic hooks on chains, on which clothes and personal belongings were left. The original ceramics, a shower system and a fragment of a cloakroom with hooks and chains have been partially preserved inside. The Coal Mining Museum in Zabrze carries out the project of the "Królowa Luiza" adit here. The adit complex includes both buildings, the industrial infrastructure of the Królowa Luiza mine and the main adit. The mine bathhouse is a place where tourists buy tickets and collect helmets while waiting to visit the adit.

As part of the revitalization of the bathhouse, three large spaces were composed: The mine's cloakroom, the exhibition hall, and restaurant area, on 1,200 square meters of space. Thanks to application of flexible solutions, the service of tourists can be performed together with concerts, theater performances, and museum exhibitions, supporting industrial tourism development. The revitalization is an example of a creative activation of industrial heritage in Upper Silesia. The opening of the facility to the public was enhanced by an exhibition of paintings by Silesian painters, Marek Idziaszek, Andrzej Marcol and Czesław Fojcik (Figs. 1 and 2).

Fig. 1. Coal mine bathhouse Zabrze (Poland). Design: Konior Studio and OVO Grąbczewscy (2014–2015).

Fig. 2. Coal mine bathhouse Zabrze (Poland). Design: Konior Studio and OVO Grąbczewscy (2014–2015).

"Browarium" in Tychy, Poland

The project of Tychy Brewery "Browarium" assumed a comprehensive modernization and renovation of the historic substance along with its expansion. The basic rule in the project was to preserve and display the unique values of the historical site, with new elements characterized by strongly contemporary aesthetics and avant-garde compositional language. The two-storey entrance atrium resembles the former wooden gallery, the worn-out plaster was removed and the damaged brick and stone walls were fully restored. In the old structure, a series of voids have been 'cut out' for convenient communication for the public. Considerable heights of the interiors were used, adding an exhibition space on the mezzanine. All exposed structural elements have been made of architectural concrete and equipment details and accessories have been designed individually for the museum.

One of the top priorities was the preservation and protection of historic old trees on the site. Adapting the surroundings to new needs consisted in creating a place that would combine the function of a park, an entrance square and an outdoor exhibition space. A curiosity attracting tourists are the historic railway wagons on the tracks around the building (Fig. 3).

Fig. 3. "Browarium" Tychy (Poland). Design: Konior Studio (2004).

Academy of Music in Katowice, Poland

The extension of the Academy of Music located on a plot of one hectare in the very center of Katowice is an important element of the dense urban context. The building creates architectural continuation of the Damrota street frontage, reinterpreting historical shapes, materials, detailing in pure, contemporary architectural form. The new facility includes a concert hall with library and administrative areas and has been divided into two main bodies. Two inner axes connect the rector's office, administration, Academy's senate, auditorium hall and foyer. Two new entries lead to two parts of Academy: west side with cameral – everyday functions, and east side official – with auditorium hall and foyer. Main hall is accessible for the public supporting the urban life, providing space for direct interaction (Fig. 4).

Fig. 4. Academy of Music. Katowice (Poland). Design: Konior Studio (2005–2007).

Czechowice-Dziedzice Ecological Education Center

As the originators of this investment write, "The Ecological Education Center would be a facility combining recreational and educational functions, and at the same time will enable the protection and exhibition of the historic ruins of the Wilczków Manor". The project contains solutions typical for the development of sustainable tourism, exhibiting ecological, social and economic integrity and coherence. The project is a model example of active protection of cultural and natural heritage making this heritage

available to the general public, providing spaces for integration direct interaction. The investment provides educational, sports and recreational services serving and supporting local community.

The aim of the investment was to restore spatial order in a neglected area and protect valuable heritage of the site. Konior Studio designed the Ecological Education Center as a facility where architecture complements nature. Next to the historical ruins of the Wilczków castle, an observation tower has been built, as well as a pavilion serving tourist services. A program of education and promotion of the natural wealth of the region is implemented here, as the site is located in the area around the Czechowice stream providing an outlet for rainwater and meltwater flowing through ponds for fish farming, and there are over 260 species of plants in the area (Fig. 5).

Fig. 5. Czechowice-Dziedzice Ecological Education Center (Poland). Design: Konior Studio (2018–2020).

3 Conclusions

The presented architectural projects featuring the adaptation of space of historical value to the needs of education and culture significantly change the urban landscape, adapting the surroundings to respond to social, economical and cultural changes connected to information revolution. The buildings support the value of direct interpersonal contact as a factor that builds social bonds.

Relating this postulate to architectural practice, there is a need and a mission to build urban and architectural spaces of encounter. In this context the concepts of Jan

Gehl [4] should be taken under consideration. In "Life Between Buildings" he writes about the three types of activities in public spaces: necessary activities, optional activities and social behaviours [4]. The necessary activities are the ones which must be performed in the public space. The optional activities are the ones that a user of the space performs only under certain favourable conditions, most often in areas with high values of composition and landscape. Social behaviors are those that depend on the presence of other people in public spaces. Social attractions occur spontaneously as a direct result of people moving and staying in these spaces. Social behavior is favored (although not directly) by the situation when necessary and optional activities have better conditions in the public space.

In the information society, access to information in the form of direct communication has changed its qualifications. From the category of necessary actions performed in the space of the city, it turned into an exclusively social action in the contemporary times, after information revolution. The analysis of the presented case studies shows how the heritage sites can be been creatively transformed into an asset that socially activates the locations of the presented buildings.

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Digital Design Tools in Polish Architectural Practice Against the Backdrop of Developed European States

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Abstract. This paper presents a research report on the practical applications of digital design tools at Polish and European architectural studios. The Computer Assisted Web Interview (CAWI) method was used in the research to obtain cross-sectional data facilitating assessment of the phenomenon in question in 2019. Auxiliary observation and comparative diagnostic methods were used to augment the survey. The obtained research results are useful in determining the current competitiveness of domestic architectural studios in comparison with developed European countries and to extrapolate trends within the said scope. In their own right, the obtained results are helpful in profiling university courses in the field of architecture and urban planning at Poznan University of Technology.

Keywords: Digitalisation · Architectural design · Competitiveness

1 Introduction

The paper presents a report on comparative analyses of the use of digital design tools in architectural practice in Poland and selected developed European countries (the United Kingdom, Germany, France, Italy, Spain, Portugal, the Netherlands).

The research was carried out in 2019 with the aid of Poznań University of Technology Faculty of Architecture students and under the guidance of the author.

The research objective was to compare the degree of use of digital technologies (according to application groups) at Polish and European architectural studios.

Our research has broadened the knowledge on the use of the latest digital technologies in architectural practice. In particular, the demand within the architectural services market (sector) for new employees with specific skills within the scope of using modern digital design support tools was examined. The significance of the research results is twofold. Firstly, they will make it possible to better adapt the curriculum of architectural university courses in the field of modern computer-aided design technologies to the needs of the architectural services market, and in particular to the requirements in this area the architectural studios have in recruiting newly

graduated designers. Secondly, the research will make it possible to assess the degree to which digital tools are used in practice across architectural studios in selected European countries, and its impact on the competitiveness of these studios.

The problem set in question is current due to the fact that design is a key element of the investment process, determining not only quality of the built environment but also investment cost and time. It also has an impact on investment risk within the construction industry. According to the World Economic Forum 2016, the construction industry accounts for 6% of global GDP [1].

It is worth realising that globally, on a daily basis, the population of cities grows by 200,000. They all require housing, public transport and social infrastructure facilities such as schools, kindergartens, hospitals, etc. [1]. The growth of the design services market in the construction sector is mainly driven by increasing investments.

According to a report by Grand View Research, the global architectural services market will be values at USD 391.97 billion by 2025, an increase of USD 104.33 as compared with 2016, amidst intense competition among design service firms [2].

Such a situation requires implementation of new solutions to improve quality and reduce design costs. Digital technologies are thought to be of key significance within this scope. The most recent achievements within this filed include: cloud computing, big data, Internet of Things (IoT), predictive analytics, augmented reality, generative and parametric design, photorealistic imaging, crowdsourcing, 3D printing, swarm intelligence as well as digital fabrication. All these trends are changing the way buildings are designed, constructed and managed.

For example, building information modelling (BIM) in the UK alone is estimated to save £80 million in design costs each year. This is an example of the competitive advantage that studios applying digital design methods stand to gain.

Traditionally, the highest demand for design services is generated by residential construction. However, significant investment increases are expected in the energy industry, public transport (roads, airports) as well as the trade and services sector. According to Grand View Research, growth in these sectors will reach 9.1% by 2025. Architectural services in the education sector will grow by 8.0% during this period, and the market for regional urban planning services will grow by 3.6% [2].

At the same time, a gradual shift in the architectural industry is expected towards consultancy services, investment process management, interior design and urban planning. And this will change the profile of architectural studios [3].

An interesting trend is the development of Requirements engineering as a specialisation improving the organisation of the investment process [4].

According to the Architectural Services Market Size & Trend Analysis Report, traditional architectural services such as computer-aided (CAD) architectural and engineering drawings as well as graphic visualisations will see a sharp decline by 2025 as these services are being increasingly outsourced to small firms in Asian countries (India, China, Philippines, Indonesia). Expectations in terms of project innovation will increase until 2025. In particular, this entails new design methods that result in an unconventional association of ideas and concepts in order to search for creative design solutions [5].

It is worth noting that this applies to all stages of an investment project, from the coining the creative concept, through the successive, increasingly advanced stages of

the design process, to the production of components and on site implementation. Importantly, this applies to the organisational, economic, construction, functional and utility aspects of a project.

The growing popularity of studio rankings according to prestigious architectural competition awards reflects these trends well [6].

The World Design Rankings, published interesting results which rank countries based on the number of designers who have won A'Design Award prizes between 2010 and 2019 [7]. Figure 1 shows the overall number of awarded designers in selected European countries. Clearly Italian, British and German designers currently enjoy the greatest reputation.
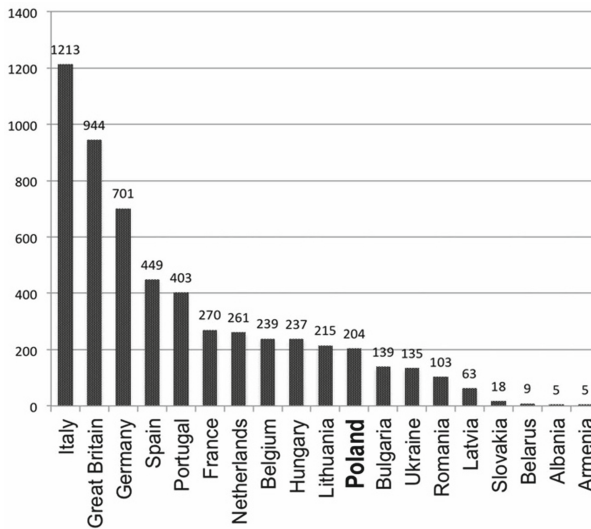
Fig. 1. The overall number of designers who have received the A'Design Award between 2010 and 2019 in selected European countries. The score is calculated based on the aggregate platinum, gold, silver and bronze awards won (source: World Design Rankings. A'Design Award & Competition. https://competition.adesignaward.com/index.html)

Together with increasing technical, environmental and social complexity, the traditional design process is becoming more costly and less efficient. This stimulates demand for new design technologies to meet increasing environmental protection, building materials efficiency and more expedient construction requirements.

There is no doubt that digitalisation attracts the attention of all investment process participants, from the largest construction companies to small design studios. However, one should bear in mind that in practice it is used in a variety of different ways: from the simple replacement of a drawing board by a computer screen (CAD) to advanced tools which rely on artificial intelligence, generative algorithms as well as collaborative design.

The facts cited above constitute the reason for the undertaken research. The aim is to investigate the extent to which architectural studios are adapting modern digital technologies in their design practice.

2   Materials and Methods

The research was carried out in 2019 with the participation of Poznań University of Technology, Faculty of Architecture postgraduate students (3rd term) [8–10].

The Computer Assisted Web Interview (CAWI) method was used as part of the research. This technique is one of the rapidly growing market and business research methods. Application of this method made it possible to achieve the intended research objectives while optimising its duration. An important advantage of the method is its large (virtually unlimited) territorial scope. Using the CAWI method it was possible to effectively reach people in key positions at design studios behind the implementation of digital tools in the design process. It delivers control over course of the research and adherence to standardisation rules.

The survey was carried out on a sample of 220 Polish and European architectural studios (UK, Germany, France, Italy, Spain, Portugal, the Netherlands) with more than 20 employees working under various forms of employment: employment contract, contract for specific work, contract for mandate, university internship. The sample included 70 domestic studios and 150 foreign studios. The sample was selected according to randomised stratified sampling.

In addition, the following auxiliary research methods were used:

- an observation method, entailing an analysis of architectural competitions' results in the aspect of digital tools applied in solutions submitted for the competitions
- a comparative-diagnostic method using information collected from students who have completed design internships at Polish and European architectural studios (as part of the Socrates programme). This methodology proved immensely valuable in complementing the surveys.

Direct observations show that, in many cases, ambitious digitisation declarations are not reflected in practice. Therefore, in order to obtain more reliable data, the questionnaires did not directly ask about the status and extent of digitisation nor the type of computer aided design software used. On the other hand, the questions were posed about architectural studios' demand for new employees with specific skills in the use of specialised digital tools supporting design, based on the assumption that it is this indicator that best characterises the development plans of companies in the area of digitisation in connection with the actual situation in the design services market.

An advantage of the applied research method is ease of data acquisition, relatively simple interpretation of results and the possibility of direct comparison of data from Polish and European design services markets. A certain drawback of this method is the

difficulty in accurately assigning design studios to a particular country, due to the fact that some (especially larger) studios are subsidiaries of global design firms.

The survey comprised standard and multiple choice questions on the demand for new designers with skills and experience in the following areas:

1) CAD computer-aided technical drawings,
2) computer graphics,
3) computer visualisations without 3D modelling,
4) computerised cost estimates and drafting of construction works specifications,
5) computer visualisations (architectural rendering) and 3D modelling,
6) augmented reality design,
7) crowdsourcing type design,
8) parametric and generative design,
9) collaborative design,
10) use of BIM 4D, 5D, 6D software.

It is easy to see that these skills can be attributed to four problem groups:

a) technical drawings using CAD software,
b) computer-based visualisation and graphics processing tools,
c) computerised cost estimates and drafting of construction works specifications,
d) latest digital technologies (BIM 5D-6D, collaborative design, crowdsourcing, etc.).

The research yielded a ranking of domestic and foreign design studios with qualitative identification in terms of digital technological sophistication.

Once again it should be noted that the survey questions were not about specific design support platforms (software), but covered specific skills in the use of these software. This is due in part to the fact that some software on a single platform offer a very wide range of design process support: from simple plotting of technical drawings to complex 4D-6D BIM analysis and an option for high-quality rendering, and even parametric and generative programming. They also allow direct control of 3D printers and the machining process (production of components and models) [11]. However, in many cases, the full functional capabilities of these platforms are not taken advantage of as the designers do not have the necessary skills.

3 Results

Computer Assisted Web Interview (CAWI) research results showing the application requirements for designers in Poland and selected European countries (the United Kingdom, Germany, France, Italy, Spain, Portugal, the Netherlands) in terms of the use of digital design tools are presented in Table 1.

Table 1. Computer Assisted Web Interview research results showing the application requirements for designers in Poland and selected European countries in terms of the use of digital design tools (compiled by W. Bonenberg).

No	The ability to use digital design tools	Application requirements for designers in Poland	Application requirements for designers in Europe
1	CAD computer-aided technical drawings	100.0%	100.0%
2	Computer graphics	81.2%	27.4%
3	Computer visualisations without 3D modelling	67.1%	6.9%
4	Computerised cost estimates and drafting of construction works specifications	8.8%	62.0%
5	Computer visualisations (architectural rendering) and 3D modelling	81.5%	23.2%
6	Augmented reality design	2.3%	18.4%
7	Crowdsourcing type design	0.0%	16.4%
8	Parametric and generative design	2.7%	36.8%
9	Collaborative design	0.0%	33.9%
10	Use of BIM 4D, 5D, 6D software	22.5%	76.8%

Out of the studios part of the research, 38% declared their willingness to hire new staff, and in all cases, employment was conditional upon the ability to use computer programmes. However, the scope of desired skills in this area varied, especially when between Polish and European architectural studios.

Both in Poland and abroad, the basis for employment is the ability to use basic computer-aided technical drawing software (CAD). There were also differences in terms of the other design skills requirements. The biggest discrepancies appeared in the following problem groups:

– computer-based visualisation and graphics processing tools: Poland 76.6%, Europe 19.2%,

computerised cost estimates and drafting of construction works specifications: Poland 8.0%, Europe 62.0%,

latest digital technologies (BIM 5D-6D, collaborative design, crowdsourcing, etc.): Poland 5.5%, Europe 36.5%.

4   Discussion

These are the findings of our research:

– competitiveness of architectural studios is associated with innovative digital tools that aid design,
– there are significant differences between European countries within the scope of demand for employees with skills in modern design methods.
– here is relatively little demand for workers with advanced skills in digital design support tools in Poland. Very well educated architectural degree graduates are unable to find satisfactory work in Poland and therefore frequently make the choice to work in West Europe (the United Kingdom, Germany, Italy).

These findings were confirmed whilst presenting the research results at the "2019 Digitisation in Construction and Architecture" Scientific Conference in Krynica, Poland. The discussion which ensued at the Conference was attended by representatives of the professional board of architects (Architects Chamber), representatives of universities which offer architecture courses and representatives of architectural design studios. Discussion participants stressed that in order to increase the competitiveness of architectural services, a widespread introduction of the latest digital tools to support design is essential. To achieve this, local monopolies providing architectural services have to be broken up. Local monopolies restrict free competition on the architectural services market by inhibiting price competing in architectural design contests and tenders.

Architectural firms unable to use digital technologies to increase the quality of architectural designs whilst reducing costs are defending themselves against free market mechanisms through the intervention of local Architects Chambers that interfere in the tender processes. Such a situation has arisen in Poland. As a consequence the overall quality of provided architectural services has decreased.

It should also be emphasised that the research results can provide a reliable basis for fine tuning computer-aided design methods curriculums for architecture students.

5   Conclusion

To conclude, one may venture to say that in Polish architectural studios digitisation is mostly treated as a modern drawing board, where computer and mouse are used instead of paper and pencil. A basic requirement for new employees is familiarity with typical software to aid the production of technical drawings There is also a strong emphasis on digital imaging (computer visualisation). One can see relatively little interest in new employees with skills in BIM software and no interest whatsoever within the scope of skills in generative design, collaborative design or crowdsourcing.

Against this backdrop, European studios are making more creative use of the latest digital technologies by seeking out staff with skills in BIM 4D - 6D design, collaborative design as well as generative and parametric design. There is less emphasis here on seeking employees with rendering and visualisation skills. This is probably because these services are subcontracted to specialised graphic studios.

It is important to remember that the identified differences determine the competitiveness of architectural studios on the design services market. The fact that Polish architectural studios are behind their European counterparts within this scope is a cause for concern. Figure 1 presenting a ranking of countries according to the number of designers who won the most awards in the international A'Design Awards 2010–2019 confirms this conclusion.

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Digital Diagrams in Contemporary Architectural Design: A Creative Interface Between Human Imagination and Form

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Abstract. In recent decades, digital diagrams have taken on a greater role in architectural projects, permitting, in terms of graphic prefigurative artifacts, other creative, relational and perceptive possibilities in the process of conceiving and representing architecture, which is increasingly focused on topics of complexity, transformation, flexibility, versatility, interaction, imprecision, virtuality, etc. Alluding to the notions of *diagrams*, *machinic* and *figural* of Deleuze and Guattari, these diagrams are constituted as strategic-communicative-productive *intermediate matrix-space* among architecture, the architect and the *digital machine*, and between architecture and other disciplinary fields. Functioning as hypertexts and creative and affective interfaces between the human imagination and architectural form, they propose a new type of reality in a permanent becoming, integrating both order and chaos, intention and the unexpected, mechanical and organic, real and virtual. Diagrams are no longer simply a strategic-informative technique that represents, they have become a technique or poetic operation that, in addition to representing, also presents and evokes.

Keywords: Architectural design · Contemporariness · Digital diagrams · Interface · Human imagination · Form

1 Introduction

Architectural projects, in addition to sketches and drawings that show the more or less defining traits of the form, usually include digital diagrams, computerised diagrammatic models that have gained momentum in recent decades. As pre-figurative models or graphic artifacts, these diagrams allowed other relational, synthetic and creative possibilities within the complex manner in which several current architectural spaces are configured, which are increasingly more unstable and blurred in both a conceptual and perceptive sense.

2 Sketches and Diagrams

Unlike sketches, which are incomplete and in some ways are intended to be defining or conclusive in a specific situation (phenotypic), diagrams refer to intentionalities, orientations, directions, overall generating or guiding conditions (genotypic), or even

random or accidental conditions that themselves contain and propose structuring guidelines. Since they are prefigurative graphic tools, diagrams are constructed as guiding lines or force fields where the most important things are the relationships, flows, directions, meaning or meanings that our perception and intention can capture in them, and the formal or functional possibilities that can be derived from this. In sketches, however, the main question is to provide, in a more or less concrete manner, the specific references of the idealised space, its form or configuration, scale, dimensions, position, etc.

In other words, in a general sense and unlike sketches, the basic function of the digital diagrams in architectural design (especially those of a conceptual-generative nature) is, on the one hand, to relate/interconnect the parameters in question (site, programme, user; the architect's ideas, intentions and sensibilities, etc.); it is also to prefigure the generic conditions of the proposal and suggest or allude to a set of configuring possibilities, at the level of both form and function. Hence, diagrams always involve a potential quality (unrevealed or unactivated) that is *indexically structuring* and *geometrically guiding*; that is to say, it includes no details, descriptions or configurative specifications. They are constituted as a *matrix-space* that functions as a *meta-writing* rather than a methodology, since its ambiguous dimension at the same time contains, informs and proposes structuring guidelines that are merely possibilities, but not resolutions. These are matrix possibilities that are embodied in the project and that continue to be formally and functionally embodied at the architectural site.

Due to their open, flexible and versatile nature, diagrams can correlate –with different levels of complexity and appearance— matters or data typically considered in architecture, such as: the flow of people, air and light, sunlight, visual fields, topography, spatial and functional aspects or those related to use, the construction sequence, etc.

3   Analog Diagrams Versus Digital Diagrams

From the mid-20th century on, all analogical diagrams have been used in architecture to generate strategic conditions, to understand and communicate the design process (especially as it related to the distribution and interrelation of form and function). However, their recent new variant, digital diagrams, now adds other valences/potentialities to current architectural projects. It does this in various ways:

- By proposing new iconographic repertoires (the interrelation of several types of written and graphic information based on data aesthetics);
- By making a new project mode possible, in terms of the pre-figuration technique (with computer programs that, using some given premises, randomly develop the space-form, presenting original spatial-formal hypotheses that were unimaginable and unattainable without the help of a computer). Eisenman's *spacing* processes are an example of this;
- By making their direct conversion into the formal model of the architecture itself (in the form and space of the building or site) more easily viable. This is something that occurs in many of the works by Greg Lynn, UN-Studio (Ben van Berkel and

Carolina Bos), FOA – Foreign Office Architects (Alejandro Zaera Polo and Farshid Moussavi); Toyo Ito and Sou Fugimoto; and finally,

– By allowing for the detection and visualisation of underlying structures in random and unpredictable processes (such as the potential mapping of space, time and any type of movement, or the mapping of more abstract matters, such as accidental, divergent or potentially changing aspects, and the respective formal conversions); or by permitting the creation and construction of complex formal and functional spatial systems, generated with the help of virtual operations (simulations, animations, etc.). These can be used to propose new focuses in the field of architecture and generate other ways of imagining and conceiving form and space.

Contemporary architecture is discussed with reference to concepts, phenomena, systems and spaces or sites that are increasingly more complex and dynamic, and as a result, with complex non-Euclidean geometries and non-Cartesian and topological spatialities. Digital diagrams have become a technique or artifact of information and possibilities suitable for communicating, organising and prefiguring/generating intentions, strategies and procedures that are conceptual, formal and functional, increasingly focused on complex issues, transformation, flexibility, versatility, interaction, virtuality, etc.

4   Digital Diagrams as an Interface

More than serving for the analysis or representation (as occurs with analogical diagrams), the function of digital diagrams is to develop, produce and communicate, while at the same time incentivising imagination and presenting or combining new ways of viewing, perceiving and creating/producing (generation, production, manifestation). As a *mediator*, between interpreting the graphic media that are designed, communicating, stimulating the human imagination and projecting, they act as a strategic-visual interface, and in certain cases, as a productive/creative one (a "generative and formal *matrix-space*"), being used as a pre-figuration technique of the architectural object itself, in which the premises of the project are intentional and random (e.g., Eisenman's and Tschumi's projects, where the *conceptual-generative diagram* is an instrument, albeit in different ways). In the most extreme cases, they are the formal model of the architectural object (e.g. FOA's Virtual House or many of Eisenman's projects, such as the Virtual House, the Church for the year 2000/Rome, L'Ihuei Library in Geneva, the Ciudad de la Cultura in Santiago de Compostela, etc.).

Digital diagrams are increasingly used in practice in contemporary architectural projects. Computer technology is continuously evolving, and the forms and spaces are becoming more and more complex, intricate and intertwined, in an ambiguity that is increasingly more explicit among buildings, and between buildings and the territory (what is referred to as *topologies and operative topographies*). More and more architects (such as OMA, MVRDV, Nox-Lars Spuybroek, UN-Studio, Libeskind, Tschumi, Eisenman, Lynn, Ito, SANAA, Hadid, FOA, Ábalos & Herreros, and E. Arroyo, for example, among others) are using diagrams in the project process for their works as a procedure or technique to materialise or develop their concepts and ideas,

although each interprets them in their own way. Likewise, a great variety of cognitive styles of conceptualisation, formalisation and communication are revealed that are used in contemporary architectural practice, in which digital diagrams take on the role of that *intermediate or interstitial space,* with indefinite limits between syntax and semantics, what is real and what is virtual, intentional and random, creator and created, imagination and perception, ineffable and expressed, geometry and form, structure and configuration. This practice is linked to increasingly more powerful computers, capable of working directly in three or more dimensions, for example, which makes it possible to conceive, draw, visualise and calculate complex spatial structures more easily and with greater efficacy. Digital diagrams also help architects to immerse themselves in the complexity of what is real, activating a broader perception, a more immediate communication and a more efficiently operative action in terms of both the project and the works/construction.

4.1   Types of Digital Diagrams

Within the multiple possibilities for working with digital diagrams in contemporary architectural projects, we can identify four main modes of working that characterise, in turn, four types of diagrams:

Type 1. Diagrams as a digital projectual-generative technique (*conceptual-generative diagrams)*: This type of diagram is used as a generative technique or a method of annotation, based on which spatial-formal dynamics are generated, experimented with and investigated through a diagrammatic lexicon that is created based on a certain idea, concept or register. It is a computerised project technique, the purpose of which is to generate a formal-matrix architectural structure (a *matrix-space*), from which to investigate and verify the possibilities for form and space of the object/building/site, regardless of whether it behaves as an intentional or random component, many times provided by digital computer programs. As an example, and in generic terms, we can say that both Eisenman and Tschumi use this type of diagram as a technique or instrument in their design practices, although each does so in his own way.

Type 2. Diagrams as a pragmatic formal model (*conceptual-formal diagrams)*: These are used a concrete formal models (two- or three-dimensional) of an idea, concept or expression; they can operate as guidelines for the future configuration and spatiality of the architectural object (for example, Möbius strips have been used as guidelines in terms of form, space, function and possibility of use in the Möbius House by UN-Studio); or they can be converted directly into the configuration and spatiality of the architectural object; for example, Möbius strips have been converted directly into the form and space of FOA's Virtual House. These diagrams are constituted as a conceptual and geometric *matrix-space* of the architectural object, and they are a recurring type of diagram in contemporary architectural projects, especially after the early 1990s. We can see this in several architectural studios: Eisenman, UN-Studio, FOA, Holl, Ito, Fugimoto, Libeskind, Miralles (with Pinós and Tagliabue), Lynn, Nox Architects, MVRDV, Herzog & De Meuron, Koolhaas (OMA and AMO) and Hadid, among others.

Type 3. Diagrams as a cognitive method of communication (*strategic-informative diagrams*): These diagrams are used as organisational and morphological-functional structure in the visualisation and planning of procedures. The FOA, Sejima, Ito, Fugimoto, Holl, Libeskind, Hadid, MVRDV, Miralles and Koolhaas (OMA and AMO) studios use them a lot in their projects, presentations, communications and publications.

Type 4. Diagrams as functional organisational charts (*functional diagrams*): Used as an organisational and functional strategic structure in order to correlate the functions, uses and flows of a programme. Most architectural studios use this type of diagrams, since they are an important functional strategic-organisational complement to the project, and a support for formalising architectural objects with complex programmes or specificities.

The basic function of some diagrams is *to represent and communicate*. In other cases, it is to *present and create,* or to *present and represent at the same time*. With the development of computer or computational systems, diagrams have evolved from an analog condition (in which they were representative) to a digital condition, in which they can be presentative (Type 1: *conceptual-generative diagrams*), presentative and representative at the same time (Type 2: *conceptual-formal diagrams*), or just representative (Types 3 and 4: *strategic-informative* diagrams and *functional diagrams*).

4.2 Digital Diagrams as Matrix-Space: A Creative and Affective Interface

Both *conceptual-generative* diagrams (Type 1) and *conceptual-formal* diagrams (Type 2) can be understood in architectural projects as the conceptual, formal and prefigurative expression of the matrix condition of the site or building. They are diagrams that, regardless of their character or specificity, are formed between an idea, concept or preliminary register, and the configuration of the architectural object. They are diagrams constituted as *matrix-spaces*, as *in-between matrix ambits* or *spaces* (formal, conceptual, receptive and generative) and *figural* matrices (blurry, imprecise, open, inconclusive) in the Deleuzian sense[1] [1]. The *figural* in a Deleuzian sense, marked by *becoming processes*, becomes in these contemporary projects and works (e.g. In the Church for the Year 2000, in L´Ihuei Library, or in the City of Culture in Santiago de Compostela), as Eisenman states, a "matrix of forces, a condition of becoming which uncovers potential attributes of space covered up by the formal. The figural uncovers these attributes in the formal through an act which is here called *spacing*. *Spacing* is a process which lies within forming." [2]. It can be said that these architectural spatialities (either as the diagrams in their projects), by revealing *figural* attributes through the concept of *"blurring"* in their form and space (a process that Eisenman refers to as

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[1] According to Deleuze, the *figural* realm lies somewhere between the figurative and abstract realms, where the figurative (associated with the illustrative, representational, incarnate and narrative) aspects are blurred to give way to an *intermediate/in-between moment* that is neither figurative nor abstract, but which entails/affects both at the same time.

"spacing"[2]/*"espacement"*)*,* are themselves constructed as affective architectural objects (which imply and interact affectively and creatively in their own space-form and in their relationship with humans), as a *figural matrix of forces* in which the weak and dynamic form incorporates the ground.

These two types of diagrams are, as Eisenman states, a *"meta-writing"*[3] insofar as the field of orientations and possibilities to be apprehended and inscribed, first in the project, and then in the construction of the architectural site. These possibilities and orientations, guidelines or meanings are not totally contained within the diagram itself; rather they also reside in the *in-between space* between the diagram and the observer, creator or architect. The diagram is simply an evocative and inspiring matrix: its contents or evocations are not found "embedded" or "enclosed" in their form or matter; rather they are indicated or delineated more or less explicitly as signals or fingerprints. These types of diagrams thus evoke multiple interpretations or considerations and at the same time stimulate the expansion of the human imagination in a vast field of creative possibilities and possible spatialities and formal configurations.

Only those diagrams that have the capacity to *present* can be constituted as *matrix-spaces*, given that the *matrix-space* is, to our understanding, a space of qualities that is suggestive, structuring, open or inconclusive, as orienting as it is disorienting, without any specific or concrete formal definition, or any defined or finished configuration, but ones that are active and interactive, and therefore, they operate as creative and affective interfaces. As Deleuze and Guattari argue, alluding to their notion of *diagrams*, *machinic*[4] and *figural*, these diagrams and these architectures are constituted as *spaces or ambits/environments* that propose a new type of reality, that integrates both order and chaos or chance, and that is still to come, or a reality in a permanent becoming: "An abstract machine in itself is neither physical nor corporeal, nor is it semiotic; it is

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[2] *"Spacing"/"espacement"/"espaciamiento"* is a term defined by the philosopher Jacques Derrida in reference to writing. Derrida distinguishes writing from architectural writing, claiming that the latter involves a condition of creative reading that did not previously exist. In other words, *spacing* is the implied, affective reading that a subject can make within the mental and corporeal architecture, not limiting itself to merely meandering through it. *Spacing* in architecture is opposed to *forming*/formal, just like Deleuze's *figural* is opposed to the *figurative*. "In the context of architecture, *spacing* as opposed to *forming* begins to suggest a possible figure/figure relationship, which in turn suggests a new possibility for the interstitial. *Spacing* produces another interstitial condition. (…) now figure/figure is a *figural* condition that is no longer necessarily abstract. It is space as a matrix of forces and meaning. It is affective in that it requires both the body and the mind and the eye in order to understand it." [2].

[3] The term "meta-" (from the gr. μετα-), according to the dictionary of the Spanish Royal Academy, means "next to", "after", "among", "with", or "about". Therefore, for Eisenman, diagrams - both two or three-dimensional - are a *meta-writing,* an inter-writing/in-between-writing, a space-writing, a matrix-space, in terms of both orientation and inscription: they are more properly defined as the writing of writing, the language of the writing/architecture or the intrinsic reflection of the architecture, which Eisenman calls the `interiority of architecture'. Thus diagrams are neither a methodology nor a mere process.

[4] For both Deleuze and Guattari, the *machinic* processes and systems function as interfaces and are articulated with one another as hypertexts, operating therefore as *intermediate/in-between spaces* between the mechanical and the organic, the will/intention and the chance/unexpected, reason and chaos (understood as something pre-existing the system, or any system) [3].

diagrammatic… It functions as a result of the matter, not of the substance, because of its function, not because of its form… A diagrammatic or abstract machine does not function to represent, not even something real, rather that builds a reality that is yet to come, a new type of reality" [1].

According to Jean-Luc Nancy in L'oubli de la philosophie [3], the only meaning that stands the test of time is the *open* meaning, either through "the opening up of the meaning", or through "the opening up to the meaning". This is what Tschumi intends in his architecture through the diagram: to generate a place of open meaning through the opening up of the meaning; to generate places of events and happenings –open, receptive, flexible, versatile– that are conceived of in the project (as his Manhattan Transcripts drawings decry) and resonate in the constructed architectural site, in other words, in life, facilitating their future modification, expansion or development, and making it possible to operate creatively through imagination, experience, consciousness and culture. For Tschumi, diagrams function as *artifacts* or *operational drawings,* where the programme, context and the concept or idea are transmuted and articulated as a sequence of events or happenings, movements and spaces. Based on computerised diagrams (*conceptual-generative*), a diagrammatic lexicon of basic architectural research and experimentation is generated that builds a formal operational grammar that joins concept, form and experience with the aim of designing and constructing space for events, space for life, space with an open meaning; in other words, spaces of possibility, open, dynamic and interactive, both formally and functionally.

5 Final Considerations

The four types of diagrams express the forces that act within a project, in terms of formal or functional vectors, encompassing the complexity of the current system, representing formally and spatially, in a synthetic and interconnected manner, the decisions made, helping to develop and express ideas, concepts, programmes, sensitivities and emotions, and to explore in a controlled manner (and in one that is also non-controlled, in the case of *conceptual-generative* diagrams) the evolutionary process of form and space (Type 1 and 2), or the possible relationships among idea-space-form-programme-use (Type 1, 2 and 3), or simply the relationship between functions and/or uses (Type 4).

In a general sense, since digital diagrams constitute part of the heuristic, perceptive, communicative and productive-creative process, they serve as an *in-between ambit/environment* or *space* of open/receptive, emergent and latent meaning between the architecture, the architect and the *digital machine*, and between the architecture and many other topics in different disciplinary fields, which these days are increasingly more easily accessible and interconnected by means of computers. It is an environment or artifact that functions as a *hypertext* (a polytopical and multidimensional matrix of

the current media-cybernetic system) or *interface* of connection and articulation between the different domains of knowledge, and between perception, imagination, information the so-called *artificial intelligence* and the process of the architectural project, explicitly specifying in its formality the different implied themes and its various levels of complexity. At the same time, between virtuality and possibility, intention and chance, perception and imagination, idea and form, it aspires to conquer new or other territories –creative, conceptual, geometric, spatial, programmatic, perceptive, affective and inter-communicative- for architecture, promoting a continuous renewal of its language and a progressive development of human imagination.

Digital diagrams, as a heuristic tool to articulate and generate the project strategies and as a means of expression to graphically communicate the architectural contents, generate within the project process an *in-between space* that is transdisciplinary. strategic-communicative-productive, functioning as a *creative interface* between the human imagination and form, and represents an important advance in relation to the traditional dialogic diagram so thoroughly explored in the Modern Movement, the function of which was to represent processes or strategies in a linear, precise manner to achieve the architectural solution that is the most optimised in the form-function relationship. Diagrams are no longer simply a strategic-informative technique that represents, they have become a technique or poetic operation that, in addition to representing, also presents and evokes.

Beyond serving to organise functions or flows and community concepts or strategies, in current project practice, and with the intention of absorbing both syntactic and semantic aspects, digital diagrams, of a relational nature intimately related to the concept of space and organisation, in particular serve to expand the imagination, activate emotion and other sensitivities and from there, *pro-duce* (create, unveil) other modes of conception and formation in the project, in terms of the artifact, technique, procedure or, as Eisenman alleges, "*meta-writing*". Digital Diagrams as creative interfaces ultimately serve to open up the possibility of constructing other spaces in culture and life, between the virtual realm, human imagination and what is formally and specifically manifested.

Appendix

See Figs. 1, 2, 3 and 4.
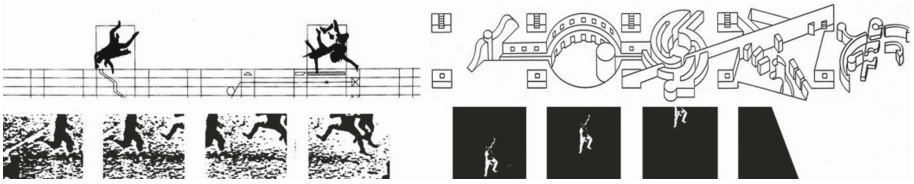
Fig. 1. The Manhattan Transcripts, B. Tschumi (*conceptual-generative diagrams*).
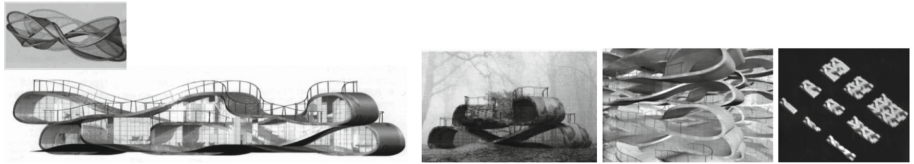
Fig. 2. Virtual House, FOA (*conceptual-formal and conceptual-generative diagrams*).
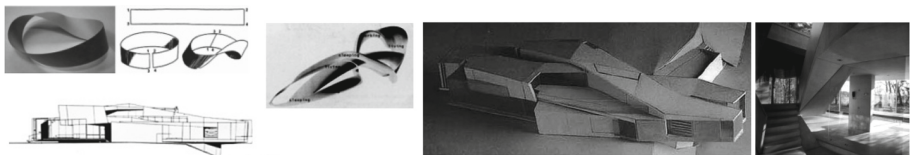
Fig. 3. Möbius House, 'T Gooi-Utrecht, 1993–98, UN-Studio (*conceptual-formal diagrams*).
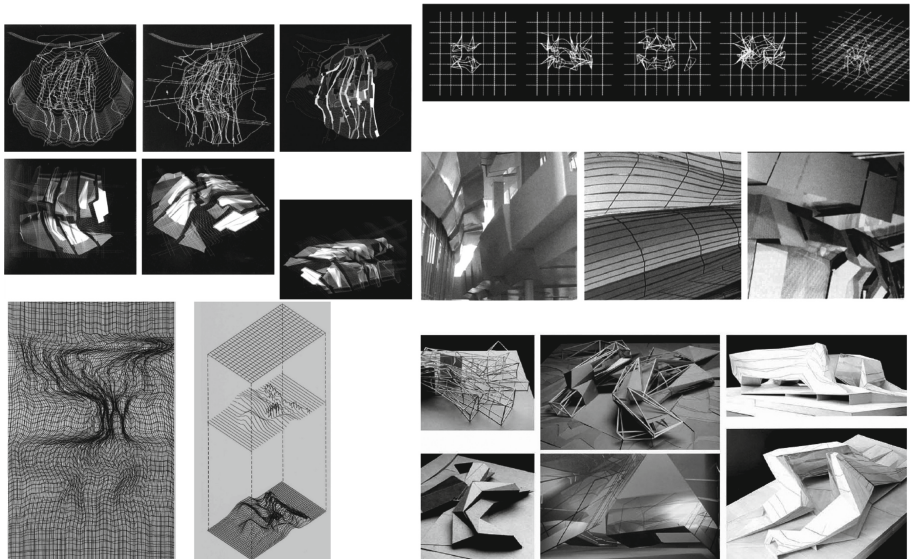
Fig. 4. Above: City of Culture of Galicia, Santiago de Compostela, 1999, P. Eisenman. Virtual House, P. Eisenman. Below: L'huile Library, Geneva, 1996, Church for the year 2000, Rome, 1996, P. Eisenman (*conceptual-generative diagrams*).

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Influencing Factors of Residential Well-Being Under COVID-19

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Abstract. Due to the changes of lifestyles brought by COVID-19, people have spent most of their time in residential communities for the past about one year, which makes people pay more attention to their psychological feelings and emotional needs in their living environments. This study aimed to explore the relationship between multiple influencing factors and residential well-being under COVID-19. By collecting 172 valid online questionnaires, this study explored the aspects of the residential community which would cause more attention after experiencing COVID-19. Based on previous research, the paper analysed the influence of six environmental factors and five emotional factors on residential well-being by SPSS and discussed the reasons for the differences between the results of correlation analysis and attitude analysis. The results of the study contribute to propose strategies for the transformation of residential communities to improve people's residential well-being when facing an epidemic in the future.

Keywords: Residential well-being · Influencing factors · COVID-19 · China

1 Introduction

COVID-19 can be considered as one of the most widespread global pandemics to hit humanity in nearly a century, causing severe shock and panic around the world. China has given top priority to the safety and health of its people and taken very comprehensive and stringent prevention and control measures to effectively stop the transmission chain of the virus. To reduce the possibility of infection, the lifestyles of Chinese have also changed greatly in the past one year, their work, entertainment and social activities have all taken place in the limited residential areas, even in their own houses. The changes have produced some positive effects, making some people pay more attention to their health and expanding new areas of the Internet. Meanwhile, the changes have also produced some negative effects, making some vulnerable people worry about the survival difficulties caused by the shortage of money and resources.

However, what the epidemic has caused people to have in common is a greater focus on the environment in which they live [1–3]. In this case, increasing Chinese researchers have begun to pay attention to the impact of the epidemic on psychological states of different population, such as pregnant women, doctors and nurses, and patients [4–7].

This paper focuses on people's perceptions of living environment in the special context of COVID-19 outbreak and aims to exploring environmental factors that can influence residential well-being during home isolation. The basic premise of this study is that residential well-being is a complex concept that includes people's emotional perceptions and satisfactions with their living environment. The previous study had explored six environmental and five emotional factors that impact residential well-being as the support for the questionnaire of this study [8]. Taking online questionnaires as approach during the epidemic, this paper summarizes new requirements of residential communities after lifestyle changes by collecting people's concerns and perceptions of living environment and analysing the influence of different environmental factors on residential well-being. Also, the relationship among five emotions and environmental factors and residential well-being during COVID-19 outbreak is explored in this study to propose some environmental intervention strategies that could promote positive affect.

2   Methods

2.1   Data Collection

To explore the overall residential well-being and the impact of emotional and environmental factors on residential well-being under the COVID - 19, data collection was conducted mainly in the form of online questionnaire due to the actual condition limit. The online questionnaire was randomly distributed on social media for three days, and 172 valid questionnaires were collected. The questionnaire was divided into four parts, which were mostly closed questions with an open question at the end relating to respondents' expectations about the community environment during COVID-19. The first part was the basic information of respondents, including the basic survey of the interviewees' gender, age, occupation, residence duration, activity frequency. The second part was the self-evaluation of the respondents on their overall residential well-being in the community. The third and fourth parts were about the satisfaction with the different aspects of living environment and the evaluation of the intensity of emotions.

2.2   Characteristics of Respondents

The total sample size of male and female in this survey was 32% for men and 68% for women. The age structure of the respondents was mostly young and middle-aged; 62.2% of the respondents were aged 15 to 34 years old, and 32% of the respondents were within 35 to 59 years old. We can reasonably speculate that the main reason for this result was that many elderly people cannot used smart phones and could not fill in the online questionnaire. The education level was concentrated in graduate, and the

proportion was over half, reaching 55.2%, while the proportion of university/college took 38.4%. In terms of cohabitation structure, most of the respondents lived with family members, with a ratio of 73.8%, and 16.3% of respondents live alone. Regarding the distribution of residence duration of the respondents, the number of residents who lived for more than 5 years was the highest, accounting for 48.3%, and the number of respondents who lived for 1 to 5 years accounted for 29.1%. Respondents had a wide range of occupations, and students and those in professional fields took a large proportion, accounting for 37.2%. In addition, the number of people who went out for activities more than 5 times per week during COVID-19 was less than the number of people who took activities within the community (Fig. 1). Majority of respondents maintained the frequency of activity 2 to 4 times every week, both inside and outside the community. Combined with the open questions in the questionnaire, the frequency of people's activities outside the community was reduced by COVID-19 and most of the activities outside the community were due to the necessity to go to work or purchase daily necessities.
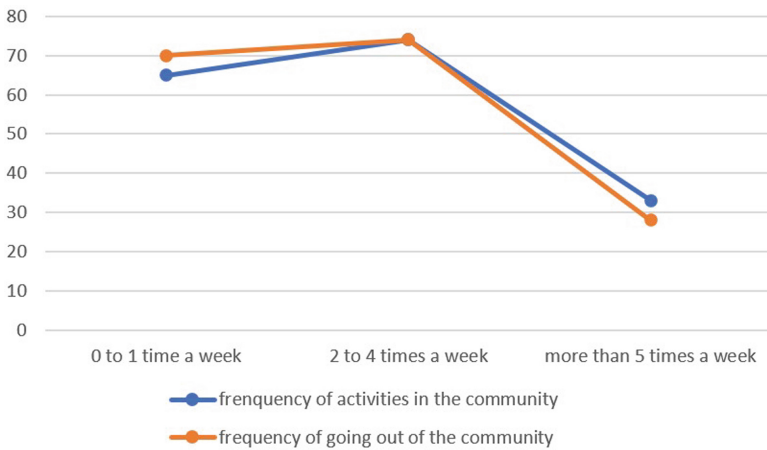
Fig. 1. Frequencies of activities

3   Findings and Discussion

3.1   Statistics of Residential Well-Being

Figure 2 shows the statistical results of the second part of the questionnaire, most of respondents rated the sense of overall residential well-being was weak during COVID-19, with 90 residents giving a score of 2 to describe their residential well-being. Also, 47 people chose a score of 3 to describe their sense of well-being in residence, while 25 considered their sense of residential well-being during COVID-19 was extremely weak. According to the statistics, the average residential well-being score of all respondents was 2.25, which to some extent could indicate that people's overall residential well-being during COVID-19 was very low.
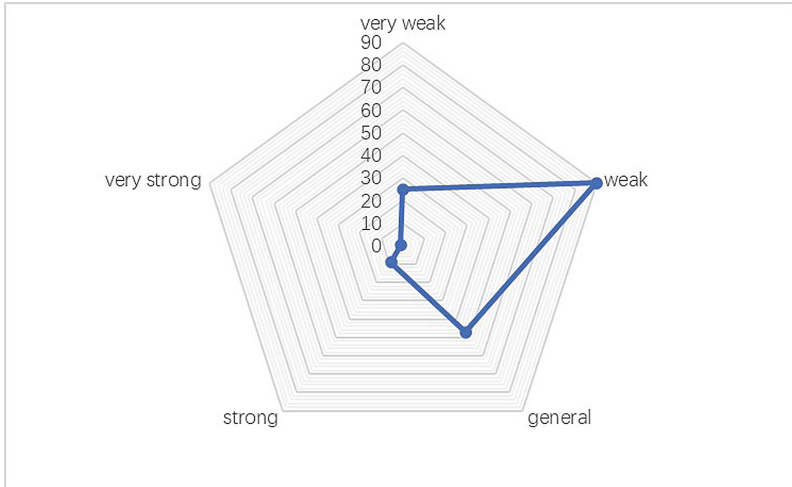
Fig. 2. Statistic of overall residential well-being

3.2 Attitude Analysis of Respondents on Potential Influencing Factors

Respondents were asked to rank five emotional factors impacting on their residential well-being, and the results were shown as Fig. 3. The prominent results were that most respondents placed security as the most important sense of impacting their residential well-being, while belonging was ranked the last place. In other words, most respondents believed that their senses of belonging had a weak impact on their overall residential well-being compared with the other four emotions. Also, the questionnaire asked the respondents to choose the three environmental factors that most affect their sense of well-being in residence from eight options, including an option named "other". According to the result shown in Fig. 4, property management was selected as the environmental factor that most people believed to affect their residential well-being. Moreover, the proportions of greenspace, open space and facilities, housing quality, and surrounding infrastructure were similar, which could be seen that respondents believed that they had similar influence on residential well-being. Neighbourhood was found to have the weakest impact on residential well-being among seven environmental factors. In addition, only four people who chose other options mentioned Internet speed, dog walking in the neighbourhood, too little rest time and air quality. Among them, dog walking in the neighbourhood and Internet speed could be classified as open space and facilities to some extent, while too little rest time and air quality were uncontrollable factors in this study, which were excluded from the category of environmental factors.
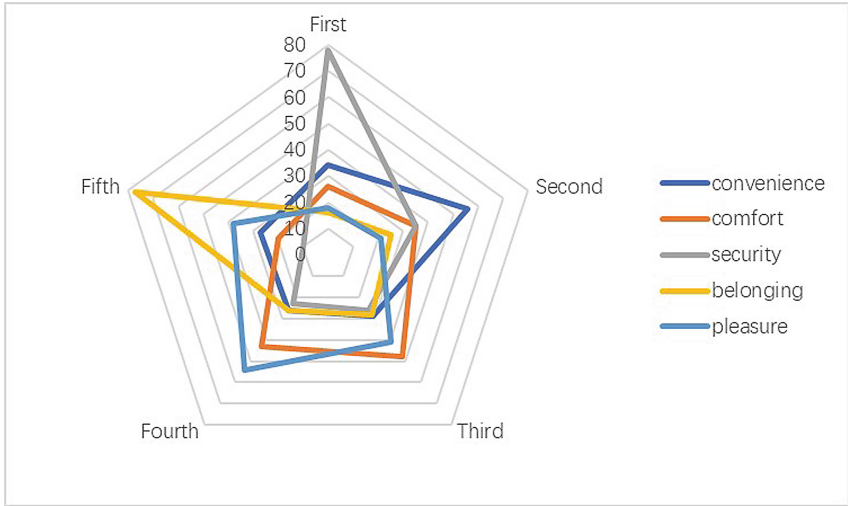
Fig. 3. Rank of five emotions
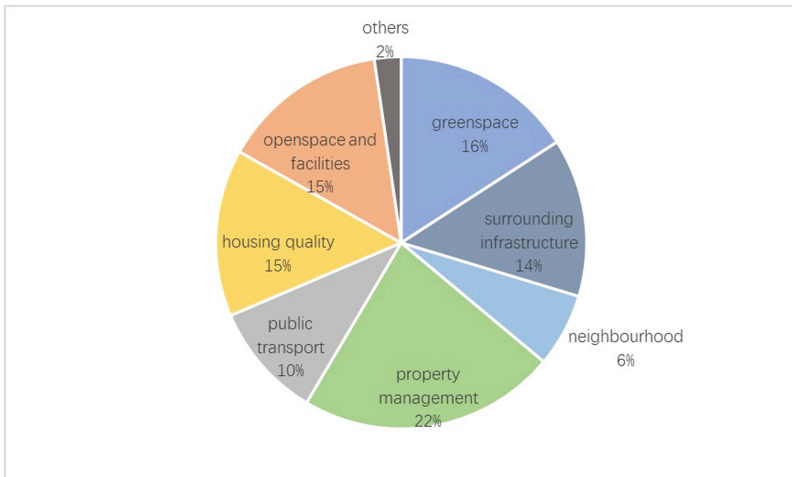
Fig. 4. Selection results of environmental factors

Besides, since the activities of respondents were basically confined to the community during COVID-19, the questionnaire excluded the option of surrounding facilities, and investigated the self-evaluation of respondents on six environmental factors and five emotion intensities in the community. According to Fig. 5, more than 50 respondents were very dissatisfied with traffic accessibility, and 32 respondents were satisfied with open spaces and facilities in the community. In addition, the satisfactions with neighbourhood and property management were concentrated in the options of 2 and 3, while the satisfactions of housing quality and greenspace were distributed in

other four options in a similar way excepted "very satisfied". Also, more than 120 respondents had a low intensity of travel convenience and epidemic prevention safety, and the distribution was concentrated in 1 and 2. In addition, the number of respondents choosing 2 was the highest in all of five emotions, and the proportions of people choosing 2 and 3 in the evaluation of belonging and pleasure were almost equal. Almost no one chose 4 or 5 to rate their emotion intensity, which may mean that living in the community cannot totally fulfil one aspect of the respondents' emotions.
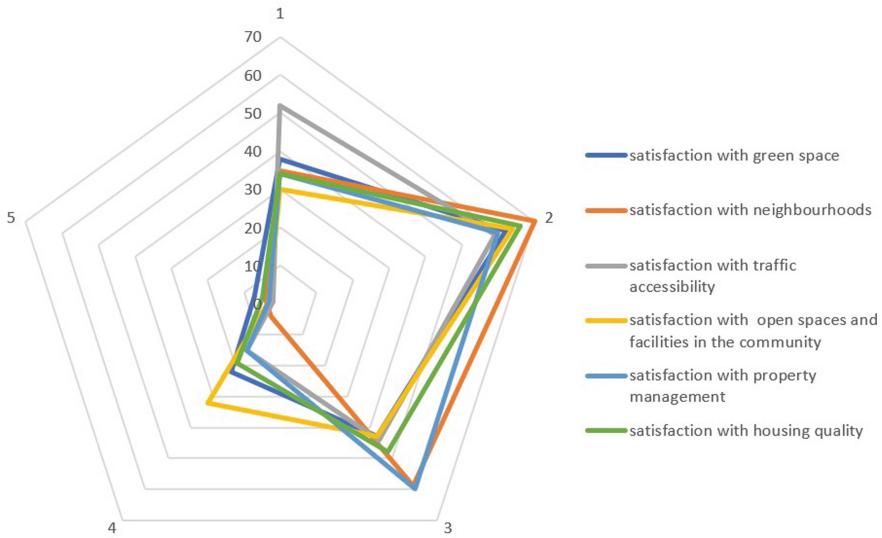
Fig. 5. Results of satisfactions of environmental factors

3.3   Relationship Between Residential Well-Being and Influencing Factors

Correlation analysis was carried out based on the data of overall residential well-being and attitudes on impact factors, to find the relationship between residential well-being and different factors. Table 1 shows the results of environmental factors and residential well-being. We can see that satisfactions with six environmental factors were significantly positively correlated with residential well-being, while satisfactions with traffic accessibility and housing quality seemed to have weaker correlations than other four factors with residential well-being. Property management had the highest correlation coefficient with residential well-being, which is consistent with the above attitude result. This result showed that property management occupied a strong proportion in the influencing factors of residential well-being. In addition, the satisfaction with neighbourhood showed a high correlation with residential well-being according to the correlation analysis, which is quite different from the previous attitude analysis (Fig. 6).
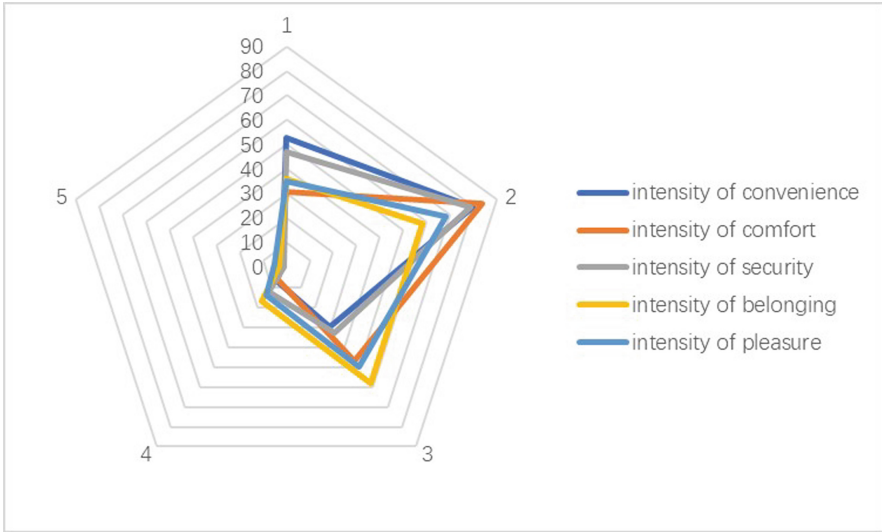
Fig. 6. Results of emotion intensities

Table 1. Relationship between environmental factors and residential well-being

	Satisfaction with environmental factors	Green space	Neighbourhoods	Traffic accessibility	Open spaces and facilities in the community	Property management	Housing quality
Overall residential well-being during COVID-19	Pearson	.466**	.401**	.401**	.453**	.549**	.549**
	Sig. (2-tailed)	0.000	0.000	0.001	0.000	0.000	0.000
*p < 0.05 **p < 0.01							

Table 2 shows the results of correlation analysis between five emotions and residential well-being. All the five emotions were significantly correlated with residential well-being, and the correlation was always positive. Among them, the sense of pleasure and comfort were much closely related to residential well-being. This result is different from the attitude analysis that respondents considered security as the most important to residential well-being. Moreover, the sense of convenience, which was ranked second in importance in attitude analysis, showed the lowest correlation with residential well-being in the five emotions but still significantly correlated with residential well-being.

Table 2. Relationship between emotional factors and residential well-being

	Intensity of emotional factors	Convenience	Comfort	Security	Belonging	Pleasure
Overall residential well-being during COVID-19	Pearson	.374**	.505**	.480**	.460**	.508**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000

*p < 0.05 **p < 0.01

3.4 Discussion

From the above analysis, the results of correlation analysis had some consistency with the previous attitude results of interviewees, and there were also some differences. Regarding the environmental factors, property management was considered as the most influential factor of residential well-being, whether in the attitude analysis or in the correlation analysis. Neighbourhood was shown to be the least influential factor in the attitude analysis, while transportation accessibility had the least impact on residential well-being in the correlation analysis. The reason of the difference may be the lifestyle changed due to COVID-19, people were encouraged to reduce their outdoor activities and spend most of their time at home, which led to the decrease of the related impact of traffic accessibility on residential well-being. In addition, neighbourhood showed a high correlation coefficient in the correlation analysis, even higher than housing quality, which was somewhat different from the results of attitude analysis. Considering the special epidemic background, people could not go out to socialize during home isolation, and they might turn to people living next door for help in some emergency difficulties. All these would promote the rapid improvement of neighbourhood relations and psychologically enhance people's sense of well-being in residence. Also, people were familiar with their homes, where spatial layout and furniture were arranged according to their own preferences, this might weaken their focus on housing quality to a certain extent.

Besides, the importance of five emotions was ranked differently from the result of correlation analysis. According to attitude analysis, security was considered as the most influential emotion to residential well-being, but the correlation coefficients of pleasure and comfort on residential well-being were higher than security through the result of correlation analysis. The reason for this result might be that there was a certain difference between perception of subjective emotions and actual cognitive performance. Also, convenience showed the weakest correlation with residential well-being in correlation analysis, which might be related to the travel limitations associated with home isolation. It also indirectly proved that during the epidemic period, the influence of traffic accessibility and convenience on residential well-being was significantly reduced compared with the cognition result of respondents. Furthermore, although a detailed

explanation of five emotions was given in the questionnaire, respondents would have different understandings of the same explanation, which could directly affect their final choice. It might be difficult for respondents to assess their own emotional intensity within a short period of time, so more scientific methods should be adopted to help respondents face up to their emotional perceptions, such as verbal descriptions of their perception. Also, it was important to have a clear explanation of the different emotions before the survey, so that respondents could understand and evaluate their emotions as accurately as possible.

4   Conclusions

Influencing by COVID-19, the lifestyles of people had been greatly changed, home isolation and reduced travel and other changes would affect residential well-being in some way. As designers, we have the responsibility to enhance residential well-being through the design intervention of community environment. In this study, six environmental factors and five emotional factors were significantly associated with residential well-being. As for environmental factors, the satisfactions with property management, open space and facilities in the community, and greenspace showed greatly impact on residential well-being. Neighbourhood showed a high correlation coefficient with residential well-being, possibly due to increased communication and mutual help during COVID-19, while the correlation of traffic accessibility was lower because of home isolation and travel restrictions. In addition, there was a significant correlation between pleasure and comfort and residential well-being of the five emotional factors. Convenience might be affected by COVID-19 and lifestyle changes, showing a significant but not very high correlation. Belonging was more relevant to residential well-being than respondents thought. On the contrary, compared with the importance ranking in attitude analysis, the correlation between security and residential well-being was at a lower level.

However, more diverse research methods and analysis techniques are expected be conducted to deeply explore the relationship between multiple factors and residential well-being, and to further develop more potential impact factors. Based on the conclusions of this study, future research will further explore the relationship between residential well-being and multiple impact factors and put forward the concrete strategies of community environment design. Also, a comparative analysis would be conducted based on the data of epidemic period and non-epidemic period to explore ways to improve residential well-being through design under special circumstances.

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Renovation of Campus Old Buildings Under the Service Design Perspective

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Abstract. Under the background of the "Internet +" era, social education is facing continuous transformation and change. Campus buildings need to constantly break through the fixed thinking, rationalize and update, and seek new ideas for cross-border development. Take the "Morning Garden" of East China University of Science and Technology as an example, analyze its renewal and renovation strategy, and explore how to use service design methods to renovate and design campus old building spaces, so as to conform to the diversified needs of social education and realize the symbiosis of people, space, environment, architecture and knowledge.

Keywords: Service design · Campus building reconstruction · Functional reorganization · The third space

1 Background

In the university education system, the development of disciplines is showing an increasingly strong trend of diversification and integration, and campus teachers and students have increasingly diversified demands for educational space. The existing campus education space is unable to adapt to the continuous transformation and change of social education due to its single and closed characteristics. In order to promote the diversified development of campus education, it is necessary to continuously update and construct the educational space environment of colleges and universities. The campus building is not only a place for teachers and students to study and research, but also a comprehensive space where different behaviors and activities collide, including subject exchange, open cooperation, independent learning, and leisure interaction. Therefore, it is particularly important in the construction of colleges and universities to renovate the campus building environment to cater to the background of national education trends, to better stimulate students' vitality and creativity, and to promote mutual exchanges and thinking collisions. At present, the adaptability of campus buildings at home and abroad mainly shows the following three trends: 1. The focus of campus building renovation: increase the utilization rate of space, pay attention to the establishment of functional space systems, pay attention to the spatial effects and the renewal of the humanistic and green space environment, adjust the spatial layout of the open and interactive teaching mode, and use information technology and Ecological

technology improves architectural performance; 2. Spatial strategy highlights the relationship between art and humanity; 3. Functional strategy also presents a trend of diversification and complexity with the deepening of the development of social college education.

2   Service Design and Campus Old Building Renovation Design

2.1   Introduction to Service Design

Service design was first proposed by Bill Hollins and his wife in the 1991 design management book "Complete Design". Service design sets the function and form of service from the perspective of the customer. It follows people-oriented, advocating co-creation, focusing on service rhythm, realizing the tangibility of intangible services, and focusing on the basic principles of overall thinking. There are various types of service design tools with different purposes. They can be mainly divided into investigation and research, design and development, testing and evaluation, and delivery and execution tools, including 14 tool methods such as storyboards, character roles, service prototypes, and service blueprints (Table 1). Reasonable use of design methods can help designers obtain accurate information, turn abstract design problems in their minds into concrete icons for intuitive analysis, explore customer needs, and help people make better decisions on the design of the entire service system.

Table 1. Service design tool chart.

Classification	Tool	Purpose
Research tools	Storyboard	Show the characterization of touch points and the relationship between touch points and users in experience creation
	Shadow action	Observe the various behaviors and needs of related people
	Situational interview	Thoroughly investigate the specific behavior you want to investigate in depth
	Action ethnography	A way to use existing technology to guide service participants without being affected by the geographical environment
Design development tools	Character role	Prototype used to analyze users
	Tell a story	Show service design plan more convincing and appealing
	Mind map	Use graphics or phrases to express personal opinions and ideas of design members
	Contact point matrix	Show different structures, interfaces, use environments and interactive results in the service system

(continued)

Table 1. (*continued*)

Classification	Tool	Purpose
	Desktop deduction	Use a small 3D model to establish the context of service generation
	User journey map	Help designers to in-depth interpretation of user experience and feelings at all stages of using the service
Test evaluation tools	Service prototype	Use props or visit service touch points to construct service prototypes
	Usability testing	Evaluate service quality by implementing tests on typical users
Delivery execution tools	Service blueprint	Specify the methods of service at all levels and the processes behind the service
	Task analysis grid	Show the task progress and get an overview of the service project

2.2 Study on the Possibility of Service Design Intervention

With a series of factors such as the increasingly rich campus life of modern universities and the increasing population of campus life and activities in the new century, today's campus buildings are more open and their functions are becoming more complex. During the boom in university construction, universities in various parts of my country are limited. The large-scale campus built quickly in time has gradually presented various problems, and the renovation of campus buildings can be regarded as a systematic project. The service design is user-centered, and it cooperates with many stakeholders to participate and build a cooperation platform, as well as the integration of products and services, and the concept and method of continuous iteration and update, which are very suitable for the project of college campus building renovation.

As a result, the research on the renovation of campus old buildings under the service design system is proposed. It should focus on the relevant stakeholders of university campus buildings, determine their basic needs and specific needs, and deeply analyze the interactive relationship between users and architectural space services. At different stages, the service contacts are analyzed through a variety of methods to create an architectural space environment that meets the needs of users.

2.3 Reference Significance of Service Design Methods to Campus Building Renovation

The architectural renewal of university teaching buildings is a form of building renovation that gradually arises when the educational buildings have developed to a certain stage and users' requirements for the space quality of the teaching buildings continue to increase. The service design system emphasizes the openness and sharing of buildings, accepting the diverse needs of different groups of people with an inclusive attitude. Combining service design methods, taking smoother service processes, higher user

experience, and more comprehensive service management operations as appeal points, plan conception and design in a more scientific and reasonable way, creating a good academic environment, and improving the entire The learning experience on campus.

3   Base Research and Design Strategy-Taking the "Morning Garden" as an Example

3.1   Project Overview

The Xuhui campus of East China University of Science and Technology is a historic campus built in the 1950s. It is continuously undergoing campus renewal. Located at the intersection of campus living area and learning area, the morning garden is a representative architectural work of East China University of Science and Technology. It is close to the library in the north, and surrounded by water from the south to the east. The original function of the morning garden is a doctoral student dormitory and an international student exchange center. There is an interesting botanical garden in its own building. There are also unique tiles and log windows on the wall façade, which reflects the unique architectural style of the end of the last century. The collective historical memory of the teachers and students of the school.

The total construction area designed for this renovation is about 5827 m^2, of which the foreign student apartment building is 2870 m^2, the expert building is 1040 m^2, the conference building is 1090 m^2, and the restaurant is 827 m^2 (Fig. 1 and Fig. 2).
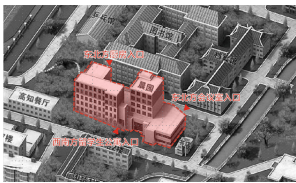
Fig. 1. Overall overview of Morning Garden

Fig. 2. Status of the south facade

3.2   Analysis of Service Elements

In construction-related design, there is no clear implementation rule for how to transform, rebuild and reuse old buildings and their structures. To renovate the old campus buildings from the perspective of service design, the following service elements need to be analyzed:

User-Centric. There are usually three-character roles in design projects: customers, designers, and users. With the development of experience economy, design is more concerned with the feelings and expectations of users. The judgment of design value depends more on the daily life of the users. The impact of the user experience. Although the current population of university campuses tends to expand, the main

users are still students. Therefore, fundamentally speaking, the core content of campus building renovation is to meet the needs of students. In a general sense, campus students' activities are mainly divided into three types: necessary activities, spontaneous activities and social activities (Fig. 3). The reconstruction of campus building space mainly serves students' spontaneous and social activities. Yes, these activities depend on the participation of the campus building space. In other words, it is necessary to ensure that it meets the needs of these activities for students when renovating the old buildings on the built campus.

Collaborative Design by All Parties. Under the new situation, the renovation of campus building space in colleges and universities is a systematic project involving various stakeholders. It is basically divided into four categories, namely, decision-makers, design planners, project implementers and building users. The benefit value balance result directly affects the implementation progress and implementation effect of campus renewal (Fig. 4). It is necessary to fully mobilize the enthusiasm and creativity of all stakeholders, look for connections between all stakeholders, discover and meet their needs, so as to form a good coordination and cooperation mechanism between various subjects.
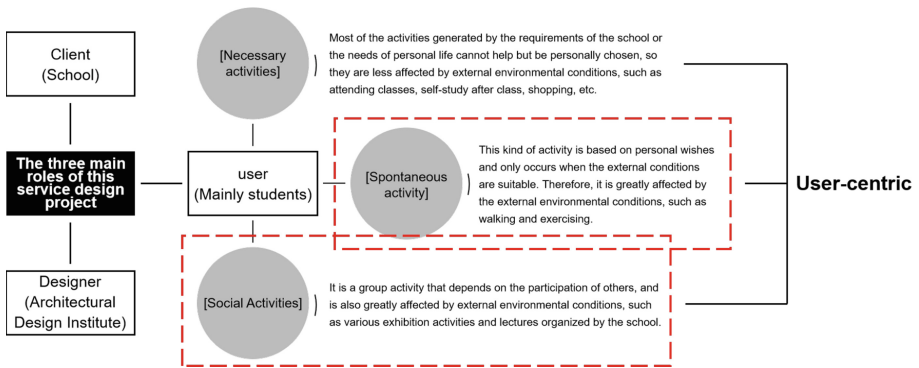
Fig. 3. User-centric

Factors Coexist and Coexist. Service is not a stable and fixed entity, in which contact points of people, goods, service procedures, and environment interact with each other and are interdependent to form an organic whole. The design of this organic whole is not a specific design for something, but a comprehensive design that includes a series of activities and processes. In these activities, the design objects include not only materials, but also non-materials such as processes, structures, and systems. The component is a systematic project. Designers need to have the overall control ability and always control the overall project in order to realize the coexistence of people, space, environment, architecture and knowledge.
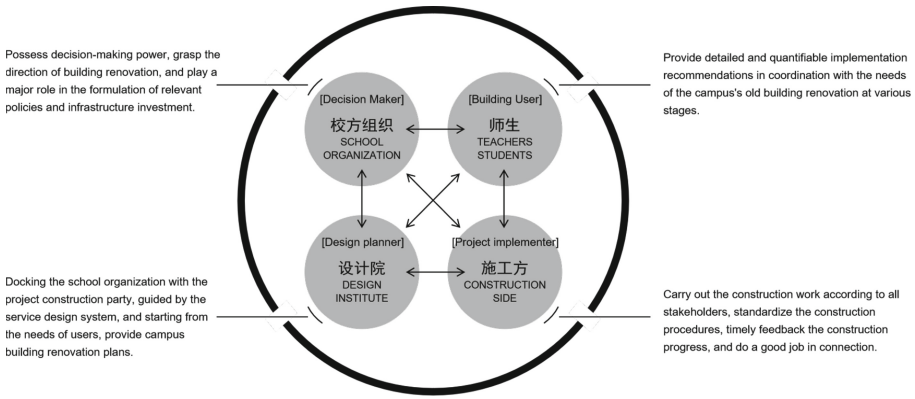
Fig. 4. Stakeholders.

3.3 Design Strategy

Based on the service design concept and the actual problems faced by this design, the common methods in the service design system are used to transform them into the renewal design process of old buildings on campus, forming the process method and implementation framework of this article (Fig. 5).
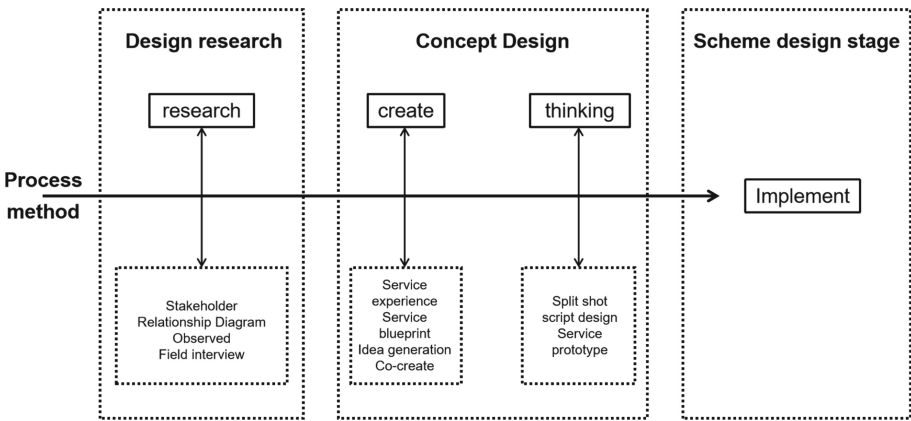
Fig. 5. Design process and method framework.

At the beginning of the design of Chenyuan, the designer put forward the design goal of integrating science and art, industry-university integration, and first-class disciplines. After planning and construction from 2018 to November 2020, Morning Garden has completed a gorgeous transformation.

Site Activation-Additional Plot Space. In the reconstruction and construction of the morning garden, the designer tried to create multiple plot spaces by adding walls,

comprehensively using perceptual and rational thinking to solve the level of space problems, and achieve the unity of movement and pathfinding in the entire space: ① The original meeting Part of the first to second floors of the building will be extended, the entrance hall will be enlarged, and the usable area for office and teaching will be increased; ② Add a glass corridor as the main passage connecting the functional areas, and can cooperate with the courtyard to enhance the landscape; ③ Add toilets on the second to fourth floors to meet The needs of users and cleaning staff; ④ The first floor was built to meet the office area requirements; ⑤ The roof was built as an extension of the conference room; ⑥ The roof was built as a small house for the labor union (Fig. 6 and Fig. 7).
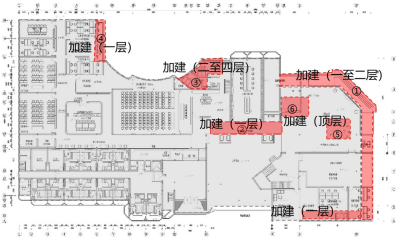
Fig. 6. Floor plan of the additional area.

Fig. 7. Space map of the additional area.

Functional Replacement-Reconstruction of the Third Space. "Third Space" is a concept put forward by American sociologist Ray Oldenburg in his book "A Wonderful Place". It is between a closed space and an open space, interspersed with gray in the building. Degree space. The introduction of the concept of "third space" into the campus is not only to expand the spatial concept of campus buildings, but also to construct a multifunctional platform that integrates free communication, promotes campus culture, and releases psychological pressure.

Morning Garden is not only a place for learning, but also a place for people to communicate and share. Based on the concept of "third space", the designer broke the original enclosed exhibition halls and classrooms in the morning garden, and added a reinforced structure on the first floor. The exhibition halls and corridors are the center of the enclosed development (Fig. 8). The main entrance of the morning garden adopts a futuristic curved glass curtain wall. The flowing and protruding transparent body promotes the integration of the internal and external spaces of the front square of the college, and at the same time reflects the college's open and innovative teaching concept. The "Sunshine Corridor" connects the two large spaces of the indoor multi-functional lecture hall and the outdoor shared garden. Inside the lecture hall, you can see the outdoor plant landscape on the north side. Under the sun, the beautiful scenery is panoramic, which reflects the concept of open design (Fig. 9).
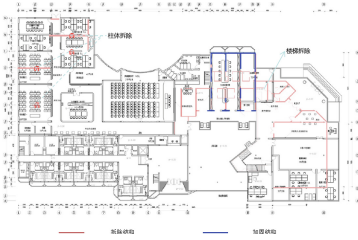
Fig. 8. Reconstruction of spatial structure.

Fig. 9. Space scene after reconstruction.

Space Reconstruction-Reorganization of Functional Space. Reorganize the original functional space to ensure a large space while rationalizing the layout of the space. The foreign student apartment building is changed to a doctoral student apartment; the restaurant, conference building, and expert dormitory building are changed to the School of Art Design and Media; The colleges and apartments on the relevant floors are respectively set up with access control. Among them, the School of Art Design and Media uses the Sunshine Corridor as the center to connect various functional spaces, which are continuously separated, and at the same time solve the functional needs of teacher-student interaction. Rotating exhibitions in the lobby on the first floor, a five-dimensional VR laboratory and a molding process laboratory are set up next to it, and an ecological laboratory, an advertising photography laboratory, a comprehensive art laboratory, etc., are set up on the second floor to implement the whole-process education concept, and the entire space is an educational experiment field (Fig. 10).

During the renewal of the morning garden, a large number of original elements of the landscape were preserved. The artificial hills and vegetation in the shared garden, as well as the mottled old walls and pillars, intersect each other, and the projection of time on space makes the building richer and warmer. The Zen-inspired dry landscape on the first floor, the patio, links the enclosed indoor space with the external natural space. Snow in winter and rain in summer realize the harmonious communication between man and nature. The multiple space nodes of the laboratory on the second floor are arranged wide and tightly crossed, which embodies the concept of moving and changing scenery with sliding windows in the oriental garden. It not only retains the
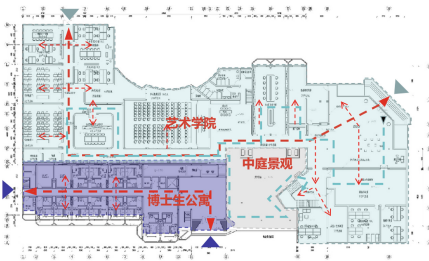
Fig. 10. Zoning and building entrances and exits.

Fig. 11. Dry landscape-Patio.

original spatial structure, but also provides more convenience for new functions through the series of spaces Sex and possibility (Fig. 11).

4   Conclusion

The campus environment stimulates the formation of place culture through physical place effects. In a deeper sense, campus architecture is a "probation place" for knowledge activities, cultural inheritance and educating talents, which determines its personality different from other environments. The characteristic is a special space environment based on the principle of "life world". Morning Garden is a "haven" hidden in the East China University of Science and Technology. It uses a multi-level and rhythmic space design to break our definition of traditional campus architecture. It is a place for learning and living that is both rational and romantic. As a practice of rethinking, transforming and utilizing the old building space in colleges and universities, it respects the original buildings while re-exploring the relationship between the interior and exterior spaces of the building through appropriate environmental strategies. It is a product of the renewal and regeneration of campus buildings affected by China's educational reform. It provides a new design direction for the renewal of architectural space.

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Bradscape - An Element of Placemaking on the Example of the City of Poznan, Poland

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Abstract. This article presents brandscape as an element of placemaking on the example of the city of Poznań. The subject is attracting increasing attention due to the growing interest in brand scape as an element of place promotion. In the proposed scientific approach, the architectural form is treated as an expressive brand of space. The research results support the theory that the appearance of architectural objects creates the brand of a place. Thus, the architectural form (appearance) is an element of the so-called marketing communication. Brand strength was measured by the questionnaire method using quantitative indicators. This research is a springboard for further research into placemaking theory.

Keywords: Bradscape · Visual communication · Territorial marketing · Placemaking

1 Introduction

Branding of urban space is the management of beneficial relations with the social environment. The goal of branding is to add value to the place in the eyes of users. In this sense, space promotion is a process responsible for identifying and meeting user requirements. The idea of brand of place comes down to placing the user of space at the center of design activities. This kind of design can be called "user requirements design". Place branding is a tool to meet the needs of residents. This kind of marketing is a catalyst of change that helps to adjust the built environment to the dynamically changing needs of urban space users.

1.1 Urban Space Branding Features

Branding of the place is primarily aimed at the satisfaction of the space user. This goal is achieved by handling information streams (two-way information flow - from recipients to spatial planners).

Branding Information Gathering Functions. The basis for conducting marketing activities is acquiring knowledge about the needs and behavior of the users of the urban space. The scope of information necessary to build the brand of space depends largely on local conditions. Today, it is a common practice to refer to the unique features of

urban space, created by history, local tradition, and social customs. Such an approach reduces the risk associated with space marketing in conditions of uncertainty.

Functions in the Field of Space Perception. These functions are closely related to the quality of the built environment. The visual quality as well as the functional and utility quality of the urban space are important elements here. The information and stimulating mechanisms used here make it easier for users to understand the space and the attractions offered. Thanks to a comprehensive analysis of the flow of information to residents, city planners gain the tools needed to establish a marketing strategy.

Social Functions. At the heart of marketing activities are the needs of space users and their behavior in relation to particular places. Knowledge of the psychology of space (proxemics) plays an important role in creating new needs and creating the desired reactions of recipients. These areas require a detailed analysis of user reactions to new design proposals. The brand of a space is an intangible value that eludes unambiguous definitions. It lives in the minds of space users. Certainly, the brand of space serves to draw attention to stand out in a positive aspect. The brand carries specific messages, emotions and stories. It is thanks to the space brand that we notice these places. This is the strength of the brand.

What are the basic functions of an architectural brand?

– the brand of architecture makes it possible to distinguish some places from others; places are no longer anonymous,
– an architecture brand helps to identify the features of architecture, allows you to value architectural works,
– the brand of architecture fits into the lifestyle of the inhabitants,
– the architecture brand communicates the emotional benefits of being in a given place
– the brand of architecture makes us remember a given place (we can come back to it in the future);
– the architecture brand facilitates decisions regarding the choice of place of residence.

1.2   Architecture Branding

Place Driven Branding. The brand's axis is the place, and more specifically the attributes and satisfaction of being in a branded place. The brand bases its strength on the quality of the place, its uniqueness and uniqueness. All activities around the brand are based on the philosophy that staying in branded places increases self-esteem. Hence, the crowds of tourists visiting branded places.

Brand-Driven Architecture. Brand strength is based on the talent and personality of the creator of architecture, and the work is the result of the brand's promise. The brand is based on the achievements of an architect who belongs to a small group of "architectural stars". The brand makes the built environment offer us something totally unique that cannot be found elsewhere. Such a feature can be, for example, a fascinating form, unique design, unique colors. A brand is a trademark of a place -

originally one of a kind, which will always evoke an association with a given place. Branding is a technique of designing a place that involves creating a brand and consolidating its positive image in the minds of urban space users. Therefore, a given place must stand out so that the user of the space notices its originality and wants to stay in it. However, one-off contact with a place is not enough, the place must attract people permanently, it must be remembered by them. In this way, brand awareness of the place is built. The place becomes liked and desirable, which is an essential factor in place branding. A positive brand should give a sense of satisfaction and fulfillment.

2   Materials and Methods

This study was conducted in July, August, September, and October 2020, with the main objective to provide useful recommendations, supplemented with useful references and good practices that may contribute to an effective and proper improvement of the brand of space in the city of Poznan. Thirty students performed research as part of the compulsory subject "design and research studio" (2nd degree studies, semester 2).

The research was led mainly by: a literature review on urban space branding and past project experiences, current articles about place brands, survey visits around the city of Poznan, web queries, supplemented with significant cognitive experience, gathered by acquaintanceship with tourists and some stakeholders in the city of Poznan.

The research was of an observational nature and was based on empirical data obtained from the following sources:

– questionnaire completed by students of architecture from Poznan University of Technology,
– an internet query aimed at assessing the strength of the brand of the Poznan metropolis space.

The research procedure consisted of three methodological steps:

Step One. Identify representative places for comparative studies according to the following criteria:

– history and identity of the place,
– legibility of the place,
– uniqueness of the place,
– the fashion of the place,
– personification of the place,
– reference to local tradition,
– uniqueness and originality of the architectural form,
– content and attractiveness of the services offered,
– city recognition.

It can be said that the set of these criteria defines a space as a place distinguished by a strong brand.

Step Two. Preparation of a list of branded places located in the City of Poznan and determination of keywords for the Internet query.

Step Three. Quantification of brand strength of the indicated places by means of an internet query. For this purpose, the Google Trends program was used, by means of which the popularity of the distinguished keywords describing branded places in the city was determined.

Step Four. Creating a map showing the distribution of brand places in the City of Poznan.

3   Results

The first and second step of the research procedure led to the identification of 21 representative places: (1) Poznań Fair, (2) City Hall, (3) Billy goat sculpture, which is a symbol of the city of Poznan, (4) Stary Browar, Cultural and Commercial Center, (5) Malta Lake, (6) Ostrów Tumski, the historical heart of Poland, (7) Old Market Square, (8) Collegiate Church, (9) Bamberka Monument in the Old Market Square, (10) St. Adalbert's Hill, (11) Cytadela Park, (12) Airport in Poznań, (13) Old Town, (14) Jeżyce, (15) Wilda, (16) Winogrady, (17) Sołacz, (18) Rataje, (19) Ławica, (20) Naramowice, (21) Morasko.

Step three of the research procedure led to a quantitative assessment of the brand strength of the featured places. When analyzing the indicated keywords in Google Trends, the frequency of searches (popularity) of these words in a period of 1 year (January 2020–December 2020) was taken into account. The diagrams show the results of the research (Fig. 1).

Step four of the research procedure led to the mapping of branded places in the City of Poznan. The map was made using MapInfo Professional based on the geolocation of the assessed places.
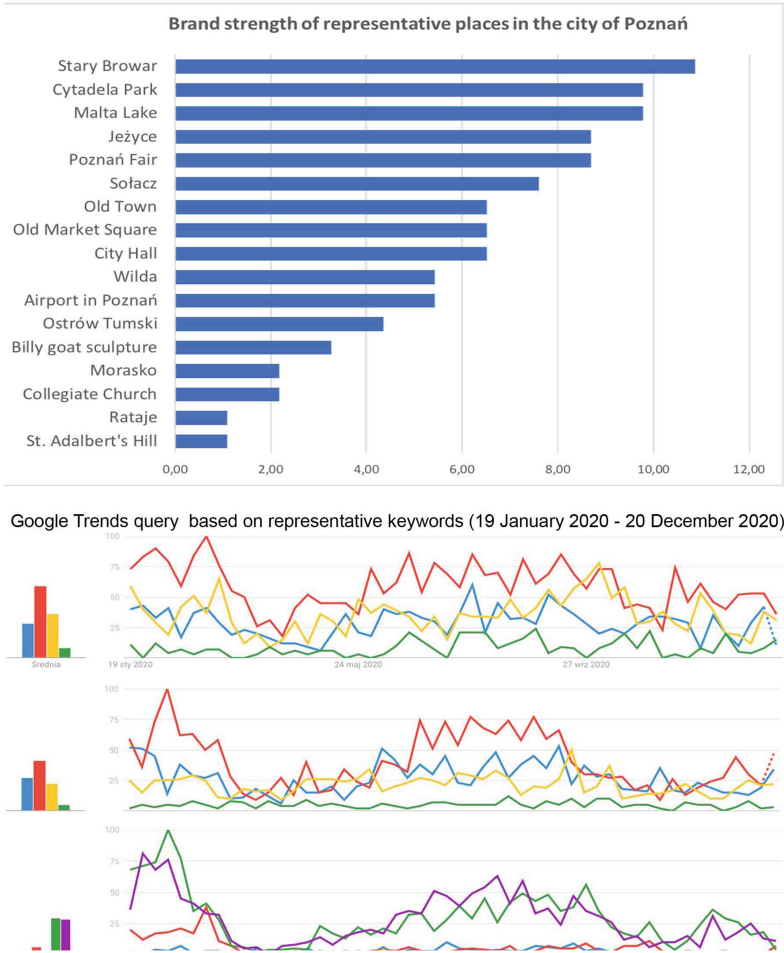
Fig. 1. The results of the brand strength survey of representative urban spaces in Poznań

4   Discussion

The data collected from this study suggests that the issue of space branding is complex and multidimensional. The participants of the research indicated a great interest among the people who were surveyed. They pointed out that the brand of places is the main criterion for tourists who visit the city. Brand is also important when choosing a place to live. Our study was hampered by the small number of our participants. All our participants were students and this may have influenced our results. More research is also needed on various aspects of urban branding. The obtained results enable a critical discussion regarding the branding of places. The notions of "brand", "space", "branded places" and "the meaning of narration in place branding" come to the fore here.

In a global and rapidly changing world, spaces become icons for brands, their image, and relationships with people. Space "becomes more and more a brand" [11, 13].

As Arvidsson [1] claims, we are doomed to an all-encompassing brand of space. Brand and marketing research began to shift their perspective to spatial dimensions [2, 6], and space scientists became interested in the brand [4, 5]. In this context, space is becoming increasingly important to many people as there is a legitimate need for place branding. Nowadays, space and brand are interdependent, which leads to new forms of interaction between the brand and people in the built environment. Branding determines the space. Each spatial unit has a strong or weak brand, but few spaces own a strong brand. We believe that the art of building a strong brand of place is closely related to the quality of architecture. It is true that branded spaces can arise spontaneously and develop in an uncontrolled way, but such situations are rare. Most often, brand spaces are the result of well-thought-out, well-designed and thoughtful activities. We would like to emphasize that branded spaces must be built taking into account cultural, social, philosophical, architectural, and managerial perspectives.

4.1   Brand

The "brand" phenomenon has developed into a global key problem because it is now difficult to imagine social, cultural, and consumer life without brands. Brands are the cornerstones that provide orientation in everyday life. In this sense, brands are treated as symbols [8], archetypes [3], social creations [10], performances [12] or cultural resources [1]. Branded places "arise as a result of the interaction of many parties, institutions, public opinion, and social forces" [10], The relationship between the brand and place has had many theoretical models [3, 8].

4.2   Space

Space is an ambiguous concept. In addition to the traditional understanding known from geography, a new understanding of space has developed that treats space as a social category: space is a social product" [7]. According to this view, a place in space is a setting for everyday life. A place is determined by movement, actions, relationships, and patterns of human behavior. In this sense, there are many kinds of spaces and places: places of residence, places of work, places of recreation, and entertainment. Each type of these places can have positive or negative social connotations. There are spaces we like to be in, but there are also places we do not like, which we avoid [9].

4.3   Branded Spaces

The branded space consists of two attributes: the way of perception and the interpretation of the feeling caused by the space (built environment) [9]. Place branding is a complex process as it includes the history of place, collective memory, local identity, local traditions, as well as the habits and preferences of the people living in the space. Architects, spatial planners, local authorities, entrepreneurs, journalists and politicians are involved in the process of building the brand of the place. The brand image of a place and the strength of its attraction largely depend on them [1]. To create a branded space, all of them (place brand stakeholders) must join forces to assign the place a magical power of attraction. This process is about giving the place a unique meaning.

Managing the meaning of a place must take into account finance, politics, and culture. For this reason, architecture is crucial to managing a place's brand. Architecture as the concept of place branding plays a key role in our research. Contemporary architectural design has become a place branding tool. Architecture understood in this way gives sense to space, establishes relationships and social feelings. Social feelings determine the strength of a place's brand. The appearance of the place plays an important role here, as does the sensitivity to aesthetic sensations. Regardless of the purpose of brand space, visual perception plays a leading role here.

4.4 Narration

Branded places tell stories to interest people and give the possibility of multilayered interpretation of the place. History can be multidimensional. It can refer of collective memory to real facts taking place in the past. A story can also be a fictional story created especially for the needs of a given place, skillfully enriched with a myth. The narrative creates stories connected with a branded place. Hence, an exciting and successful space can emerge through a narrative that describes a place. The created scenario of emotions is to arouse the interest of the audience and focus their attention on a branded place. Architecture should refer to the narrative and be a unique element of the heritage of the place. In this sense, architecture is an important element of space branding. Brand building, in particular, involves generating new knowledge for the recipient. Such knowledge should be exciting, stimulating, touching, sometimes fun, but always fascinating.

Future research should investigate how this message can affect place branding, and what methods are best for quantifying place brand strength.

5 Conclusion

The concept of a place brand refers to improving the attractiveness of urban space. This attractiveness is built by the image of places which are informative, symbolic, and functional for the inhabitants and tourists. Research has shown that the city of Poznan is diverse in terms of the strength of the brand of space. Most places have a weak brand, and places that city planners intend to attract attention need to be improved. To achieve this goal, it is necessary to improve the quality of architecture that does not show originality and respect for tradition and local identity. Brand management of the city of Poznan requires the cooperation of many stakeholders dealing with space branding. Architects and city planners play a key role here, but also architecture critics and journalists who have an impact on shaping public opinion.

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The Comprehensive Analysis of Micro-climate Adaptability and Design Mechanism Based on Traditional Villages in Northern China

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Abstract. The innovative of this project lies in combining the traditional village mountain and water pattern with the study of the micro-climate adaptability, taking the traditional villages mountain and water pattern in Beijing-Tianjin-Hebei as the research object, focusing on the microclimate adaptability design mechanism of the mountain and water pattern, and using microclimate indicators Based on the establishment of the system, computer numerical simulation and microclimate comprehensive analysis methods, the system studies the coupling relationship between mountain and water pattern and microclimate and adaptive design mechanism, controllable morphological parameters, map expression technology of morphological parameters and new design processes, and Based on key scientific issues such as the optimization plan of landscape pattern based on microclimate adaptability, and theoretical verification and application with typical cases of traditional villages in West Beijing, a comprehensive analysis and design optimization plan based on microclimate adaptability design is proposed.

Keywords: Traditional village · Mountain and water pattern · Microclimate · Numerical simulation · Parameterization design

1 Introduction and Significance of Research

The protection and optimization of the mountain and water pattern of traditional villages play an important role in the context of the current new urbanization. The integration of urban and rural areas in rural areas and the intensive development of villages and the improvement and transformation of the village environment urgently require in-depth research on the microclimate adaptability of the mountain and water pattern to protect the ecological characteristics and core values of traditional villages. One focus of traditional village protection is village's mountain and water pattern.

This study fills up the gaps in existing research. Starting in 2016, four batches of traditional Chinese villages and three key villages in Beijing-Tianjin-Hebei have been studied for more than 3 years, and certain results have been achieved. The construction

and the improvement of the human settlement environment play a certain positive reference and practical guidance significance.

2   The Problem

2.1   Domestic and Overseas Research at Present

The world has always paid great attention to the protection of traditional villages, from focusing on their physical properties to the reaction of hidden factors in the settlement pattern [1]. At present, the research on the development and protection of traditional Chinese villages mainly focuses on qualitative value research, evaluation system, tourism development, village spatial form and layout, and research on building single objects [2]. In recent years, domestic and foreign research work on microclimate adaptability has achieved remarkable results [3–6], but there are few studies on the analysis and design strategies of the meso-level mountain and water pattern and microclimate adaptability of traditional villages.

2.2   Analysis of Existing Problems and Development Trends

It shows a trend of informatization and multidisciplinary research. We found that the current research on this field has the following main problems: Microclimates are mostly used in the research of urban environment, but there are few research results in village. There are more qualitative analysis and evaluation, less quantitative analysis and design strategies, and lack of application of comprehensive analysis methods; Most of the research conclusions are a single regular result, lacking the research and expression of coupling relations and predictive control methods [7, 8].

2.3   Key Issues to Be Solved

The proposed solution includes the coupling mechanism between the microclimate and the mountain and water pattern, the establishment of the microclimate index system, and the comprehensive analysis methods and modeling techniques.

3   Research Objectives and Research Content

This project focuses on the research on the microclimate adaptability of the mountain and water pattern of traditional villages, based on the establishment of microclimate index system, numerical simulation and comprehensive analysis, to systematically study the coupling relationship between the characteristic types of mountain and water pattern and the microclimate of the traditional villages in Beijing, Tianjin and Hebei. And with typical cases of traditional villages in Beijing-Tianjin-Hebei for theoretical verification and application, a comprehensive analysis and design optimization plan based on microclimate adaptability design is proposed (Fig. 1).
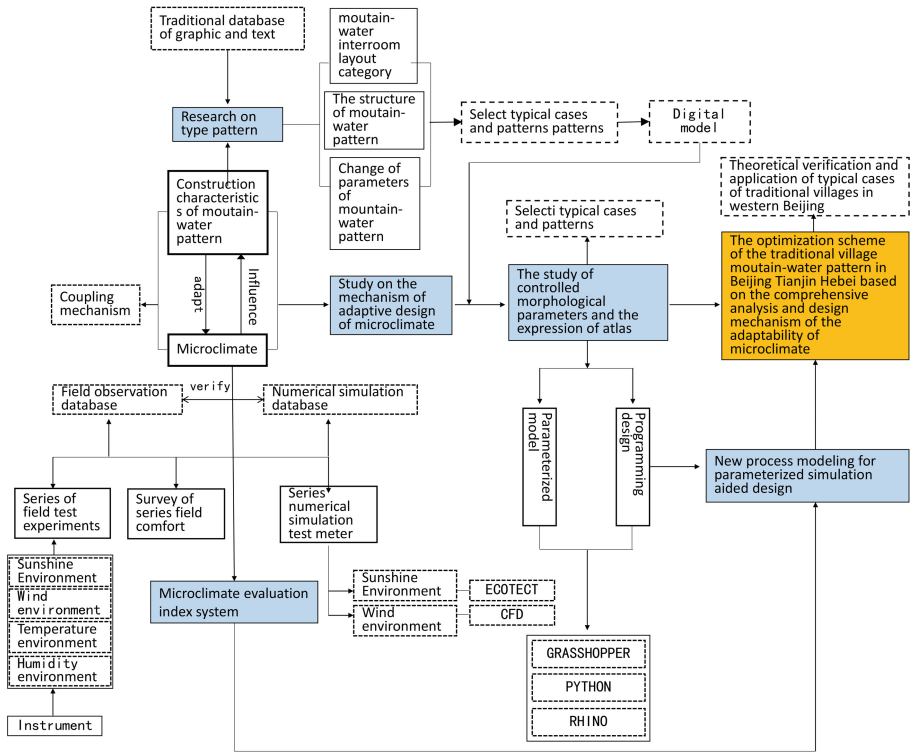
Fig. 1. Technical roadmap.

The research objectives are mainly divided into three parts. The research content in 2017 mainly includes basic research, data compilation, and preliminary analysis and research. In 2018, the work including data collation, statistics, analysis and evaluation index construction and model construction, and preliminary research on morphological parameter control will be carried out. In 2019, systematically complete the study of parameter indicators, parametric design paths and parametric map expression.

4 Research Methodology

The research methodology includes literature research, observational analysis, data analysis, simulation analysis and model analysis.

4.1 Literature Research and Model Research

This paper studies the characteristic types of mountain and water patterns of 169 Beijing-Tianjin-Hebei villages in the list of traditional Chinese villages [9]. From the site selection, function, scale, morphological relationship, mountain and water ratio

relationship, slope and other aspects of classification research and summary of feature types (Fig. 2), summarizes 16 types of mountain and water patterns.
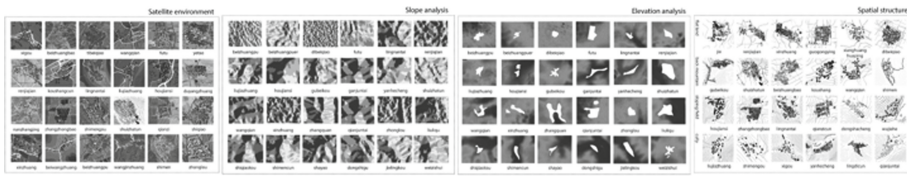
Fig. 2. Satellite environment map, slope analysis, elevation analysis, space structure diagram.

4.2   Field Observation

Field Observation is about 1.5m from the ground to observe the actual study object. Analyze climate data such as air temperature, wind speed and direction, relative humidity, and radiation temperature at the experimental measurement points.

Experimental Instruments. The facility and instruments used in this experiment are as follows: mobile weather station, portable thermosensitive anemometer, hygrothermograph, and black-globe thermometer. One day in each season was chosen for the observation of 10 test locations.

Layout of Observation Points. According to the experimental conditions, the characteristics of the mountain and water environment, the height and slope direction and the principle of uniform distribution of points, the survey points are arranged in the study area. The selection of observation point contains four types of topographic patterns: mountaintop, mountain slope, valley and the flat ground (Fig. 3).

Observation Approach. The research team completed the installation of small weather stations in the three typical Beijing-Tianjin-Hebei villages of Shuiyu Village, Xijingyu Village, and Lujia Village in advance, and performed fixed-point observations for 24 h, and monitored and collected data through the information platform.

4.3   Numerical Simulation

The research team constructed a three-dimensional model using CAD and Sketch up. After the modification with Rhino, this model was imported into software Phoenics and Ecotect for simulation.

Test point	space structure	Environmental characteristics	Site environment	Measuring instrument	Plan	Section	Landscape pattern
Q		Located in the southern part of the west village committee, the roof is open.		Hand-held anemometer Thermo-hygrograph Large globe temperature instrument			
1		Located between the two mountains, the east side of the mountain, the west side is the valley.The asphalt road runs roughly north and south.There are more vegetation on both sides.		Hand-held anemometer Thermo-hygrograph			
2		The mountain path, gravel and soil mix.The south side is the household, the elevation of the land, there are green plants.		Hand-held anemometer Thermo-hygrograph			
3		This is the west side of the village, halfway up the hill, with a north-south road and a valley on the west side.		Hand-held anemometer Thermo-hygrograph			
4		A large area of sunken square.Flat, sunny, surrounded by several large trees, and some dwellings.		Hand-held anemometer Thermo-hygrograph Large globe temperature instrument			
5		Located on the mountainside of the mountain, the north side is the mountain, the south side is open, the west side is around the mountain, there are trees.The east side of the mountain, relatively open, very flat,		Hand-held anemometer Thermo-hygrograph			
A		High in the region, vegetation is mainly shrubs and shrubs, with steep sides and a part of a mountain range.		Hand-held anemometer Thermo-hygrograph			
B		This site is located at the top of the mountain, the wind speed is large, and the vegetation is sparse.		Hand-held anemometer Thermo-hygrograph			
C		The east and west sides of the east and west side of the mountain, north and south side of the ground.		Hand-held anemometer Thermo-hygrograph Small black ball thermometer			
D		The mountain top is flat, surrounded by mountains.The mountain is increasing in height.The land is dry and has certain vegetation.		Hand-held anemometer Thermo-hygrograph			
E		This site is located in the mountain valley, the terrain is relatively flat, more open.There are mountains to the south and more vegetation.		Hand-held anemometer Thermo-hygrograph Small black ball thermometer			

Fig. 3. Experimental observation points

5 Research on the Formation Mechanism of Features of Mountain and Water Pattern

5.1 Qualitative Research on the Formation Mechanism of Features of Mountain and Water Pattern

Through qualitative analysis, with regard to the microclimate-related parameters, the initial conclusions are as follows (Table 1):

Humidity: At the top of the mountain that is not affected by the mountain, the humidity will first drop and then rise. The mountains act on the sunlight and affect the humidity. The higher the mountain height, the longer the influence time.

Wind speed: The wind speed between the valley and the top of mountain is close, the wind speed and direction on the top of the mountain are more evenly distributed.

Temperature: The degree of space opening and closing and the direction of space opening to-gether have an effect on the temperature of the measuring point.

Table 1. The Relationship between the Mountain-water Pattern Features and Microclimate.

Mountain-water Pattern	Wind Environment	Thermal Environment (Heat Gain)	The Wind and Heat Comfort
A Open Mountain Top	The wind speed is relatively high and the wind direction is very variable.	The thermal radiation is the highest when there is no obstruction or the occlusion of mountain.	It is not suitable for accommodation largely, but it is suitable for scene viewing at the high altitude.
B Open Flat Ground	Wind environment is mainly affected by buildings and plants.	Terrain affect buildings and plants. The level of influence is relatively low.	The reasonable layout of buildings and plants form a pleasant microclimate.
C Dependent Slope	The wind speed of slope dependent field is lower than surrounding wind field.	The larger the slope, the less the heat gain.	South slope might form better microclimate environment.
D Two Sides of the Valley	When it is perpendicular to the wind direction, the wind speed decreases. When it is parallel to the wind direction, the wind speed increases.	It is obstructed by mountains on two sides and the heat gain is relatively low.	The wind direction perpendicular to the valley creates a calm wind zone. The sun is affected by the valley, so it is not suitable for accommodation.
E Three Sides of the Valley	It significantly affects wind direction. The wind speed is relatively low and the calm wind area come into being.	The low heat gain area and the extremely low heat gain point can be formed in specific locations.	Will form a calm wind zone, not suitable for getting sunlight. Not suitable for accommodation.
F Four Valley Sides	It significantly affects wind direction. The wind speed is relatively low and the calm wind area come into being.	The low heat gain area and the extremely low heat gain area can be formed at the centre.	Will form a calm wind zone, not suitable for getting sunlight. Not suitable for accommodation.

## 5.2 Quantitative Study on the Formation Mechanism of the Features of Mountain and Water Pattern

Comfort—"Number". Comfort is used as a comprehensive factor of microclimate factors, and the comfort analysis and calculation of each point are carried out. The comfort analysis part is to calculate the comfort index based on field measurement results. The quantitative factors of mountain and water pattern are verified by correlation factors such as degree of opening and closing of points and the former.

Analysis of the Correlation Between Comfort and Mountain and Water Pattern. We assumed a linear relationship between the village landscape pattern and the village microc limate, and used R language software to perform regression analysis to obtain the formula:

$$547.36c_1 + 470.34c_2 = W_{summer} \tag{1}$$

$$W_{summer} = 0.8901t + 7.3771 \times 10^{-3}G + 13.8279a - 8.7284v - 0.0551 \tag{2}$$

$$9.5001c_1 + 0.3601c_2 = W_{spring} \tag{3}$$

$$W_{spring} = 1.7 + 0.1172t + 0.0019G - 0.322v - 0.0073a \tag{4}$$

$$38.06c_1 + 33.35c_2 = W_{winter} \tag{5}$$

$$W_{winter} = 1.7 + 0.1172t + 0.0019G - 0.322v - 0.0073a \tag{6}$$

Among them, the summer model is adjusted $R^2 = 0.9958$, the spring model is adjusted $R^2 = 0.9664$, the winter model is adjusted $R^2 = 0.9829$.

(t is the temperature, G is solar radiation, a is the relative humidity of the air, and v is the wind speed, C_1 is the southward openness, C_2 is the dominant wind direction, w_{summer}, w_{spring}, w_{winter} are the village comfort levels).

Through the algorithm coupling of "number" and "shape", We find that the mountain and water patterns of traditional villages, such as the shape of the terrain, the slope of the mountains, the sheltering of plants and the arrangement of buildings, were closely related to the local micro climatical factors.

6 Research on Evaluation System of Microclimate and Mountain and Water Pattern

6.1 Determination of the Evaluation Index Weights of the Landscape Pattern

Through the basic investigation and research of the microclimate environment, the results are compared and checked, and the Matlab software is used to program calculation and superimposition to obtain the comprehensive microclimate index score of the site, construct the evaluation standard suitable for the mountain and water pattern of the Beijing-Tianjin-Hebei region (Table 2).

Table 2. Mountain and Water Pattern and Microclimate Evaluation Index.

Mountain and Water Pattern Evaluation Index

	Evaluation	1 (Too low)	2 (Low)	3 (Moderate)	4 (High)	5 (Too high)
Spring Autumn	Southward Space Openness (N%)	N ≤ 30	30 < N ≤ 40	40 < N ≤ 50	50 < N ≤ 60	N > 60
	Dominant Wind Direction Openness(W%)	W ≤ 30	30 < W ≤ 45	45 < W ≤ 60	60 < W ≤ 75	W > 75
Summer	Southward Space Openness (N%)	N ≤ 25	25 < N ≤ 35	35 < N ≤ 45	45 < N ≤ 55	N > 55
	Dominant Wind Direction Openness(W%)	W ≤ 45	45 < W ≤ 55	55 < W ≤ 65	65 < W ≤ 75	W > 75
Winter	Southward Space Openness (N%)	N ≤ 35	35 < N ≤ 45	45 < N ≤ 60	65 < N ≤ 80	N > 80
	Dominant Wind Direction Openness (W%)	W ≤ 15	15 < W ≤ 25	25 < W ≤ 35	35 < W ≤ 45	W > 45

Microclimate Evaluation Index

	Evaluation	Extremely Low (-2)	Low (−1)	Moderate (0)	High (1)	Extremely High (2)
Spring, Autumn	Temperature (°C)	T ≤ 7	7 < T ≤ 12	12 < T ≤ 15	15 < T ≤ 18	T > 18
	Humidity (%)	0 ≤ RH ≤ 20	20 < RH ≤ 25	25 < RH ≤ 30	30 < RH ≤ 40	RH > 40
	Wind speed (V)	0 ≤ V ≤ 0.3	0.3 < V ≤ 0.5	0.5 < V ≤ 1.5	1.5 < V ≤ 2.5	V > 2.5
Summer	Temperature (°C)	T ≤ 20	20 < T ≤ 25	25 < T ≤ 30	30 < T ≤ 35	T > 35
	Humidity (%)	0 ≤ RH ≤ 30	30 < RH ≤ 40	40 < RH ≤ 50	50 < RH ≤ 60	RH > 70
	Wind speed(V)	0 ≤ V ≤ 0.5	0.5 < V ≤ 1.5	1.5 < V ≤ 2.5	2.5 < V ≤ 3.5	V > 3.5
Winter	Temperature (°C)	T ≤ −10	0 ≥ T > −10	0 < T ≤ 10	10 < T ≤ 20	T > 20
	Humidity (%)	0 ≤ RH ≤ 20	20 < RH ≤ 30	30 < RH ≤ 40	40 < RH ≤ 50	RH > 50
	Wind speed (V)	0 ≤ V ≤ 0.3	0.3 < V ≤ 0.5	0.5 < V ≤ 1	1 < ≤ 1.5	V > 2

6.2   Mountain and Water Pattern Evaluation Map Expression

The different grading standards for comfort are compiled into the Grasshopper program to generate a comfort map (Fig. 4). Special attention is paid to the relative values for the spring colors in the figure. For winter and summer, the comfort evaluation standard is used to divide and screen.

● Very uncomfortable ● Uncomfortable ● Comfortable ● Very comfortable
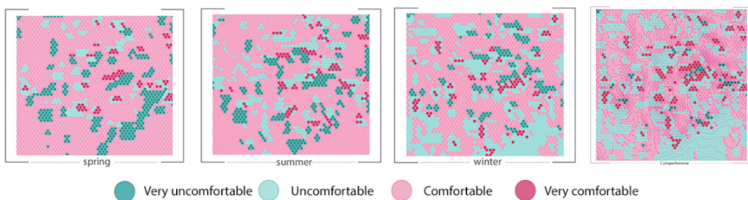
Fig. 4. Comfort map analysis (Spring, Autumn, Winter and Comprehensive)

7 Research on Process of Parametric Simulation Aided Design

7.1 Parametric Design Prototype and Framework

In this research, the Grasshoppcr programming program, combined with the characteristics of the mountain and water pattern elements, selects the more targeted landscape pattern factor parameter group, and quantifies the parameters, brings them into the corresponding program calculations, and uses the Rhino platform for map expression to construct the traditional village mountain and water pattern parameterization Model design framework.

7.2 Parametric Design Process

Research on the Correlation of Morphological Parameter Group Factors. On the basis of the microclimate adaptability design mechanism and the control of morphological parameters, comfort is used as a comprehensive factor of the microclimate factor; the southward spatial openness (N%) and the dominant wind direction spatial openness (W%) are taken as the mountain and water pattern Comprehensive factors to achieve morphological parameter control.

Optimal Selection Within the Morphological Parameter Group. The traditional village numerical simulation results, microclimate adaptability morphological parameters and actual measurement results are compared and checked, combined with the national thermal environment WBGT index and Ts-Givoni index hypothetical microclimate comfort evaluation standard system and the mountain environment and water environment analyzed in the previous period. The correlation of microclimate comfort related values can be used to generate computer-based recommended construction points for the mountain and water pattern based on climate adaptability.

Graphic Expression and Optimization Strategy of Design Mechanism and Morphological Parameters. Through the construction of village site model and parameterized morphology generation, the algorithm is coupled, set appropriate parameter conditions, and iteratively calculate and output a combination map of morphological relationships that meets the requirements. Qualitative classification guides village planning. quantitative evaluation the formation mechanism of landscape pattern.

8 Conclusions

This research takes traditional villages in Beijing-Tianjin-Hebei Region as the research object, selects typical traditional villages based on expert suggestions and social influence, and conducts in-depth field surveys and surveys for many times and seasons to explore the multi-factor coupling relationship between microclimate conditions and landscape layout. According to the microclimate human comfort standard, it constructs the evaluation system index suitable for the traditional village landscape pattern in the

Beijing-Tianjin-Hebei region, and then proposes a design process based on climate adaptability. This research not only improves the coupling relationship between site and design, but also significantly improves planning efficiency, providing a scientific basis for improving the living environment of traditional villages.

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Ergonomics in Urban Design

Cultural Identity of the Cities—The Use of Narrative Design in Urban Spaces

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Abstract. The Narrative process build histories. It exploits the ability of different human sensory experiences to trigger the imagination, evoke emotions, and capture universal cultural truths and aspirations. Cities need to use narratives to recreate a system of relationship between urban space and people. This paper explores the narrative design strategies for urban spaces and proposes the "Perception-Interaction-Make sense" narrative design model. The paper presents a case study of Iranian regional culture in the context of a workshop at Alzahra University in Tehran, Iran. The work also provides a vision of data as a tool for urban narrative in the era of smart cities. The value of this thesis is to provide a theoretical reference for the construction of regional distinctive culture in a global context, as well as a theoretical guide for the sustainable development of urban culture in urban renewal.

Keywords: City identity · Narrative design · Cultural diversity

1 Introduction

In the development of smart cities, technology is changing people's way of life and the social perception in cities in a way invisible to the naked eye. Human activity in cyberspace is closely linked to the influence in real environment. The way people perceive the city environment is increasingly not only limited to the experience in physical space, but more about overlaying the physical space with shared information layers and collaborative location-aware technologies that rely on emerging technological media. The saying "seeing is believing" is no longer applicable to the process of generating knowledge of a place. In many cities the perception of space by citizens is today much more complex than what happened not more than twenty years ago.

Due to rapid globalization and the continuous advancement of technologies, identifying relations and values that define humans and their environments in various ways has become crucial [1]. Following the development of the communication society, the fierce competition between cities has gradually developed from a single economic competition to a competition of social innovation and cultural vitality. Societies are increasingly admiring the innovative capability of urban life. The identity of a city is therefore increasingly important for the sustainable development of a city

and the well-being of its society, also thanks to the economic benefits that a recognized identity can generate. According to The 2030 Agenda for Sustainable Development issued by the United Nations. Urban cultural inclusiveness is an important indicator of sustainable urban development and social peace and prosperity. This paper therefore focuses on the question of what aspects of urban identity are embodied in the city and how these aspects capture the dynamic and fluid character of human social self-expression.

2 City Identity and Spatial Narrative

2.1 Premise

In different disciplines, the word "identity" has specific reflections and diverse specific explanations. In order to avoid ambiguity, this paper first sets a premise on the meaning of the word "identity". The meaning of the term "Identity" in this paper mainly relates to the uniqueness of a local cultural environment and social relationship, which is quite different from other cultural forms.

The connotation of "City Identity" in this paper mainly refers to the social and spatial cultural value of one city that makes it different from other cities. This value creates an empathy and attachment to the city. It represents the collective field of experiential knowledge and psychological identification in the urban space. Citizens and visitors need to perceive, experience and learn in order to acquire this experiential knowledge.

2.2 The Spatial Narrative Constitution of Urban Identity

In many of the studies belonging to the same field of research, are identified some characteristic elements of urban space, such as colors, materials, light, buildings, furniture and so on. These tangible and intangible feature elements contained in urban space can be discussed as urban identity elements. Collecting them together, they are the chapters that make up the narration of the city.

In "The Production of Space" Henri Lefebvre argues that space is the product of social relation. His theory promotes people's attention to the spatial dimension of cities, not just the termporal scale. The various activities and changes in the city are shown through the spatial dimension.

In the semantics of urban identity, the concept of "space" takes on a completely new meaning. The Urban space is a medium for telling stories, expressing emotions and transmitting knowledge. Urban spatial narrative is a narrative carrier that focuses on human behavior as the core.

3 Analysis of Spatial Narrative Elements

The concept of urban space narration in this paper can be understood as: to think of space as the representation of all narrative activities in a city. The tangible and intangible elements in the space are seen as storytelling tools that can tell the story of the city to the people and define the transition from "space" to "place". The attentions are no longer to technologies and function but to people and events, to the many aspects of living that involve our emotions and our feelings. They focus on the phenomenon related to identity as the place where stories and things develop.

In the book "The Image of The City" Kevin Lynch explores five material form elements as city images: Path. Node, Landmark, Edge, District. People built their own city images through these five elements. From the perspective of the design discipline, there are many other tangible and intangible elements in the city that can express the "Genius Loci" of a place, that profoundly influence the perception of space, and that are the soul of the city. People perceive both tangible and intangible spatial qualities in space, and placemaking focuses on valuable intangible spatial qualities, such as aesthetics, neighbourliness, traditional culture and identity elements in urban spaces, which are closely linked to human perception. Through desk research and city scene analysis, this paper investigates the feature elements of urban spatial scenes, and makes quantitative analysis of these elements, so as to finally arrive at the classification of urban spatial narrative elements in the diagram (Fig. 1).
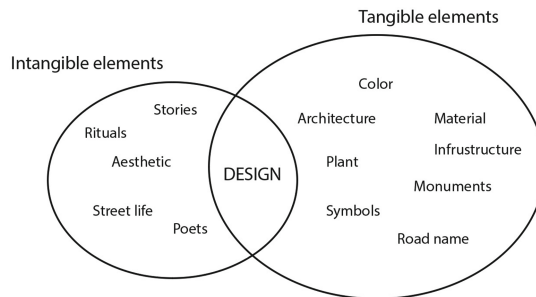
Fig. 1. The urban space narrative elements category

The narrative elements in urban space represent the realm of the common experience knowledge of the local people. "Space is freedom, place is security" [2] (Yifu Tuan, Space and Place 1977). There is a series of cognitive transformation processes from space to place for people's cognitive patterns of the place. In the book Space and Place Yifu Tuan describes the Warner Brown's learning maze experiment. From the experiments, it was concluded that: in a completely unknown space, people learn to understand a completely unknown environment by integrating a number of sensory modalities to perceive a range of actions in space. Ultimately "when one is completely familiar with the space, it becomes the place" [5]. It is the same situation when people first time enters in an urban space with different identity, firstly, people perceive the

various elements of the space through their senses. Secondly, one participates in the activities in the space, interacts with the elements or events in the space, and finally, one develops an emotion and memory of the place. At first people use their senses to perceive and learn about the various elements and activities in the space, then participates in the activities in the space, interacts with the elements or events in the space, and finally, people develops emotions and memories of this space. After this cognitive pattern, space becomes a place. From perceiving, interacting to make sense with the space, we are able to see in the space the common characteristics of local people that help us to communicate through it. Through this cognitive model, people will acquire the identification between alter and ego (Fig. 2).
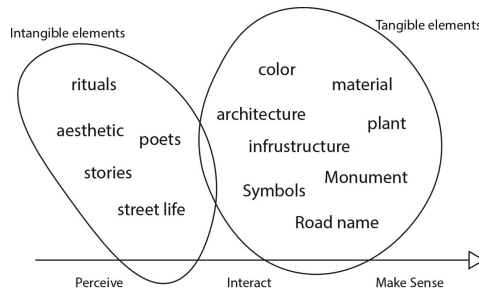
Fig. 2. The spatial cognitive model: from space to place

Through the analysis of spatial narrative elements and spatial cognitive model, this paper focuses on how this model can help the research analyses the growth patterns of different regional cultures. The growth patterns of different regional cultures are the same, or each has its own way of development? In the process of urban dynamic development to provide theoretical guidance for the potential human model.

4   Case Studies: Take Iranian Territory Culture as an Example

In order to test the results of the theoretical analysis presented in the initial phase of this paper and verify on the field the potential of a narrative model applicable to public space, we have developed a method of investigation and then apply it to a case study. In collaboration with the Department of Design at Alzarha University, Tehran, Iran, we organised the workshop 'City As A Book', which combines teaching activities to quantify and qualitatively analyze the cultural identity of Iranian cities.

The workshop considers urban space as an environment that provides an understanding of local values and cultural identity, analysing the diversified and multidimensional cultural identity of urban spaces, As well as discussing the possibility of digital technology as an interface to establish the identity of cities, urban data as an urban narrative method in the future.

The Workshop consists of two phases: the fieldwork phase and the theoretical concept phase. The fieldwork phase consists of two sessions: Urban Identity and Urban Narrative; Human Activities and Perception in Urban Public Space. In this phase the narrative elements of the city physical space and the people's activities and perceptions in the space are investigated. The theoretical concept phase consists of two sessions: Changes in Spatial Characteristics in Smart Cities; Digital Narrative Design of Urban Spaces. This phase discusses the new features of urban spatial narrative and the development framework of digital narrative in the era of smart cities. In the course we mainly use research methods such as field research in social studies and brainstorming in design discipline.

During the fieldwork phase, the scope of the urban space investigated was mainly the open public space in a particular area of the city. Such as, a square, a street, or a space in a crevice. In the investigation results of this phase, the students' investigation report mainly combines the city scene pictures with the text description. In the paper we will present some items as examples. The items in the Urban Space Narrative Elements Category are analysed in turn, culminating in a scenario analysis of the narrative elements of urban space, as shown in the Fig. 3.

Inverstigation content from the students: Maryam Ramezani , Sandra Azari, Golsa Abbasi, Asal Abbaspour,Saba Arshadi, Zeinab Zarei
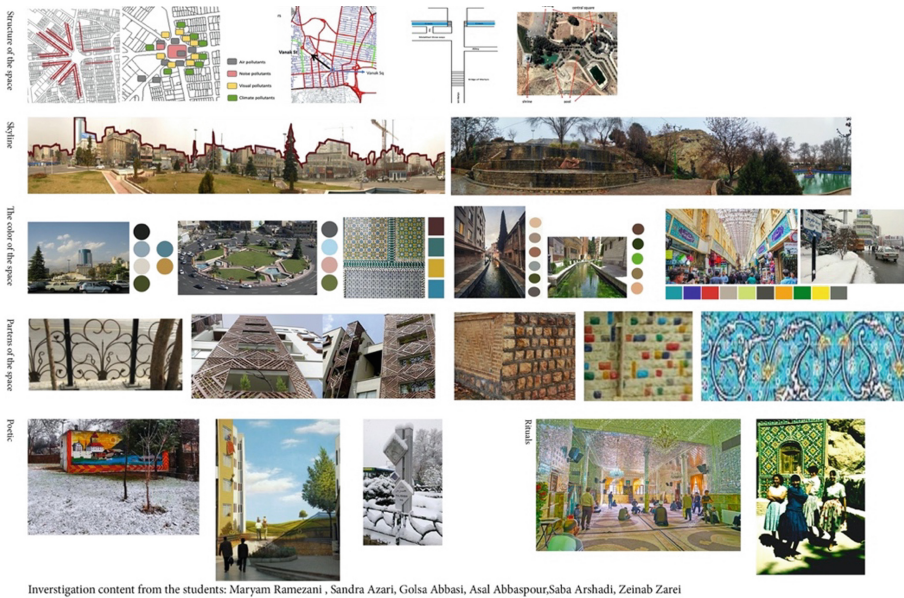
Fig. 3. Students' investigation in the city public spaces

In the analysis of the scenario, a five-sensory map analysis was used to assess the quality of experience in the space and to analyse the specific perceptual elements (Fig. 4).
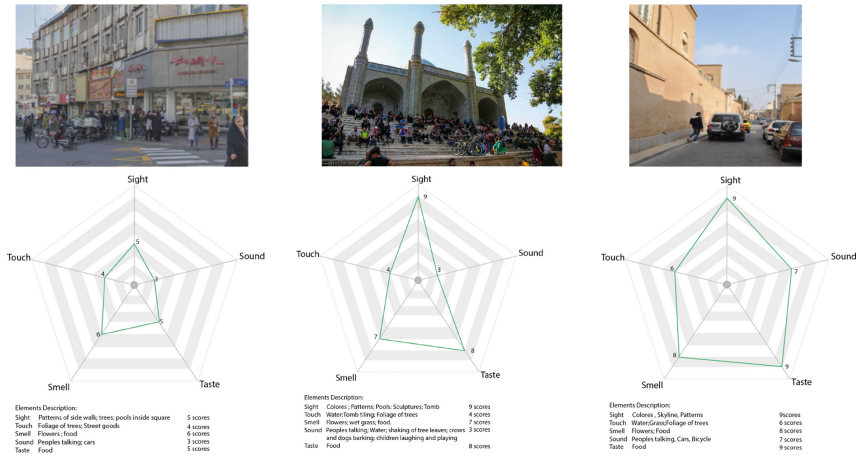
Fig. 4. Analysis of the five senses in urban public space

The public image of this space is analyzed by cognitive map method, and the residents draw the image map composed of various elements. A map (sketch) of the space is drawn on white paper by residents based on memory (Fig. 5).

In this map drawn by an 8-year-old child, only the pools come to mind. One of the pools is the central pool, which is shown with its fish and a statue of a fisherman, and the other two pools are where he swims and plays with his father and friends.

This map was drawn by a 23- year-old man, which shows more details of the park than other maps that he has remembered, including the only pavilion in the park, mountains, springs, etc.

In the map on the right, drawn by a 52-year-old woman, there is a lot of focus on drinking water collection points, because in previous years, people used to draw water from springs due to the lack of piped water in cities. The car in the park has been noticed because of his driving. In ancient times, due to the establishment of the circus and the wall of terror, their place is also remembered.

Fig. 5. Residents' cognitive map of the city public space

Result: This stage is analytical, examining the elements of cultural identity in urban spaces from the perspective of design discipline. The different sensory elements and human activities are analysed. The investigation revealed that, at macro level, there is the trend towards globalisation in the physical appearance of the city, which can be seen in the glass-covered buildings and the wide roads. At the micro level we find more elements of traditional culture. Such as the decorative use of traditional patterns, the yellow mud walls in the urban streets wich combine traditional colors and materials, the decorative shapes of street furniture, the colors of street signs, etc.

In addition, investigation revealed that the more closely related to people's daily activities, the more identifiable the characteristics. Such as the female dresses, food, diet, etc. Therefore, it is important to focus on people's life more in the future

investigations. More importantly, through the investigation we discovered that many aspects of the city identity are not linked to material level, but to cognitive level that related to the lifestyle, emotional belonging and religious beliefs of the local people, which are aspect can only be perceived. The study of urban identity cannot be confined to a fixed cultural paradigm, but needs to be dynamic, and with the help of the technology of this era. The second phase of the workshop has been an observation of new trends. A vision of a new narrative for the city of the future.

5   Data as City Narrative Tools

With the development of ICTs technologies, ubiquitous devices are designed to be integrated into the ordinary things of daily life. Today narratives have become more subtle, microscopic and fragmented through the use of emerging technological media. Pervasive computing is intertwined with the development of public space, where digital devices leave traces of people's activities in virtual space, creating a habitat in our virtual space. "Phones connect across distances; GPS locates people in space; Computer games and streamed media synthesize spatial environments; …Short text messages, or tweets, are propagated through the Internet and phone networks to signal the change in position of a friend ("I am in the park") or the state of arbitrary objects" [4]. (The Tuning of Place, Sociable Spaces and Pervasive Digital Media, Richard Coyne, 2010). All these devices are distributed in the space, occupying and creating environmental relevant features.

The popularity of IoTs technology in urban space makes it easier to collect real-time dynamic data covering physical space and forms a new information layer about our urban environment, which we can imagine as a digital city model of virtual space. These abundant data layers provide people with the opportunity to observe ourselves and our environment. It is possible to drive the user's sense of place and to establish a connection between the user and the place. The way digital devices transmit information about the world around us has also helped us begin to create an urban narrative that spans space and time. These data constitute a "digital memory" of a place, a city, or an event. In an IoT environment, sensors can sense physical space in real time, and individual objects can collect data about a place through a combination of sensors and location tags. The data is then transmitted across distances via the network to actuators, which ultimately intervene in the state of things in real space and interact with people. Through this process, it can eventually connect things and people in physical space with database in virtual space, thus creating interaction between different dimensions. In the IoT environment, People-Object-Space interact system formed, and in this system different dimensions are interacted.

This paper attempts to construct the digital narrative design framework of urban space, and to analyze the potential of design discipline in deploying strategies to help people both understand and create the city environment. In the envisaged digital narrative framework. As shown in the figure, real-time data is collected through IoT sensors in the corresponding urban public facilities, processed by computer algorithms, and the results are output to the objects (which can be objects, buildings, sculptures, flower beds, etc.) to interact with the people in the city spaces. Eventually people can

interact directly with the inherent objects in their space and perceive the meaning of their space, instead of perceive the space through extra-designed electronic devices (Fig. 6).
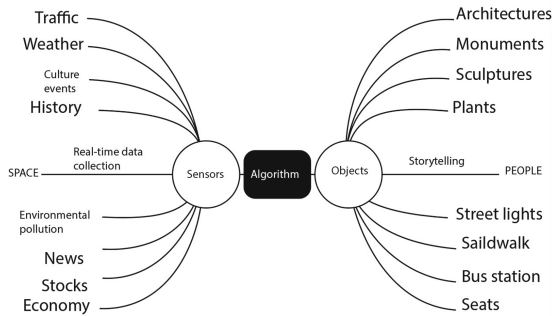
Fig. 6. Digital narrative design framework

The elements that characterize the identity of a place are themselves the best narrative tools; their constitution and aesthetics, often generated by the material traditions of the place have a narrative value much higher than that of most technological objects used with a communicative function. Such technological devices almost never have a relationship with the place where they are installed. The technology should be invisible in the environment and not cause semantic disturbance to the environment itself. In the framework of object design for digital fiction, designers should think about how objects interact with people in space and about more accessible interfaces in the People-Object-Space system.

6   Conclusion

Cities have always been storytelling tools. The walls of our suburbs are the white sheets through which street artists of every city are decoding our society.before the advent of digital technology, people express their stories through words and paintings. Objects and paintings from the past tell extraordinary stories and events. Thinking to Italian Renaissance wedding furniture - Cassone (marriage chest), paintings on cassone depict stories related to marriage and family, such as the famous Story of Lucretia. Narrative is always present in all places, people appreciate and scrutinise the fragments of the city: Small monuments, pavements, stones, tablets, folk tales, feelings, affections and the memories that exciting people. As painting art in Renaissance, digital technology is the main way modern cities tell stories. Data narratives act as a tool to link citizen with spaces, helping people to perceive the culture, identity, memory and historical significance behind the environment and urban form.

The most important feature of digital narrative is its diffusion in different spatial and temporal dimensions, when individual or social perceptions can come together around stories that generate meaning, it is the beginning of the formation of solidarity, empathy and identity.

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Diversity in a Landscape Revitalization Process

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Abstract. The article present results of research related to the revitalization of the suburban landscape. The analysis used the research-by-design method in a case study in the Morasko district in Poznań, Poland. The results of the research allowed for drawing general conclusions, the most important of which concerns maintaining the diversity of the landscape revitalization process.

Keywords: Landscape revitalisation · Diversity · Governance

1 Introduction

Landscape revitalization is an essential element in efforts to achieve a sustainable settlement system. The article presents planning and design activities aimed at this goal. The research was based on a case study of one district of the Poznań Metropolitan Area. The research focused on:

- Previously undescribed landscape revitalization projects for the Morasko district in Poznań,
- Original interpretation of the facts suggesting the possibility of a diversified design approach to the landscape revitalization of Morasko district.

An essential element of our design activities was the context, i.e. the attitude toward the spatial environment (which is the background for design activities) as well as the social, cultural, and economic environment [1]. In this sense, the context has a value that is important for landscape revitalization and the attractiveness of the district.

2 The Problem

The research topic is closely related to landscape architecture, including the rational shaping of the human environment, in a way that allows meeting not only basic functional needs, but also social, emotional, and cultural needs, as well as preserving the identity of the Morasko district as a unique part of the Poznań Metropolitan Area.

The Morasko district aspires to be the main node of the natural network of regional importance. It has a significant socio-economic significance, it is the location of AMU Universities and many companies in the IT sector. This is where recreational, scientific, and cultural functions are concentrated [2].

An important planning challenge is the landscape revitalization of the Morasko district, carried out in such a way as to strengthen the natural and functional cohesion.

A significant element of the implementation of these plans is the attractiveness of the natural environment. In the Morasko district, there are biodiverse forest and meadow areas cut by a network of streams. These unique natural resources are subject to constant degradation due to the proximity of residential areas and the pressure of developers to allocate these areas for development.

For the complex, interdisciplinary issues of landscape change in the studied area, the authors paid special attention to:

– the ability to self-regenerate natural groups,
– the importance of organizing and hierarchizing the space in terms of functionality and utility as well as compositional and visual,
– a combination of educational, scientific, recreational, and tourist functions while maintaining the natural diversity [3].

For this reason, the main groups of stakeholders were invited to the project [4, 5]:

– farmers, owners of agricultural land located in the Morasko area,
– environmental organizations striving for strict nature protection in the Morasko district,
– UAM University authority, whose campus is located in the Morasko district,
– developers interested in building new investments.

Important design decisions were made on the basis of "personal identification". It consisted in analyzing stakeholder suggestions and confronting these arguments with the main goal of the project, which was landscape revitalization.

The question of a creative attitude.

The standard methodological steps presented above have been supplemented with an additional, but, according to the authors, essential, critical analysis of the creative attitude in landscape design.

In the discipline of landscape architecture, the creativity and creative attitude of a designer play an important role, much greater than in the case of representatives of many other specialties. The issue of the creative attitude is related to the following questions that a landscape architect should answer:

– To what extent is the project innovative and what new values does the project bring to landscape architecture?
– What is the originality and authenticity of the project?
– Did the implemented project find social acceptance or did it contribute to the environmental balance?

3   Characteristics of the Landscape Revitalization Project of the Morasko District

The landscape revitalization project of the Morasko district in Poznań is characterized by an integrated approach to the designed space while maintaining maximum natural and functional diversity. In the proposed approach, the designed space is characterized by landscape quality, accessibility, functional diversity, cultural climate, and contact with nature. These diverse elements significantly affect the sustainable development of the district and the investment attractiveness shaping the economic value of the area. The aim of the project (the overriding criterion for planning solutions) is to improve the quality of the landscape of the Morasko district in Poznań. The analysis of long-term economic effects has shown that the best variant of landscape revitalization consists in the compact organization of new buildings. At the same time, the old scattered buildings were liquidated, thanks to which the quality of the landscape was improved and the ecology was strengthened. The proposed design solution ensures a high level of transport accessibility of the AMU University Campus by extending the fast tram line beyond the railway line No. 395 (Kiekrz-Ligowiec) and the location of the buffer car park. As a result, the volume of car traffic has been reduced along Naramowicka Street towards the center of Poznań. There has been a significant improvement in air quality. The main criterion for selecting the presented variant was to ensure sustainable landscape revitalization while ensuring natural and functional diversity and high attractiveness for scientific, educational and cultural functions.

4   Results

Synthetic characteristics of the project.

– Total area covered by the study: 2,538.8 ha.
– Planned development area (gross investment areas): 455.4 ha (17.9%).
– Existing green area (forests): 625.3 ha (24.6%).
– Area of the planned greenery (mid-field afforestation belt): 200.6 ha (7.9%).
– Areas designated for protection (natural values): 199.2 ha (7.8%).
– Number of inhabitants: 4,900 people.
– Number of users of area No. 2 (students and employees of UAM University): 5,900 people.
– Average dwelling density in the area within the scope of the study: 1.93 m²/ha.
– Average dwelling density in the area designated for development: 10.76 m²/ha.
– Area's development capacity: 24,500 m² (assuming a population density of 50 m²/ha), which covers the prospective demographic needs for the next 30 years (optimistic forecast assuming the dynamically developing educational function of UAM University).
– Planned number of users (students and employees, UAM University) of region 2 and 3 (155.4 ha), based on the data on investment expenditure of UAM University, it amounts to 35,000 people, which is 225 people/ha (Figs. 1, 2, 3 and 4).
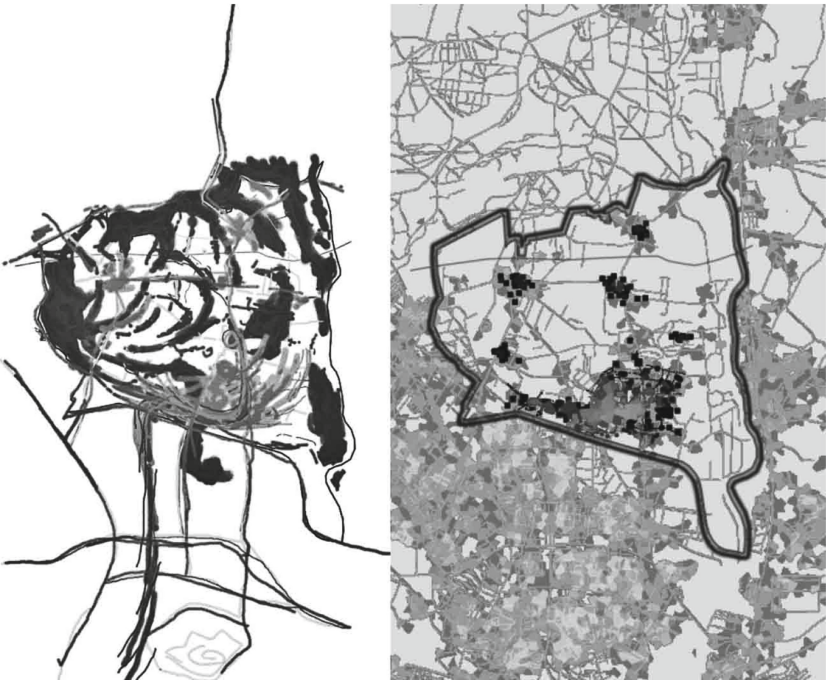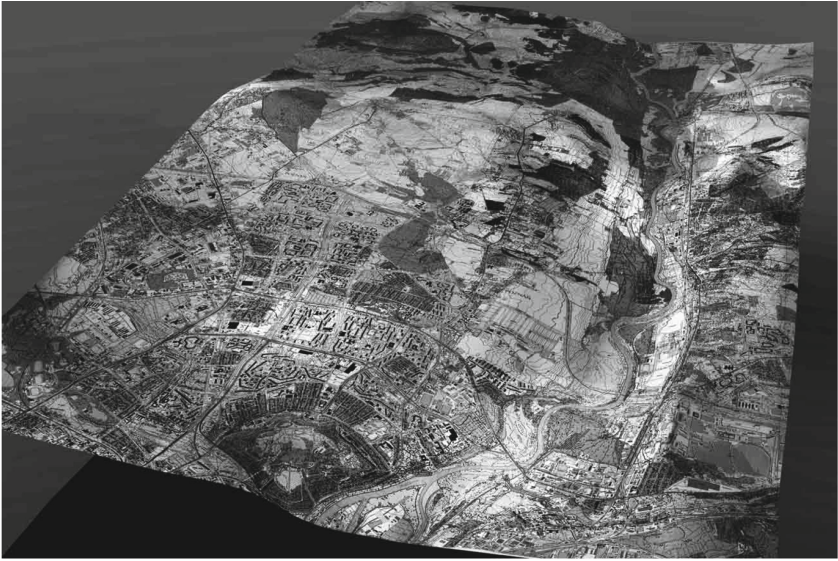
Fig. 1. Landscape revitalization project. Morasko District, Poznań, Poland. Author: Wojciech Bonenberg. Existing states and a sketchy concept of a selected landscape revitalization concept.
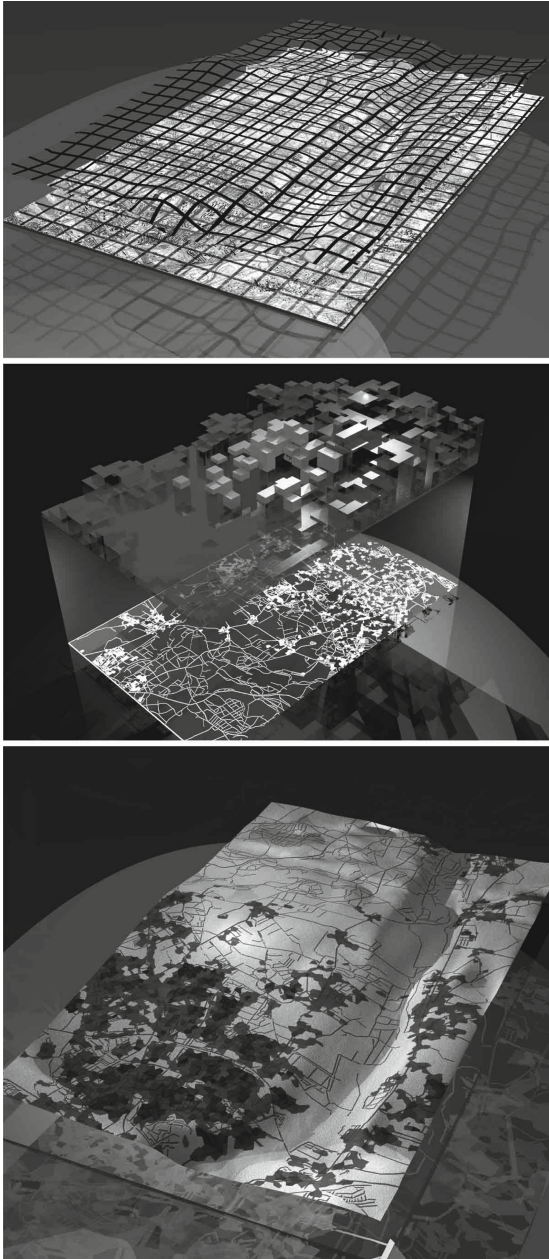
Fig. 2. Landscape revitalization project. Morasko District, Poznań, Poland. Author: Wojciech Bonenberg. Physiography. Economic attractiveness analysis. Flood risk analysis.

Fig. 3. Landscape revitalization project. Morasko District, Poznań, Poland. Author: Wojciech Bonenberg. The system of transport connections to the center of Poznań

Fig. 4. Landscape revitalization project. Morasko District, Poznań, Poland. Author: Wojciech Bonenberg. The designed greening system.

5   Conclusions

Conclusions regarding the importance of diversity in landscape revitalization (on the example of the Morasko district) can be grouped into two groups. The first concerns a creative approach to landscape revitalization, the second concerns positive design effects.

The experience gained in the implementation of the presented revitalization project allowed to indicate the three most important values in the creative approach. These are:

- readability - which enables understanding of the possibilities offered by the landscape and shows the various possibilities of rational design creations,
- diversity - which affects the range of landscape use and the diversity of impressions related to the perception of the landscape

– flexibility - which affects the extent to which people can use the landscape for different purposes, taking into account the dynamics of social, cultural, and economic change.

The second group of conclusions concerns the effects which increase the attractiveness of the landscape. You can include here:

– a significant increase in natural green areas,
– liquidation of scattered old energy-intensive buildings.
– limiting new investments to compact housing estates in a limited number,
– reconstruction of the natural network of surface waters,
– partial use of natural biocenoses for the disposal of domestic wastewater,
– on-site electricity production based on the use of renewable sources.

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Residences and Their Gardens

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Abstract. The work discusses the evolution of historical residential gardens. Their mutability is chartered against the changing aesthetic canons in subsequent epochs in the context of technical and technological evolution. The aim of the work is to show that despite the changing times, garden designers repeat the same or similar solutions that they interpret in accordance with the spirit and possibilities of successive epochs. Gardens accompanied the residences of rulers, aristocrats, and the church hierarchy. Always, the search for the beauty of the garden took place on the real and speculative levels, allowing for achieving harmony in accordance with the accepted cultural canons.

Keywords: Historical garden · Axis · Open layout · Composition · Symbol of status · Antiquity · Middle ages · Renaissance · Baroque · Age of the enlightenment

1 Introduction

European garden art has its roots in Mediterranean cultures, the notion of paradise as described by the Church and in the legendary Far East gardens which were described quite early by ancient Greek and Roman travellers. Together with the spread of monasticism in Europe, gardens such as cloister gardens, herb gardens and kitchen gardens became an indispensable element enclosed within monastic walls. Evolving defensive concepts were the primary factor limiting their scale within the residency of rulers and the aristocracy. The Middle Ages, Renaissance, Baroque and the Age of Enlightenment all had their characteristic garden forms, constituting a status symbol amongst the lay and clergy in the respective periods.

From antiquity until the 18th century, an axial garden complex composition was an expression of control over the surrounding environment. Real landscapes were replaced by rational, geometric arrangements transforming the original natural forms. Centuries later, a departure from such a garden concept was driven by acknowledging the beauty of nature upon cramped and dirty cities[1] promoted by medical science and artists.

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[1] London was one of the first cities where the sources of infectious diseases were discovered and studied. As a consequence, impromptu steps were taken during epidemic breakouts concurrently establishing sewage and water supply systems. https://www.bl.uk/victorian-britain/articles/health-and-hygiene-in-the-19th-century.

The influence of the Arab culture affecting Europe from the Iberian Peninsula for nearly 800 years cannot be overlooked. The engineering water management solutions employed within the scope of geometric, axial gardens were more advanced than those used in Europe in the Middle Ages[2]. Trade with Far and Middle East countries also contributed to the changes in gardens. Natural sciences gave rise to interest in exotic species of plants which subsequently entered common use.

Nevertheless, the forms which were created in the early epochs were used and interpreted in the subsequent centuries.

2   Antiquity – Composition Axis

A garden in Egypt was more than a status symbol. It was an extravagance, only indulged by the most prominent individuals. Plans of their gardens and scenes depicting relaxing time spent amongst greenery were painted in their tombs and on temple walls. Ancient Egyptian gardens always conformed to and complemented the layout of buildings, their axes and shapes. The most famous of the wall paintings illustrates Sennefer's residence and is found in his tomb in Thebes[3].

Another famous axial garden, spanned terraces in front of the Temple of Hatshepsut on both sides of a central ramp ascending from the Nile. The axial layout of the complex was emphasised by trees on both sides of it, growing on rock terraces. "Pots" carved in in-situ beds of rock, filled with fertile mud from the Nile, now stand testament to a former axial terrace garden.

Gardens of Babylon, mentioned by Herodotus as early as in the 5th century BC, have been intriguing European researchers since the 18th century. However, these constitute an entirely new category of gardens: stacked terraces built by the royal palace were full of greenery. These gardens are noteworthy on account of the roof garden concept, not seen until the 20th century.

In ancient Greece houses comprised an axially located atrium surrounded by columns with a pool (*impluvium*) in the centre, where rainwater flowing down from an inclined roof was collected. The impluvium was surrounded by flowers in pots and a centrally located shrine to guardian household deities: Lares and Penates.

A Roman house was of a similar design. It usually comprised a number of courtyards (peristyles) arranged axially in a row, with greenery and water pools. On irregular plots at least the axis of the main entrance was arranged symmetrically. An axial layout was used to emphasise the grandeur of a given building. Excavations in Italy and within the area spanned by the Roman Empire unambiguously show that an axial layout was used to emphasise the grandeur of a given building and the associated open spaces. Emperor

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[2] Bardzińska-Bonenberg T., To Strike Water From Rocks: Petra, Masada, Alhambra in: Sensitive approach to water in urban environment, ed. A. Januchta-Szostak, Publishing House of Poznan University of Technology, Poznan 2011, p. 11–28.

[3] Sennefer was the manager, "mayor" of Thebes and a noble at the court of Amenhotep II of the Eighteenth Dynasty, Rice M., Who's Who in Ancient Egypt, Routledge, London&New York, 1999, p. 12–13. https://www.siamcostumes.com/cutters_guides/pdf/michael-rice-whos-who-in-ancient-egypt.pdf.

Hadrian's Villa in Tivoli near Rome is the only known asymmetric residential complex. Here the hilly landscape and water management requirements forced freely scattered composition[4].

Thus one may observe that in ancient cultures, which in time to come were to influence the way space was perceived by architects, axial layout of buildings and their immediate vicinity reflected the position of their owner, as a person able to control their surroundings. A monumental, clear layout was quite opposite to natural, disorderly[5] forms which were experienced on a day-to-day basis and considered to be unpredictable.

3   Middle Ages

European medieval gardens, were castle gardens, city "meadow" gardens located outside of defensive walls as well as monastic gardens. They differed in character, vegetation and architectural associations. The first two had no set rules of composition or size; only certain fittings were the same. Monastery gardens were defined in every respect. They complemented buildings, filling a rectangular or square cloister gardens, around which, in a specific order, the buildings forming the monastery were arranged. The cloister garden was crossed by paths creating a geometric arrangement with a central point emphasised by a sculpture or a well. The plant material was associated with religious symbolism, and the geometric division was justified in Scripture, where it is said that God created the world by *measure, number and weight*[6]. As time went by and mathematical sciences developed, geometrical principles were applied more and more consciously, in a manner "guaranteeing" beauty. The monastery may have had 2–3 cloisters including a cloister for the novices, and also had green spaces with specific functions, such as a *herbularius*[7], a separate cemetery, and. These spaces were not subject to a strict axial composition[8].

Castle gardens looked different: small unused areas within the castle or between the fortifications were used, and as such these were organized by the shape and lighting of the spots intended for them. Depending on their location in the castle, surrounding buildings and accessibility to the few, these gardens were meant for the ruler and his family and were referred to as *hortus conclusus.* Iconography shows it as a modest,

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[4] Majdecki L., Historia ogrodów. Państwowe Wydawnictwa Naukowe (1981). pp. 42.

[5] Żórawski J., O budowie formy architektonicznej, Arkady, Warsaw 1973, p. 39.

[6] Catechism of the Catholic Church 299, Creating an ordered and good world: Because God creates through wisdom, his creation is ordered: "You have arranged all things by measure and number and weight" (Wis 11:20). http://www.vatican.va/archive/ENG0015/__P19.HTM.

[7] The *herbularius*, due to its location outside the main complex and its ancillary, useable character, was not subject to rigorous geometrical composition.

[8] Among other things, the surviving plan for the St. Galen monastery complex and illuminations from medieval and early Renaissance prayer books.

often irregular, green space[9]. They featured earthy, grass covered benches and as there was space for only a few plant species, creepers were used for covering walls.

Leisure and play areas were outside the city walls. They were not subject to any particular design. Benches and tables were their primary furnishings.

In the Middle Ages, geometric composition and connection between architecture and its surroundings, expressed in monastic complexes, were primarily a reflection of the divine order. As prescribed through the words of the Book of Wisdom they formed a symbolic value very different from the outside world.

4   Early Modern Era

In the Renaissance, the enrichment of Italian merchants and bankers, the importance of aristocratic families and the church hierarchy, created patronage and conditions for development of arts needed in ever larger palaces with gardens. At the same time, the fascination with antiquity of artists and their principals set the direction of change. The rationalism of the epoch combined with ancient designs made architects use axial solutions and mathematically justified proportions. These principles were followed by the projections and facades of the palaces, as well as the axial and geometric compositions of the gardens. Italian gardeners adopted a square plot as the garden module – the beds (*parterres*) were planted with low vegetation and bordered with a low hedge and filled with herbs and flowers. *Bosquets*, quarters fringed with trees, and sometimes filled with them, served as groves. There were sculptures, pools with richly profiled stone boardings and fountains taking various forms. If on a slope, garden terraces were formed, and in the most advantageous places, openings to far perspectives were introduced. The large-scale projects included flights of stairs, ramps, as well as hedge mazes and viewing mounds. Smaller gardens were generally surrounded by an outer wall or thick greenery, creating a closed interior. The compositions were usually organized along one axis. Through open courtyards, galleries, arcades and loggias the palace interweaved with the garden, creating a whole with it. Natural springs and watercourses were used to arrange grottos, fill pools and construct fountains and cascades. Close to "official" garden layouts, a *giardino secreto* was often arranged, a small, composed private garden for the family and children. At some distance from the main site, there was a *giardino semplici*, which was a utility and farm garden of the residence. Due to its location outside the main area and the auxiliary character of the *giardino semplici*, it resembled the monastic *herbularius*, where compositional rigour did not apply. Usually, an entrance courtyard preceded palace and behind it there was a garden; this arrangement was called *entre court et jardin*. Over time, such courtyard entrance also became a formal, symmetrical garden with an approach alee extending the axis of a whole. Renaissance palace-garden complexes owed their harmony and clarity to the use of geometric forms consistent with the rationalism of the era, also seen in art. The scale of the Baroque complexes, greater than in the previous era, resulted

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[9] Prayer books (breviaries) from the era are a particularly good source of information on this subject. Their illuminations depict Biblical scenes against the background of scenes from everyday life as they were during that era, including work and leisure in the castle gardens.

from the social and economic situation of European countries: a relatively stable political situation, a stable economy and strong power of monarchs made it possible to build vast palace-and-garden complexes. In France, the construction of Versailles had been underway since 1660, in England at the same time Hampton Court with its Baroque gardens was being built, in 1696 Schönbrunn Palace started operating near Vienna, and in Russia Tsar Peterhof Palace was built between 1714 and 1725. Following the example of the rulers, the aristocracy also built magnificent residences. Gardens, just like palaces, were scaled up, comprised almost independent parts, and water machinery used there applied the latest discoveries within the scope of physics and technological achievements[10]. The multiaxiality and endlessness of the greatest French, German, Austrian and later Russian complexes were a manifestation of control over the world[11]. The composition of Baroque gardens as well as architecture, was based on the grand scale and the juxtaposition of contrasting forms: horizontal planes and green vertical walls of sheared trees, sculptures and fountains. However, as in the Renaissance, the narrative of the sculptural decoration referred to an ancient tradition: Greek and Roman mythology. Compared to the Renaissance, units had more sophisticated shapes of elongated rectangles, often irregularly shaped at the corners. Colourful flowers arrangements[12] that filled them featured soft lines and fancy patterns. Bosquets became an inherent part of Baroque complexes, and their interiors contained arbours and dedicated entertainment facilities. The palace and garden were part of a common compositional axis. Diagonal avenues, arranged often as three pronged layouts led to wooded parts of the garden.

Peterhof Palace near St. Petersburg, the summer residence of Tsar Peter II was the last of the great Baroque residences. The garden stretches along the coast of the Gulf of Finland and projects into it along a promenade with a water channel that forms part of the main axis of the whole complex. On its two sides avenues form an approximately symmetrical, star-shaped layout. A water cascade comprising one hundred and forty fountains was crowned by the palace topping the slope. The garden in front of the southern, entrance façade was also subordinated to the main axis. The world domination motif is as clear here as it is in other complexes built for European monarchs.

As it turned out, zoning of Baroque gardens heralded the method for composing gardens in the centuries to come.

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[10] Many devices were used, such as Archimedes' screws; the most advanced was the Versailles Garden water supply system. The machine was located in Marly, from where water pumps and wheels supplied water to a six-kilometre-long aqueduct running above and below ground. In: Hobhouse P. Historia ogrodów, Arkady Sp. z o.o., Warszawa 2007, p. 156.

[11] And it was legitimate: Christopher Columbus discovered West Indies (America) in 1492, Ferdinand Magellan circumnavigated the world in 1522, a compass was used to facilitate land travel, and information in printed form was available after 1450.

[12] Some of the first exotic plants were brought to the garden in Versailles. Hobhouse P., op.cit., p–p. 156.

5   18th Century

Since the 18th century, a geometric, ordered garden compositionally connected with a residence was no longer the only solution. Although the Enlightenment era rediscovered the Antiquity, whose forms were recognised as suitable for the architecture of residences, other spatial solutions, inspired by the distant cultures began to be introduced in gardens. Trade with Asian countries brought differently decorated everyday objects to the European market: porcelain, fabrics and works of art. The depictions on them comprised scenes taking place in beautiful landscapes. On Chinese rolled paintings the space around people and houses was filled with forests, lakes, rocks, birds and animals. Moreover, in most Middle and Far East countries, the gardens resembled a natural landscape, regardless of their size[13]. The accounts of travellers and merchants proved to be inspiring, as have the imported specimens of exotic plants[14]. Contact with the colonies of European countries and the rise and rule of the British Empire have had a major impact on the interests and tastes of Europeans. As a result, gradual changes have been taking in gardens by old and new residences. This coincided with new trends in art: first groups of painters abandoning their work in the studio and going out into the open air gave rise to a turn towards landscape painting[15]. As the establishment of the Baroque garden required time and enormous expenditure, the creation and maintenance of a landscape garden was easier, at least seemingly.

In terms of composition characteristic features of the 18th century gardens comprised intersecting viewing axes not discernible on the plan of the garden. These unobvious vistas were supposed to be "discovered" by the people in the garden[16]. Also the element of surprise, became a permanent tool for shaping the gardens.[17] These effects were helped by artificially changed landscape forms, watercourses and ponds and appropriately located forms of greenery and scattered pavilions of different shapes. This arsenal of means of expression was partially imported from the garden art of China, Japan and India. The trend began in England, where the influence of the Orient on garden art was strongest and came earliest[18]. Most eighteenth-century residences had gardens comprising of two stylistically different parts: geometric parterres in the

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[13] For example "tray" gardens with bonsai trees shaped like a fragment of a miniaturised garden. The character of Indian gardens was different - they were composed of scent zones.

[14] The history of the British Horticultural Society and the creation and expansion of Kew Gardens and other educational gardens are excellent examples of this. Janick J.:The Founding and Founders of the Royal Horticultural Society. https://www.hort.purdue.edu/newcrop/pdfs/ch4801p17.pdf.

[15] In the 18th, century landscape painting blossomed in Italy; England had William Turner and John Constable whilst Caspar David Friedrich worked in Germany.

[16] Such methods were known from the Far East gardens in the form of paifang archways and the introduction of green walls or walls with "windows" directing the eye in the right direction.

[17] The garden at Chatsworth Palace is one such example, where a canal that marks the axis of the garden elevation is higher than the lawn separating it from the palace. The approach to the Palace from the landscape part of the garden affords a view of the building standing on water. Lancelot Brown is the author of this solution.

[18] Landscape, sentimental, romantic and neoclassical forms were developed. L. Majdecki, op. cit., pp. 473–512.

immediate vicinity of the palaces, often a remaining fragment of an earlier, "French" garden. The second, more distant "natural" part, was a transformed geometric garden or an added - merging with open landscape.

Similarly, there were changes in pre-revolution France, where court life also evolved towards outdoor games and the fascination with rural life, "played out" by palace residents. These late Baroque, sentimental, village-style parts of gardens[19] were inscribed in the Baroque way of composing large-space complexes.

It may be said that the idea of a landscape garden was adopted in France in 1775, when Louis XVI had the double row of shaped trees in Versailles garden, in the vicinity of the Apollo Fountain, cut down.[20] In the 18th century, the departure from the axial composition of gardens meant many Baroque complexes were redesigned. Lancelot Brown (Capability Brown), the successor of Charles Bridgeman and William Kent[21], who designed the first layouts of this type, was the key figure attributed with popularising such new forms. Lancelot Brown's works included the famous conversion of the French garden in Chatsworth into a landscaping complex accomplished also by several other architects (1730 - 58).

The gardens of the 18th century perfectly reflect the duality of that period: on the one hand, Europe with its social and cultural tradition rediscovering antiquity but following industrial development. On the other hand, distant cultures which, although they were observed with superiority and exploited, had a huge impact on the art and architecture of Europe in the 18th and 19th centuries.

Garden art of the 18th century demonstrates the crossroads at which the artists and architects of that period found themselves, looking for a path adequate to scientific and art milestones, by juxtaposing Baroque, antique and oriental motifs.

6   Summary - Common Traits in the Composition of Gardens

Over the centuries enormous changes have taken place in terms of building gardens, but they do have some common features that result from people's attitude towards space, regardless of place and time. Climate and topography, financial means and aesthetic preferences are the elements which determine the character of the gardens. At a time when the open space surrounding cities was perceived as dangerous and were difficult for ordinary people to decipher, regular forms were comforting. Symmetry of the palace entrance, façade, were understood as an attribute of power and authority. Thus, clear, geometric arrangements: a grid of paths and corresponding quarters in a garden instilled a feeling of control also over this part of the surroundings. Therefore, urban complexes and garden plans were based on geometrical forms.

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[19] The "The Queen's Village" complex was established in 1783 for Marie Antoinette at the Grand Trianon in Versailles (arch. Richard Mique). The model "village" had an artificial pond, meadows and stylized rural buildings.

[20] In pre-revolution France, where court life evolved towards fascination with rural life, "played" by palace residents in sentimental, village-style parts of the gardens.

[21] William Kent was also the architect who was the first to introduce Palladian architectural solutions in England.

A comparison Renaissance and Baroque garden compositions is particularly interesting. This is a faithful reflection of the evolution which occurred in architecture. When it comes to Renaissance palaces, early structures where the wings surround the inner courtyard are still medieval, then open forms were introduced *and entre court et jardin* palace was created and followed for the centuries. Renaissance gardens were a closed, separate, geometrical world rarely providing an insight into the surrounding landscape. In the Baroque, the residences opened up to the "world" by the three pronged or star-like avenue systems that did not always have a specific purpose. They emphasized the fact that a palace is in control of the world and is itself an important reference point for it. In the early times people were seeking a comfort of being in a tamed space, and later a demonstration of power and authority. Marking the world with axes which disappear over the horizon was a symbolic expression of overcoming the fear of the unknown. This led to a further revaluation associated with the development of science, trade, travel and discovering non-European landscapes and gardens. A change also took place in European art of that time with discovering *paysage*. Free compositions of clumps of trees and shrubs, watercourses and meadows evoked a feeling of pleasure rather than fear in that time. Table 1 presents the changes in the way of planning and arranging the gardens accompanying the residences.

Table 1. Gardens by residences – changing traits in compositions

No.	epoch / historical period	garden composition							
		open composition	closed composition	symmetric composition	composition with bold axes	free composition, with the parts geometrically formed	composition with not visible on the plan viewing axes	free „natural" landscape	geometric elements freely arranged
1.	**Ancient Egypt**		■	■	■				
2.	**Mesopotamia**	■							■
3.	**Ancient Greece**		■	■	■				
4.	**Ancient Rome**		■	■	■				
5.	**Middle Ages**		■	■	■				
6.	**Renaissance**	■	■	■	■				
7.	**Baroque**	■		■	■				
8.	**Age of Enlightenment / 18th century**	■				■	■	■	■

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Post-pandemic Public Space. The Challenges for the Promotion of Well-Being and Public Health in the Post-covid City

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Abstract. The current crisis has reinforced the vital role that public places play in bringing people together and promoting wellbeing. It is important to start thinking about the roles and duties of public spaces and how we can change them for the next phase of the pandemic and a more sustainable future. The recommendations for a healthy safe, and sustainable public space - analyzed in the paper - are framed into the following key points: Mitigate present and future pandemics; Promoting public health and well-being. These recommendations are applied to the design experimentation in a small city in Italy, that explores the relationships between psycho-physical well-being and public space in the design of an urban park. The recommendations for a healthy, safe and sustainable public space may provide a useful basis for Designers, Policy Makers, Public Health experts and Local Health Agencies, in promoting actions and policies aimed to transform public space in healthier and salutogenic spaces.

Keywords: Covid-19 · Urban design · Psycho-physical well-being · User-centered approach · Public space

1 Impact of Pandemic on the Public Space

The pandemic has reshaped our lifestyle and how we interact with each other: Globally, people have replaced in-person visits to town centres, sports and entertainment venues; public libraries and other mixed-use environments with virtual meetings and home workouts. Yet it is now clear that virtual is not a long-term replacement for real human interaction and that humans don't cope well with isolation.

Indeed, Covid-19 and the various measures and interventions to control its spread, have not eliminated the use of public space, but have strongly influenced how city residents relate to cities and public space, involving the following changes about:

– overall mobility. Temporal patterns and spacing of users over the day are changed (as people try to avoid peak hours), mobility has decreased, but pedestrian movement is increasing, walking and cycling have become essential forms of mobility. Cities have reacted to this by adopting measures such as wider pavements, and parks and other public spaces with markings on safe distance. These temporary road

closures and other short-term measures are serving as testing grounds for changes that may eventually become permanent [1].

Researchers in the United States are building a database of cities that have implemented cycling and pedestrianization projects in response to COVID-19 [2]. This temporary road closures could serve as a catalyst for embarking on more ambitious projects in cycle paths, pedestrianization, and public space enhancement that citizens have demanded for years [1]. In this direction, many cities, like Bogotá, Milan, Mexico City, have widened and added bike lanes [3], or other governments, like Australia, have made funding available for temporary projects (widening walkways) and more permanent, long-term projects (added crossing points) towards public space intervention projects [4].

- Pedestrian spaces. Our notion of public space as 'agora,' as spaces of civic action is threatened, risks limiting the opportunities for coming together. Also, pedestrianized shopping streets have been especially hard hit, but the city is being used more for recreation, play, and exercise (Fig. 1). People using places that are convenient for them, even if they aren't full of exercise and play equipment. Designers and architects globally are considering ways to adapt outdoor spaces for social distancing. In Italy, Caret Studio has installed a social-distancing grid inside a piazza, while Paul Cocksedge has designed a social-distancing picnic blanket. Brand consultancy Dn&co has proposed developing an app that would project shifting patterns onto the ground allowing breaking up spaces organically.

- Essential outdoor and climatic human needs. "Fresh air, water, sunlight, are as important as they always have been, if not more so!" This is reflected on how people are using meeting places and the types of public spaces they are willing to visit. Places that invite sensory experiences and good climatic conditions continue to be the most sought after [5, 6]. The search for essential outdoor and climatic human needs has become even more valuable. Google data compiled by Citymetric shows that more people started visiting parks as countries eased their lockdown restrictions. A recent survey by Natural England revealed that the vast majority of adults (89%) in the UK agreed that green and natural spaces are good places for mental health and wellbeing. Studies of green spaces and health have demonstrated that green spaces improve mental health and cognitive function [7–9]; reduce cardiovascular morbidity [10]; reduce the prevalence of type 2 diabetes [11]; improve pregnancy outcomes [12]; reduce mortality [13].

- Social and class differences. The pandemic may reinforce social and class differences in the use of public space. Geospatial data has shown that lower-income workers continued to move around in the midst of the pandemic, while higher-income workers were more likely to work from home [14]. Furthermore, skilled workers in the knowledge economy can more easily shift to online and distance working, thereby minimizing exposure. Recent data from ONS shows people on lower pay or who are unemployed are almost three times as likely as those in higher paid jobs to be without a garden. This means they rely more heavily on their local park. This is important because people with access to a private garden have been found to have better mental health, and those with an outdoor space such as a yard are more likely to do some form of physical activity (Fig. 2). Apart from access, the

quality of green space is crucial too. Quality of facilities (e.g. toilets, cafes); regular maintenance; organised activities can help ensure a green space supports the wellbeing of its citizens equally.
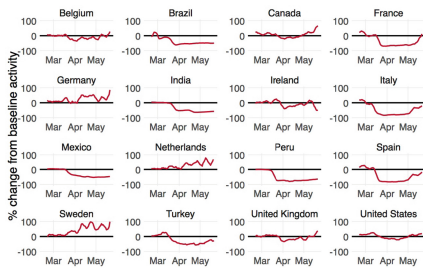
Fig. 1. People have being returning to parks across the world. Rolling weekly average of percentage change from usual park mobility. Source: Google.
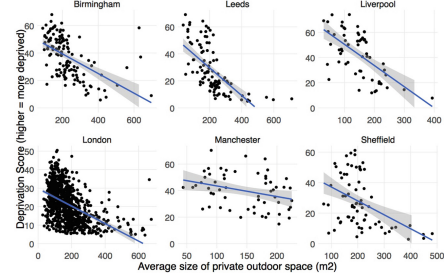
Fig. 2. The least deprived areas have the largest garden. Figure show deprivation score compared to the outdoor space. Source: ONS, MHCLG.

Can these changes lead to a recovery of the city and public spaces for its citizens? The current crisis has reinforced the vital role that public places play in bringing people together and promoting wellbeing. The fact the government's rules include daily exercise outside shows how important they believe it is for people. The physical health benefits are well known but it is also very helpful for mental health. Leading mental and physical health professionals are worried about the potential for an epidemic of stress-related health and social problems, in addition to physical problems (especially for the elderly) linked to a too sedentary life.

"In many cases, there are more people spending time in public spaces than before COVID19. It is paramount that private and public organisations understand the value of public spaces, to not only help fight a pandemic but ensure a better future quality of life" [15].

It is important to start thinking about the roles and duties of public spaces and how we can change them for the next phase of the pandemic and a more sustainable future. In this unique urban scenario, a "salutogenic perspective" that takes into consideration how cities are designed and lived opens a possibility to examine not only how urban spaces and processes are capable to stimulate active style of life but more specifically the way re-think their priorities if they want to make cities and human settlements inclusive, safe, resilient and sustainable.

2   Post Pandemic Horizon: What Next?

This attention to the relationship between well-being and the characteristics of urban space has led to the emergence of urban health, a discipline concerned with the study of the health of populations living in urban environments, and the understanding of its determinants in order to improve the health status of inhabitants of cities [16]. This

vision, even if it can be attuned to various design scales (from objects to habitable spaces and to the design of open spaces), is of particular interest when connected to the design of open spaces in our cities and their ability to promote the vital functions of those who use them. The open spaces of the city can thus overcome the current concept of spaces technically equipped for movement, to take on the role of "prosthetic" places, which thus have behavioural consequences on the user, conditioning the modes of relationship with space and people. It is therefore a matter of placing the user at the centre in terms of its variability, whose relationship with the built environment is not only metric-dimensional but embraces the cognitive and social dimension [17]. In "*A strategy for human factors/ergonomics: developing the discipline and profession*", the authors explain that Human Factors Ergonomics focuses on systems in which human beings interact with their environment: indeed, it is not possible to think of an activity that does not involve a certain kind of interaction between human beings and their surroundings. These interactions can be summarized as follows: Psycho-physical and Social Interaction.

Psycho-Physical Interaction. It concerns the quality of the interaction and depends on the proportional compatibility between user-space-objects and sensorial compatibility, understood as appropriateness and coherence of the stimuli emitted by physical systems with the physiological structures of individuals. In the current emergency situation, possible 'temporary' measures to guarantee well-being condition can include: 1) Reallocate space to allow for more physically distant walking, biking, exercising, and staying (sidewalk extensions, parking lane closures, or outright street closures at the block or multi-block level). These may be implemented by municipalities or by local residents and community organizations). 2) Manage flow into more congested public spaces by expanding the number of entrances where possible, or by dividing and designating gateways as entry or exit only. 3) Explore the possibility of "running lanes" alongside bike lanes and extended sidewalks, to mitigate conflicts and keep distance between runners, cyclists, and pedestrians. 4) Consider dedicating access to select portions of open spaces for older people to exercise (just as many grocery stores have created "seniors-only" hours).

In a future post-covid situation, we should make deliberate choices about how to promote public health and well-being, such as: 1) Focusing on walkability and quality of the walking experience, planting more trees to provide shade and providing more benches and public toilets. Walking has been shown to make people happier and reduce air pollution, furthermore, a walkable neighbourhood increases the informal interactions between people, building ties among neighbours. 2) Creating public space for play. We should be looking to maximise the opportunity for play. Playful encounters can be built into everyday journeys through interventions that foster curiosity (e.g.

playful bus stops, public art projects or pocket parks such as the Urban95). 3) Creating digital twins (online cities in parallel with our physical cities) that allow the real-time simulation of cities, enabling policymakers and urban designers to model and test ideas that could ensure all developments help contribute to making urban life more enjoyable for communities, and allow communities to understand fully the impact of different planning decisions. 4) Creating city of 15 min, to make a people-friendly city. As people's lives have gotten closer to home, many have begun to realize that most of their core needs are just a short trip away. The "15-min city", a phrase coined by Paris mayor Anne Hidalgo, means that every resident can meet their essential needs within a short walk, scooter, or bike ride. 5) Improve spaces and urban equipment that promote psycho-physical well-being.

Social Interaction. It relates to the interpersonal relationships that are established between the components of a community with the aim of encouraging and/or improving the usability and liveability of urban space, the possibilities of meeting talking, exchanging opinions, performing functions and leading to more active and healthy lifestyles.

In the current emergency situation, possible 'temporary' measures to limit the spread of virus, without giving up our need for sociality, can include the following actions: 1) Flexible use of the public space to support businesses, allocating a proportion of public space to outdoor dining to boost the local economy (e.g. Lithuanian capital Vilnius). 2) Converting the parking spaces in front of the bar/restaurant into retail space, without needing a permit to do so (e.g. Parking-day experience in Rotterdam, New York, Londra). 3) Encouraging businesses and people to take care of space, promoting creative competition for the best outdoor arrangement that will enable people to safely come together (San Donà di Piave, Venice). A lot of these types of opportunity require more flexibility in the planning system, It is, therefore, right to start discussing how to change systems of space governance to allow a more agile response to any future crisis.

In a future post-covid situation, we should make deliberate choices about the changes we wish to sustain and consider the implications of these trends on how we use public space. The long-term goal of promotional public health and well-being can be achieved through the following actions: 1) Sustaining/increasing access to green spaces. Currently, such access is unevenly distributed, as we think about the longer

term, we should consider reconfiguring public transport to make this access easier. 2) Improve spaces and urban equipment that promote psycho-physical well-being. 3) Building safer, flexible and vibrant public places that promote citizen participation. In light of this wider connotation of human well-being, the aim of the design of open spaces is prevalently that of health, understood as a state of physical, mental and social well-being.

3   Experimental Designs: Urban Parks

The design strategies are identifiable in the design experimentation conducted in the Abruzzo cost. The main objective of the study was therefore to develop some proactive reflections for the city, assuming movement is an opportunity for development, growth, and transformation, aimed at the well-being of the citizen and of the city itself. The proposed interventions focus on the recovery and redevelopment of two disused rail-way tracks in the city of Ortona in Italy, for the enhancement of the pedestrian and bicycle mobility with the rediscovery of paths and areas of inclusion and socialization. A walking or cycle path is often represented in a plan or sectioned in two-dimensional static designs that capture and record key configurations and measurements. While these tools are useful for the dimensioning of these spaces, the intention behind this research is to encourage a more dynamic, territorial approach. Such an approach would have the broad objective to identify the factors that encourage slow mobility and daily physical activity in the urban environment. This is possible by an understanding of the user's experience – user-centered approach – through his/her senses and the translation of this experience into the physical space.

The approach, to the user-centered project of urban space, therefore entails placing the user at the center of the room-walk and encourages considerations from the point of view of their perspective.
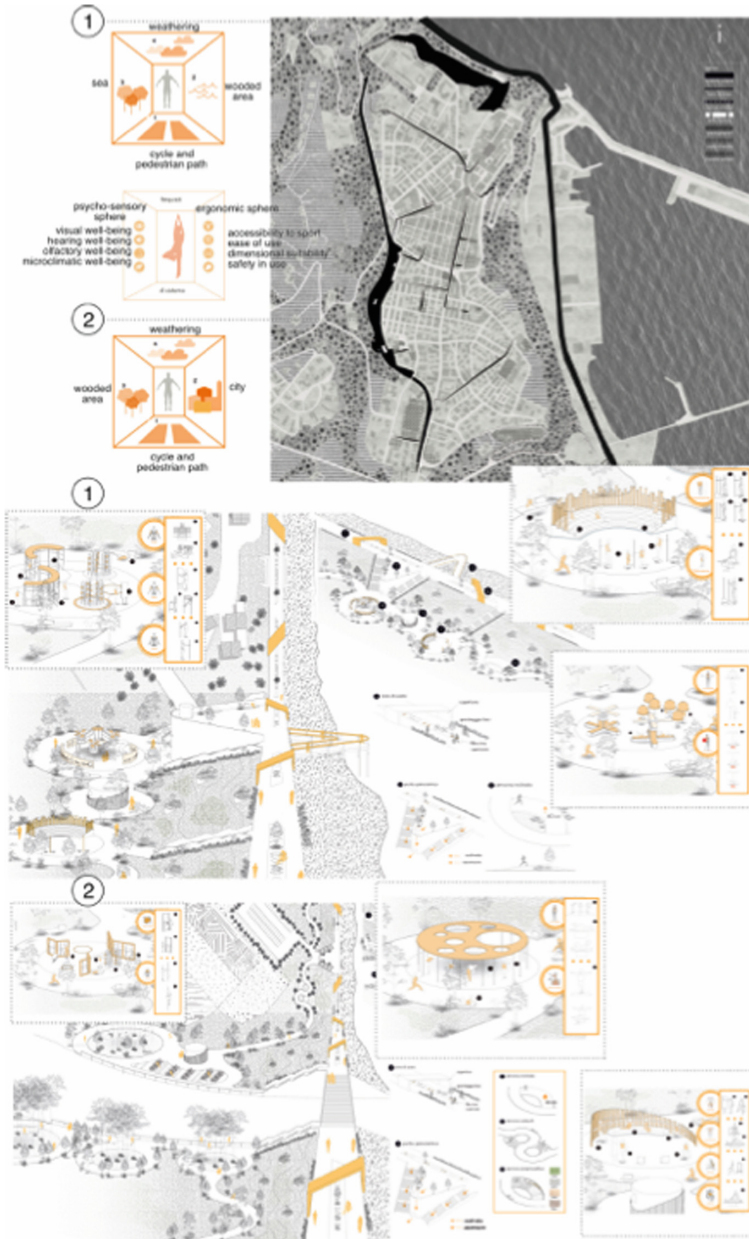
Considering, therefore, the user's perspective, this urban room coincides with what we have called "personal space," a space of tension between humans and the environment, a design interface in which complex relationships are established between the user and the environment [18]. The room-walk is therefore not a neutral scenario but an

operating factor [17, 19, 20]. The environment, understood as an entity of support to the person, as a sort of carpet in which the plot consists of physical factors and the warp by social factors [21], has the ability to adequately support the lives of people depending on its physical characteristics and the efficiency of the social support network available. Within the "roomwalk" the possible relationships that can be established are: user–urban equipment; user–urban space; user–user relationships, that depend on a number of factors that are subjective in nature and difficult to control, and others that can be influenced by the project. We can identify two groups of variables that influence these relationships: the modulators of the bio-psycho-sensorial sphere, of the ergonomic sphere, and of the social sphere that make up the filters with which we perceive the external world; and the external variables, which are the physical, cognitive, and social dimensions of the project that determine the behaviors and actions of the users, respectively, of passive use (such as the parking space), of active use (such as pedestrian–cycle paths and fitness areas), and of social use (such as spaces managed by citizens). The set of relations that develop between these two groups of variables determines the equilibrium of the urban system by favoring or hindering the conditions of psycho-physical well-being, and social well-being.

4   Conclusion

Our early review suggests that this public health and socio-economic crisis will change public space design, perceptions, use and management in diverse ways, across and within cities. We hope that public spaces in the post-COVID world will remain valued for the possibilities they offer for socialization, recreation, claims-making, community building, and identity formation. Today there are many virtuous examples on an urban scale carried out internationally; on the other hand, in Italy there are still numerous areas for the development of this theme. The pandemic experience shows that the need for the care of the person, resources, and the environment must not be limited to the creation of smart objects and smart cities, awareness on the individu-al, on the community and on the context that leads to changing lifestyles and the cityes in a sustainable/active environment must be built [22].

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Application of Geo-Urban Centric Technology in Diagnostics of Urbanization Processes

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Abstract. The article presents an analysis of urbanization processes in the Poznan metropolis (Poland) using the Geo-urban centric method. The aim of the study is to broaden our knowledge of the importance of the city center in the research area. The study also makes it possible to evaluate the distribution of urban functions using defined indicators. The samples were collected from 18 communes included in the Poznan metropolis. The research is based on the geo-urban centric methodology combined with an urban query. This methodology is the result of the conceptual and analytical work of the research team of the IAPP PUT. The method is very up-to-date in mapping trends in the distribution of places of service provision. An important feature of the method is the use of information displayed on websites.

Keywords: Urbanization · Downtown · Poznan metropolitan area · Geo-urban centric

1 Introduction

The subject of our research was the use of geo-urban centric technology in the diagnosis of urbanization processes. A research example is the Poznan metropolitan area. The research is aimed at seeking answers to the question whether contemporary urbanization processes lead to the strengthening or weakening of the importance of the metropolitan center in its spatial development. The problem is not obvious. Commonly, there are views that the center (downtown) is significantly eroded, and urbanization activity is shifting to suburban areas [2, 5]. You can also meet with opposing views, which emphasize the importance of the metropolitan center as a catalyst for activity, especially in the field of culture, art, science, and creative industries [16, 17]. To solve this problem, we used the geo-urban centric method to study urbanization processes on the selected example of the Poznan metropolitan area. The Poznan metropolis is the city of Poznan and the suburban area, including 17 communes of the Poznan County. The Poznan metropolitan area has an area of 2,162 km^2 and has 879,000 inhabitants

with an average population density of 406 people/km^2. The inhabitants of the metropolis accounted for 2.5% of the country's population and 26% of the population of the Wielkopolskie voivodship. The Poznan metropolis is one of the seven most urbanized areas in Poland, next to the agglomeration: in Warsaw, Kraków, Gdańsk, Łódź, Wrocław and Upper Silesia. In Poland, there are no legally sanctioned administrative boundaries of metropolitan areas around large cities. For research purposes, such boundaries are determined on the basis of demographic, functional, social, economic and transport criteria. The boundaries of the Poznan Metropolitan Area adopted in this study are commonly used in many scientific and planning studies [11, 18]. In recent years, the metropolis of Poznan has experienced significant functional and spatial transformations. In the Arctic, we present an original approach to spatial development planning. We study trends in urban activation using an original method. This method differs from the previously used planning approach in that it analyzes development trends on a "bottom-up" rather than "top-down" basis, as is the case in the previous planning approach. Our research is based on the analysis of the expectations, assessments, and opinions of ordinary users of space (residents). For this purpose, the team of authors used the Geo-Urban-Centric method. The method was developed at the Institute of Architecture and Spatial Planning at the Poznan University of Technology in 2019–2021. Our research was to answer the following questions:

- what are the current trends in preferences regarding new places of residence in the Poznan metropolis?
- what are the trends in locating services for residents and business of the Poznan metropolis?
- what are the trends in the location of recreation and leisure spots in the Poznan metropolis?
- whether the above trends strengthen or weaken the importance of the center. To what extent does the downtown build the urban cohesion of the Poznan metropolis?

2   Materials and Methods

The Geo-Urban Centric method is based on the analysis of urban trends in the aspect of metropolitan area cohesive. The Driving factor data on the occurrence of the analyzed phenomena was obtained as a result of an internet query in 2021. The metropolitan area is divided into 35 concentric rings, 1 km wide, which corresponds to 7.5 min of walking (two circles are the limit of 15 min travel time for pedestrians). The area of successive rings increases linearly from 3.14 km^2 (ring no. 1) to 216.66 km^2 (ring no. 34). The geolocation data resulting from a web query was processed by MapInfo Professional, a geographic information program. Methodical steps (Fig. 1):
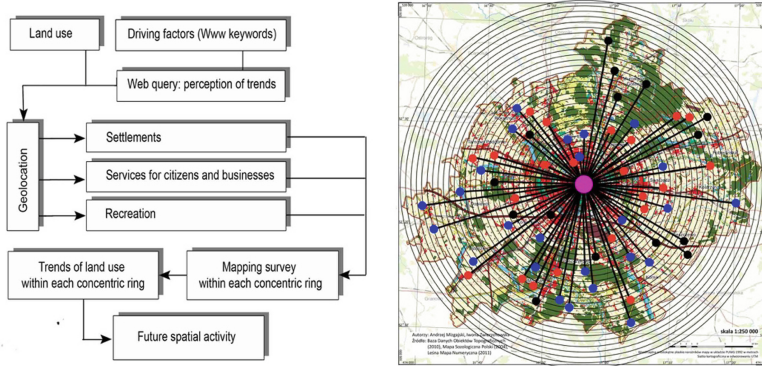
Fig. 1. Scheme of the geo-urban centric method.

The applied methodological approach refers to the classic model of urban land use (Burgess Urban Land Use Model) [15]. In the sector city model, there is a similar generalization of the use of urban areas [6]. It was emphasized that almost all large cities do not grow around one center, but are formed by the gradual integration of many separate nuclei into the urban tissue. These centers become specialized and diversified in the growth process and are not located with respect to any distance attribute, but are bound by many attributes. They emphasized the advantages of such models, especially bypass roads for the transport system and land development. Ring roads reduce congestion in central areas, offering an alternative to traffic that does not originate in these areas. In this way, they enable transit traffic to bypass downtown. This favored the radiation and development of commercial, and industrial activities in the surrounding area of motorway junctions. The decreasing dynamics of downtown is often related to the development of centers in the periphery. The geo-urban-centric method belongs to the group of methods referring to "bottom-up" urban planning. It allows for reading trends in the spatial activity of residents in many fields: economic, cultural, social, environmental, and emotional. The method allows to read the preferences of residents in terms of the choice of places of residence, places of spending free time (rest and recreation), and preferences in the use of cultural, educational, health, commercial and business services. All these trends were related to the distance from the center of the metropolitan area, which allows for the unification and direct comparison of trends in the studied areas of spatial activity. Information on these preferences was obtained from the World Wide Web and located on the map of the Poznan metropolis (Fig. 2). The network offers a large range of geo-located tools on which residents express their opinions. The information also came from entities conducting business activity in the metropolitan area in terms of marketing their services, products, employment offers, etc. They were also geolocated. The following internet tools were used in the research: Google maps, Google Earth, Google Trends, Google Street Map.

These applications are generally available and an ordinary web user can easily configure maps, ask questions, compare answers, and manage places. He can provide his opinions and ratings, view and filter objects based on personalized preferences. All this web traffic will leave traces that can be identified using specialized tools (Google

Trends). On this basis, user activity was identified on the maps of the metropolitan area, broken down into user groups, topics of interest and the location of places of interest. This activity was analyzed in terms of the distance from the center of the metropolitan area. For this purpose, the metropolitan area has been divided into rings 1 km wide, concentrically diverging from the central point (Old Market Square). On the basis of data from the Web, the intensity of selected types of user activity in each of the 35 concentric rings was determined. A synthetic measurement of trends depending on the distance from the center of the metropolitan area was obtained. In the conducted research, the measurement of trends concerned new places of residence, leisure, and recreation, services for people and business (trade, culture, education, health). The results confirmed the thesis that the city center is a place of emblematic importance for the urban community. In the center, service and business activities as well as leisure and recreation activities are concentrated. Despite the fact that the center is not a popular place to look for accommodation, the essence of the identity of the urban community is at the center.

3   Results

As a result of the research we established the current website search results for relevant information related to key urban functions and their location depending on the metropolitan center. Figure 3 shows an inventory of service functions (trade, culture, entertainment, education, health, business services) of interest to residents on the Internet. Points represent places of service (obtained as a result of an internet query). One can notice the concentration of these places in the area of the center (Figs. 4, 5, 6 and 7).
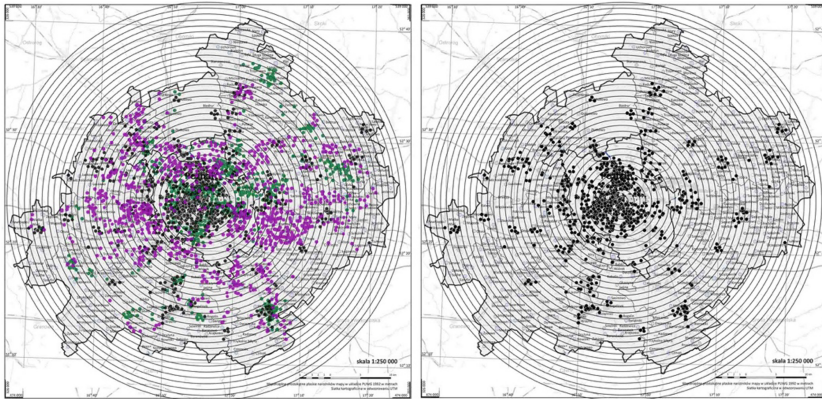
WWW query results
A) Summary of research. Location of places of interest for residents: services, commerce, culture, entertainment, education, health, business, recreation, new places to live.

WWW query results
B) Localization of service functions of interest for residents (commerce, culture, entertainment, education, health, business services).

Fig. 2. Poznan metropolitan area. WWW query results. Location of selected types of urban functions of interest for residents. A) Summary map. B) Service functions. The study was conducted by the authors in the period March - September 2021.
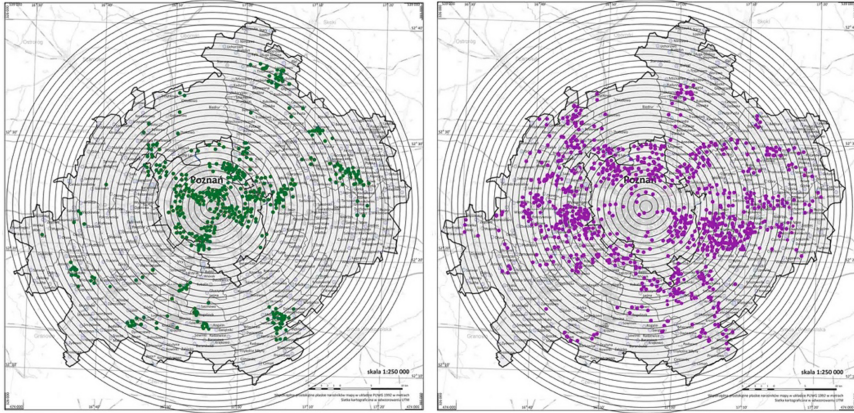
WWW query results
C) Localization of recreation functions of interest for residents (parks, nature complexes).

WWW query results
D) Localization of residential functions of interest for residents (new offers of developers and real estate offices).

Fig. 3. Poznan metropolitan area. WWW query results. Location of selected types of urban functions of interest for residents. C) Recreation functions. D) Residential functions (new housing offers). The study was conducted by the authors in the period March - September 2021.
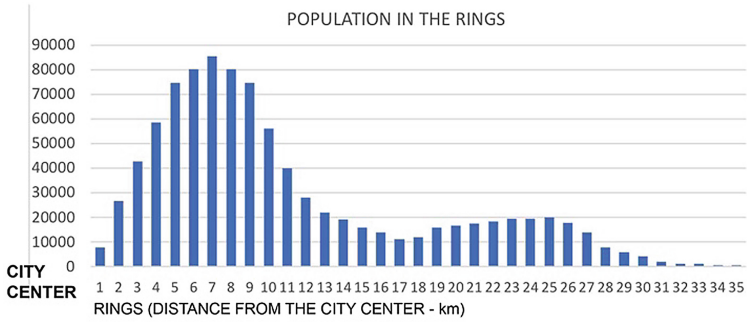
Fig. 4. Poznan metropolitan area. Population in the rings.
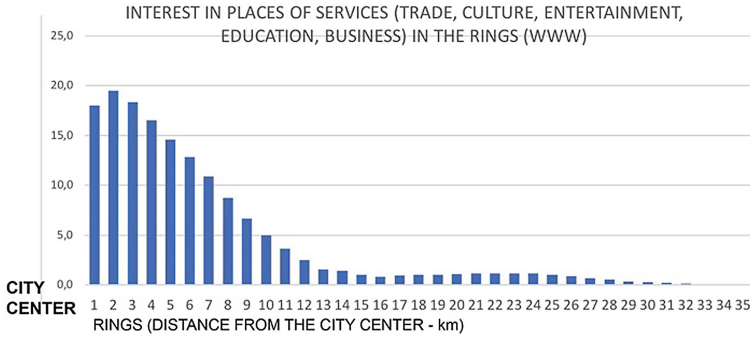
Fig. 5. Poznan metropolitan area. Interest in places of services in the rings (trade, culture, entertainment, education, health, and business services). WWW query results.
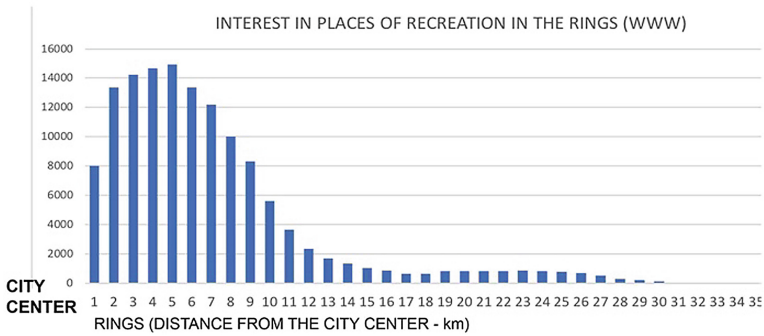
Fig. 6. Poznan metropolitan area. Interest in places of recreation in the rings (parks, nature complexes). WWW query results.

Fig. 7. Poznan metropolitan area. Interest of new housing offers in the rings. WWW query results.

4 Discussion

According to the research, downtown is a central place of interest in terms of service functions (trade, culture, entertainment, education, health, business services) and recreational functions (parks, nature complexes). In the case of recreational functions, the results of the research were a big surprise, because on the outskirts of the Poznan metropolis (ring 20–35) there were a large number of valuable natural areas (Puszcza Zielonka, Wielkopolski National Park). Despite this, the most popular are the recreation centers in the city center: the Citadel, Łęgi Nadwarciańskie and Malta. The greatest interest in new housing development is concentrated within 10–14 km from the city center. This contradicts the common thesis that the areas furthest away from the center (ring 25–35) are of greatest interest as a place of residence.

The research confirmed the thesis that the current trends strengthen the importance of the center. It can be concluded that the center (downtown) builds urban coherence and serves to activate the functional and spatial development of the Poznan metropolis. However, it should be noted that many authors point to the loss of importance of the city center as the main hub of urban activity. They point to the phenomena that weaken the importance of the center: suburbanization and urban sprawl [1, 3, 12–14]. Other studies point to the growing importance of central areas in the spatial development of cities [7]. The results confirmed the thesis that the city center is a place of emblematic importance for the urban community. In the center, service and business activities as well as leisure and recreation activities are concentrated. Despite the fact that the center is not a popular place to look for a place to live at the center is the essence of the identity of the urban community. In the last 20 years, the center of the Poznan metropolis has been subject to strong depreciation tendencies, especially due to newly built large shopping malls and the residential migration of people to the 5–7 ring. Our research shows that the role of the center is significantly dominant in the basic functions of services, trade, leisure, entertainment, culture and education. Downtown is an important factor in the cohesion of the Poznan metropolis. Our conclusions are based on research on the most recent trends visible on the World Wide Web. Downtown has a significant (signified) position as a substrate of urban processes. These conclusions are partially consistent with the research presented in other studies [4, 8–10].

5 Conclusions

In this study, the method Geo-centric urban confirmed its effectiveness. New original results were obtained confirming the importance of the downtown in the functional and spatial development of the Poznan metropolis. In subsequent studies, we will try to check whether the case of the Poznan metropolis can be generalized to other large European cities.

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Place Making for Creative Environment

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Abstract. The article presents a place that creates a creative environment adapted to the desires and aspirations of space users. Creative place-making is a growing practice that deliberately forces the influence of art, culture and innovation to advance the interests of the community. These activities are aimed at building the character and quality of the place. As a result of the research, specific architectural features were identified, which in a specific way shape the creative potential of the environment for the distinguished user groups. Based on sample architectural projects, it was shown how to improve the quality of space in accordance with the principles of placemaking.

Keywords: Place making · Creativity · Architectural design

1 Introduction

Placemaking is a method of creating a space that attracts people with its beauty, atmosphere, and the perspective of a higher quality of life and work. Such action is aimed at satisfying the needs and expectations of users. User rating determines the success or failure of the project. In the process of designing in line with the principles of placemaking, it is important to:

- diagnosis of the needs of people for whom we design architectural objects and public spaces,
- effective implementation of the conclusions of the diagnosis into the project.

It is important to meet the diagnosed needs in such a way that the users feel "at home" in a given place, that they want to stay in the space and shape it on their own. An element attracting users may be, for example, an attractive function: a new cafe, a recreational playground, a tennis court, an amphitheater, a playground, or a space for organizing exhibitions. They can also be interesting colors, shapes and textures of building materials.

Placemaking is about creating a space that is not only friendly and safe, but also trendy (popular). It should be visible on social media, it should be talked about and written about. Contact with such a space is to ennoble users. However, you should remember that a well-designed and well-promoted place will quickly lose all its charm if it is poorly maintained. In such places, it is necessary to provide users with a sense of security and care for the cleanliness of the place and the aesthetics of the surroundings.

We assume that the way in which we design architecture and shape the space has a significant impact on how we feel and behave. Therefore, places designed by architects and town planners should be designed according to the preferences of users, and not according to the personal beliefs and tastes of designers. It is a kind of bottom-up approach to the design process, not a top-down approach.

Until recently, institutionalized architectural design and spatial planning processes were the domain of authorities and specialists operating within the narrow limits of their competences. Architects have often been helpless in the face of problems such as deserted streets, deserted parks or missed investments. According to the idea of placemaking, the design should primarily meet the needs of ordinary users, and not the ambitions of architects and the priorities of local authorities. In this respect, the idea of placemaking is very inspiring. Local leaders, city movements, architects, and developers rely on it. All users of the space benefit. In this sense, placemaking is an essential element of sustainable design.

2   Materials and Methods

The research by design method was used in the analysis of the place-making phenomenon. The research was structured as follows:

– preliminary analysis of the design problem,
– diagnosis of the social and spatial context,
– creative interpretation of diagnostic elements,
– visualization of the future state,
– stakeholder consultation,
– setting project priorities as a result of consultation with stakeholders,
– creative design representation.

The following projects were selected as experimental material:

a) The Capitol Musical Theatre in Wroclaw, Poland
b) Cross-border Terminal Olszyna – Forst, Poland-Germany

The results were presented to the project developers, who were asked to evaluate the effects of the method and the final approval of the design solutions. New technologies and the sharing economy played an important role in creating the projects. The examples provided are the result of the applied design approach and illustrate the effects obtained. These examples were the basis for drawing general conclusions (Figs. 1, 2, 3, 4 and 5).

Fig. 1. The capitol musical theatre in Wroclaw, Poland, author: Kozień Architekci.

Fig. 2. The capitol musical theatre in Wroclaw, Poland, author: Kozień Architekci.

Fig. 3. The capitol musical theatre in Wroclaw, Poland, author: Kozień Architekci.

Fig. 4. Cross-border terminal Olszyna – Forst, Poland-Germany, author: Wojciech Bonenberg.

Fig. 5. Cross-border Terminal Olszyna – Forst, Poland-Germany, author: Wojciech Bonenberg.

3   The Results

The research by design method led to the formulation of general conclusions regarding the designing of a creative environment should take into account:

3.1   The Identity of the Place

In architectural terms, identity has many meanings and references. The most important of these are spatial, cultural, social and psychological aspects. The history and tradition

of the place also play an important role here [2]. Careful (detailed) analysis of the place allows one to read its identity. Thanks to this, it is possible to recognize the culture, customs, tastes, and ambitions of place users in more detailed way [4]. One can also learn about the local fears and complexes. These elements influence whether people like to be in a given place or try to avoid it. Therefore, the phenomenon of identity determines the attitude of users to a place. Good design of a place makes people to identify with it willingly.

3.2 Personalize Your Place

Sites should be tailored to a specific user, it should not be anonymous. A creative environment should be adapted to the individual predispositions of people and meet various needs. Places adapted to personalized needs give people self-esteem, thereby supporting individual human characteristics important for creativity. In this context, architecture has a wide range of attributes that can personalize a place. For example, one can mention unique arrangement, colors, form, shape, articulation, unique materials, specific architectural details [1, 2]. These features differentiate places and are related to humans in a functional, intellectual and emotional way. This is one of the reasons why people value the space in which they live, work, and rest. The conclusion from our research through design is the principle, that the place should be adapted to the individual needs of the user, creating the possibility of many alternative spatial behaviors.

3.3 Building Prestige of the Place

Prestige is understood as the respect and esteem which someone or something induces in the environment. Prestige is also associated with charm spell uniqueness. Hence, when one talks about the prestige of a place, one means that the place evokes in us the feeling of something extraordinary, worthy of attention. Prestige is related to attractiveness, which distinguishes a place from other places [6]. Prestige differentiates places and differentiates our attitude to space. Prestige builds a hierarchy of places and people and therefore contributes to the growth of diversity. Prestige is an element of competition that builds the value of the place, creating a positive image of the place in the eyes of the inhabitants [7]. For this reason, prestige has a strong emotional tinge. Staying in a prestigious place ennobles people, gives them a subjective sense of greater value. The more prestigious a place, the more users it attracts, creating social groups that we can call "fans of the place". Architectural attractiveness is the basic tool increasing the recognition of the place. Good-quality architecture increases the prestige of the place and attracts customers. It is associated with a high standard of materials, interesting details, safety and comfort (convenience) of use. Our research through design confirmed the principle that one prestigious service (e.g., a luxury store) is a magnet attracting more shops and restaurants to this area. Therefore, even a small, luxurious and unique element can raise the prestige of the entire surrounding space.

3.4   Readability of the Place

First we look at the space and then we try to read it. The readability of space means how easily we can remember and understand the spatial arrangement and create in our mind a specific "cognitive map" of space. Lynch writes about it in my book "Image of the City" [5]. The author has indicated 5 basic elements of the urban environment (junctions, paths, edges, areas, and special signs.) which make the city easier to read and allow to remember its spatial structure. Readability also means the ease of linking the appearance of a place with the function it offers (functional activity). Therefore, the legibility of a place manifests itself in two aspects: spatial structure and functional activity. Both these aspects of legibility determine the recognition of a place.

Contrary to historical places, contemporary urban space is no longer legible. Scattering, fragmentation, heterogeneity, competitiveness of spatial structures, and functional differentiation make places cease to be legible. They make up: mutual relations and contrasts in the built environment, varied durability (robustness), spatial mobility.

3.5   Culture

Culture combines the past, present, and future in one place. From an architectural design perspective, culture is an important component of sustainable development. Culture creates places that are distinguished by local tradition, local identity and local identification. Designing creative places is not only a matter of functional, compositional and economic conditions, but also a respect for cultural values. In this sense, culture is an important element of sustainable development. Culture unites the five pillars of sustainable development: technology, economy, society, nature and the built environment. The relationship between culture and the built environment is particularly important in terms of creativity. The most common problems in this area include: unification of buildings, loss of diversity, boredom, repetition, compositional chaos. These spatial problems have an impact on the deterioration of the quality of life, which results in health problems related to neurosis, anxiety, stress, alienation and frustration. In recent years, we have observed a characteristic change in the treatment of culture as a factor of sustainable development. The relationship between culture, quality of life, and sustainable development has been recognized. Culture and local tradition give a sense of strong ties to the place. People feel that they belong to their neighborhood, to their city. Local cultural resources and the creativity of the inhabitants can inspire social and economic changes and increase the local development potential. Cultural events may have an opinion-forming significance and inspire actions for sustainable development. Cultural vitality is closely related to the creativity of the environment as it permeates all its spheres: technology, economy, society, nature and the built environment.

3.6   Fashion

Fashion is an important element in creating the image of a place and marking one's own tastes [3]. Fashion differs from the factors discussed previously by its instability. What is fashionable now may become a source of embarrassment (frustration) in the future,

when the fashion changes. Fashion in architectural design is a complex issue: it is easy to design as today's fashion dictates, but it is very difficult to predict what will be fashionable in the years to come. It can be seen that in recent years, the fashion has been spreading according to the trickle-up theory. This kind of fashion diffusion features:

– the use of innovative designs, achieved thanks to functionality, price, wide public recognition, and more satisfying aesthetics,
– compliance of the innovation with the created norms and preferences of the prospective users,
– diffusion of new ideas depends on the question if they can be easily deciphered and comprehended; innovations have better chances to expand when they are clear and comprehensible,
– easiness of testing the advantages of the trendy product.

If these conditions are fulfilled, the bottom-up innovations are smoothly assimilated and diffused on a mass scale. An eloquent slogan which advertises this approach is: "It's fashionable to be creative".

4   Conclusions

The proposed concept of creative space is based on a network model in which the following creativity nodes are distinguished: the identity of the place, personalization, prestige, readability of the place, culture, fashion.

The design experiments presented above confirmed the supposition that designing a creative place is a very complex process in which intuition, emotions, and experience play an important role. It is worth emphasizing that the creation of placemaking is not about fitting as many attractions as possible into a specific space, but to extract the greatest possible potential for creativity from this space.

A creative place should meet the diverse needs and abilities of users and give the possibility of personal identification with the place.

In a synthetic approach, the process of designing a creative environment can be related to three levels: Knowledge - Diversity - Fantasy.

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Perception and Invisibility: Urban-Architectural Reception of Lisbon Downtown

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Abstract. This article starts from the "space-limit" concept, supported by a philosophical approach, in order to understand and interpret the Architecture and Urban Space perceptions between the visible and invisible. Architectural symbolic forms have simultaneously a tangible and visible part and an intangible and invisible one, where "outlines of absence" and metaphysical emptiness, open up to horizons of meaning. Under this way, architecture and urban space affect people's perceptions and emotions making them the preferred arts of political, religious and economic powers, by inscribing symbolic forms associated with spatial conformation and shaping gazes, and movements through limits and lines of force. The Lisbon downtown *Baixa Pombalina*, will be the territory for a mnemonic and phenomenological reception, between visible and invisible.

Keywords: Space-limit · Visible and invisible perceptions · Urban and architectural reception · Lisbon downtown

1 Space-Limit: Between Visible and Invisible

The entire act of designing consists in the intentional tracing of spatial limits, under the drawn form of lines, plans, which are materialized in architectural and urban elements, conforming the real spaces of buildings and cities, in articulation with other natural limits (mountains, rivers, seas, horizon…). In turn, these are combined with invisible limits that consist of symbolic, mythical, cultural, political, and social codifications that circumscribe and define spatial and territorial areas. It is these constructed material limits, the instituted and intuited immaterial limits that mark the visual, haptic, and kinetic perception that subliminally, or more consciously, guide the subject in space. Therefore, in architecture and urbanism, the concepts of space and limit are intimately interconnected at the levels of production, perception, and reception or interpretation).

We return to the integrated concept of "space-limit" and its categories – "appearance", "emergence" and "latency" - that intend to create an articulation and transition between the surface of the visible, from the more apparent epidermal dimension, to the more dense phenomenal, physical and structural, of the emergent sense, facing the

invisible, which corresponds to the ontological, metaphysical, imaginary and latent energetic dimension [1].

In the interpretation of E. Trías' ontology, we found part of the theoretical foundations that we applied to the architectural interpretation, starting from the positive understanding of the concept of limit, understood as Being and as an inhabitable hermeneutic space that opens itself to signification and meaning, through the identification of three enclosures: the "enclosure of the appearing" referring to the sensitive phenomenal world; "the border enclosure" corresponding to the symbolic space; and "the hermetic enclosure" that covers the domains of the enigma, the secret, the sacred… attainable from the ontological dimension of the symbol [2]. In a reconfiguration of the arts system, Trías identifies architecture and music as the symbolic arts of the limit, for shaping the environment (territorial/sound), and awakening the emotion and feeling in the recipient (the pathos) prior to that border of meaning and iconic configuration [2].

From M. Ponty's interpretation of phenomenology "(…) the world is what we see, and therefore it is necessary to learn to see it," we find another part of the foundations of a stratified transition between the Visible and the Invisible [3], which we transpose to architectural reception and production. The philosopher identifies a "first visibility", related to the presence and skin of things; a "second visibility" related to the "massive flesh" and "the bone", the "outer horizon" corresponding to the known phenomenological side; facing an "inner horizon," the deep, imaginary, invisible, and latent dimension. In his words, "appearances are the disguise of unknown 'forces' and 'laws' at the hinge between the visible and the invisible" [3], where are situated the forces that can be considered in the gestalt sense, as the "inner frame" of reality.

However, J. Gil's metaphenomenology [4] goes further and grants an autonomous ontological status to the invisible, beyond the retinal condition, exploring the "phenomena of the limit" that occur in subliminal territories, between the conscious and the unconscious. In his words: "looking does not limit itself to seeing, it interrogates and expects answers, it scrutinizes, penetrates, and dispossesses things and movements (…) the gaze excavates the vision" [4], allowing access to the invisible. Through the "forms of force", "osmosis" and "chaos" detected by "minimal perceptions", a complex of subliminal "active-passive" relations between the subject and the object are created at the level of aesthetic perception, which we extend to the architectural and urban perception and reception, which in its meta-functional conditions of "naked-images" and container frames for the body experience and imagination.

2   Image, Symbol, Emptiness and Invisibility

The whole image has a symbolic dimension. For this reason, architectural and urban images, as symbolic forms, harbor a phenomenological and material dimension and simultaneously have inscribed a dimension that refers to a certain invisible side.

In its definition, the symbol has a visible and sensitive part and a metaphysical and invisible part that opens up to several horizons of meaning. In Greek origin, the symbol (*symbolon*) was a coin that was cut in half to establish a pact between two people or two groups, each remaining with a half. The sensitive parts that represented the

testimony of the established agreement, had a correspondence with the missing part of the invisible symbolic dimension [5].

In the Greek amphitheater we found the paradigm of the architectural transposition of this concept of symbol. In the word amphitheater, the prefix "amphi", which means 2, denounces the existence of two theaters: a physical hemicycle with stone benches intended for the public; and beyond the stage for the actors, there is a second theater - the metaphysical hemicycle, empty and invisible, "the outline of absence" that completes the circle - for the Gods, who establish this pact with mortals, attending and participating in the course of human tragedy [6]. This emptiness corresponds to the "pre and supra ontological field, it is the supreme emptiness, it is the non-being, the possibility of being, the origin and the end, the zero and the infinite, the absence, despoiling, the imaginary breach, the hermeneutic gap" [6].

3   Perception, Emotion and Reception

As symbolic forms that contain and frame life, architecture and urban space contain those dimensions, visible and invisible, that directly affect the subject, creating with him, passive-active and unconscious-conscious relationships. Therefore, political, military, religious, economic powers have used and use architecture (castles, towers, cathedrals, belfries, palaces, museums, stadiums, skyscrapers) and urban space (layouts, streets, squares, boulevards…) as forms of symbolic representation, sometimes reinforced by the scales and geographical territories of places.

The functions associated with these architectures and the changes of use values that they have housed, are a mark of the significance of both the most representative buildings and the anonymous buildings and ensembles that fulfill housing and urban framing functions. However, the recognition of the aesthetic value, the patrimonial value, and sometimes the value of the authorship itself, sustain the symbolic aura of some buildings. They acquire an iconic condition and endure beyond the mutations of use values, through a certain meta-functionality, allowing them to survive, even after losing their utilitarian purpose, or the ideological intentions that were at their origin.

By delimiting and shaping urban-architectural spaces, the subject's gaze and walk is subliminally, or consciously shaped and his behavior towards space is in part conformed. The subject is literally subject to the passive-active sensory interactions that he establishes with space, buildings and territory.

Are called to consciousness: sensations, emotions, affections, feelings and values: ideological, psychological, aesthetic…—positive, neutral or negative—of adhesion or repudiation, of well-being or malaise, beauty or ugliness, pleasure and displeasure… Everything contributes to this: from the level of appearance, the scenographic image, the scale, the appeal to memory, the stylistic recognition, the rhetoric of the composition or the lack of it, the colors, the coatings, textures…; passing through the emergency level, the volumetries, the walls, the materialities, the conformation of the space voids; in the transition to latency, gestalts, "shape forces" and "force shapes", fields and presence effects, centers, proportions, axis lines and vector directions [7] that induce "geometries of the gaze" [8] and shape attention. Already at the latency level, the invisible dimension of symbols, and other "forms of force", like fields, flows and

turbulences, including the chaos generated by other external factors… work as stimuli that induce perception of emotion, and may lead to subliminal and conscious behaviors, such as contemplation and intentional reception.

We extend to urban-architectural perception and reception the neurologist words of the neurologist A. Damasio about "(…) those forces of attention that are called to intervene when extensive panoramas of real events, of music, literature, painting, cinema, are mentally covered and made ours, that is, made aware" [9]. His notion of "extended consciousness" or "extended mind" overflows in "exterocection", for the outside world, of architecture and the surrounding urban space, on which the "forces of attention" called to intervene. A shuttle is created between the interior of the mind and body, in terms of sensorimotor patterns, sensations, images, dynamic mappings, feelings and emotions, which interact with the subjectivity of the subject, taking into account their memories, education, culture and other systems of values and meanings. Many of these feelings and emotions towards the space are manifested in the receiver from previous experiences; others are the result of surprise and strangeness that architectural and urban spaces can produce as a way of accessing the invisible.

4   The Square: History, Memory and Symbol
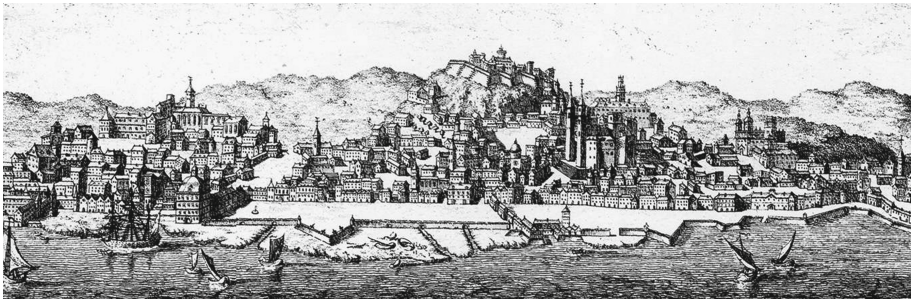
Fig. 1. Engraving of Lisbon, 17th century

Let us take as an interpretative urban-architectural example the square *Praça do Comércio*, located in downtown Lisbon, rebuilt in the second half of the 18th century. After the earthquake, tsunami and fire that devastated this part of the city on the fateful day of December 1, 1755. However, for a better understanding of this square, the site and its Genius Loci, it is necessary to go back to the matrix space that preceded it and the historical memories, experiences and symbolic images that are associated with it (Fig. 1).

Colored pictures are welcome in the electronic version free of charge. If you send colored figures that are to be printed in black and white, please make sure that they really are legible in black and white. Some colors show up very poorly when printed in black and white.

For centuries, until the Middle Ages, a large informal empty space was settled - a riverside terrace - located between the walls and the Tagus River, in front of the wide estuary, which then narrows, before reaching the Atlantic Ocean. The great void of *Terreiro do Paço* constituted the maritime entrance to Lisbon and was the scene of European and intercontinental commerce in the early modern age. With the advent of the discoveries and the Portuguese maritime expansion, the *Terreiro do Paço* was the first port of globalization, then started. Its strategic importance, in relation to the city and the commercial hub, made King Manuel I change his residence from the old Castle, located on Lisbon's most dominant hill, to a fortified tower, by the river, at the end of the 16th century, to better control the spice trade and naval production in the arsenal. The great emptiness of the square facing the river and dominated by the fortress, symbol of royal power, contrasted then with the Rossio square located at the northern edge of the city, identified with temporal power, dominated by the Palace of the Inquisition and the Hospital de Todos os Santos. Both squares hosted in their urban voids, diverse public events that reveal their multi and metafunctional character. In particular, the Terreiro do Paço was the stage of military parades, processions and *autos-de-fé*, executions, bullfights, fairs, popular and royal festivities.

The architectural and scenographic transformation of the Terreiro do Paço, with the construction of the new Renaissance cubic tower (designed by Juan de Herrera and Filippo Terzio, and built around 1590), corresponded intentionally to the symbolic affirmation of the new political power of Philip II of Spain in Portugal. The model of the cubic tower would be replicated in the first quarter of the 18th century in the two turrets flanking the Convent of Mafra designed by Ludovice (Fig. 2).
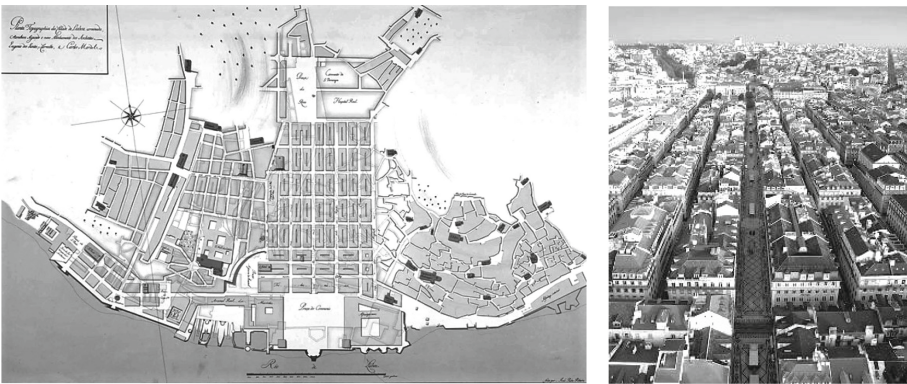
Fig. 2. Lisbon downtown reconstruction plan by Eugénio dos Santos e Carlos Andreas, 1758

After the scourge caused by the 1755 earthquake, which destroyed the Lisbon downtown, including the Royal Palace, successive plans were drawn up by order of the Prime Minister Marquês de Pombal.

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The *Praça do Comércio* is reborn over the river, flanked by the two cubic turrets, bringing to mind the original model of the Renaissance turret of the Paço, destroyed by the earthquake, and the model that followed it, the two turrets of the Convent of Mafra. In his memory, the square would be the scene of other historical events, such as the regicide in 1908, the revolution of 1974, and poetic experiences, recorded by Fernando Pessoa: "I spend hours, sometimes in *Terreiro do Paço*, by the river, meditating in vain. My impatience constantly wants to pull me out of this quiet, and my inertia constantly stops me in it (…)" [10].

5   Lisbon Downtown and *Praça Do Comércio* Square: Perception and Reception Between Visible and Invisible

Fig. 3. Lisbon downtown perspective axes of *Rua Augusta*

In Baixa, image, topology and geometry determine the conformation and qualification of space, from the despoiled scenographic appearance, to the emergence of building-blocks and urban voids, under the symbolic inscription of "forms of force" and latent matrices, that construct the perception and reception between the visible and the invisible (Fig. 3).

The layout of the Baixa plan is simultaneously a symbolic and pragmatic form of political, land tenure, economic and constructive standardization, which creates a highly organized structure, facilitating allotments, sewage, road circulation, military and civic control, under a strong unitary scenic urban-architectural image.

The plan is based on an orthogonal geometric grid that seeks to articulate the pre-existing, east and west, historical organic fabrics.

In the domain of the visible: ruptures, continuities and framings are established transversally, that lead the gaze to successive planes focused on certain iconographic architectural moments (the castle, the Cathedral, the hill of S. Francisco…); longitudinally, in the hierarchy of the three main streets - Rua do Ouro, Rua Augusta and Rua

da Prata - the scenographic perspectives flow into the North and South empty squares, defining counterpoints and framing focal elements (the arch, the central statue of the square…) while in the secondary streets the perspectives are truncated. Despite the rationality of the Downtown Plan by the orthogonal layout, in the visible domain, the mismatch of axes between Rossio Square and Commerce Square, the layout of longitudinal and transversal blocks, generates a set of expectations and perceptual surprises. These contribute to the complexity of the appearance at the level of the mental map of the city. As an example, the triumphal arch of Rua Augusta establishes a direct connection between the two squares and the river, while the arch at the Rossio axis leads to one of the standoff perspective streets. Also the connections between the plan and pre-existing urban fabrics create unusual expectations and surprises of focal architectural moments, continuities and ruptures.

In the realm of the invisible, the emergent plan is inscribed in a symbolic matrix of a latent geometric regulatory tracing that defines the ideal proportions of squares and blocks of blocks, as demonstrated [11].

Between the visible and the invisible, axes and "forces of attention" in the street space are guided by the invisible axes reinforced by the perspective of the vanishing lines, by the cornices and stone lintels that create guides "to the geometry of the gaze", accentuated through the gradients formed by the syncopated repetition of the spans and pilasters along the successive blocks of buildings and cross streets. All this is reinforced at the level of appearance, by the repetitive language of the proto minimalist façades composition along the blocks, which subliminally reinforce the movement of the user in space. In the case of Rua Augusta, the "force forms" of the perspectival guides converge to the plane of the monumental background, the triumphal arch and the focal point beyond the statue, which after being surmounted, dumps the expectation into the emptiness of the monumental square and river landscape.

Fig. 4. *Praça do Comércio* Square of Lisbon Downtown

Likewise, the *Praça do Comércio* appears to us as a scenographic compositional unit, neoclassical, syncopated by the two floors of spans over the arcades, garnished by stonework, in a contrast figure—background with the yellow chromaticism, which

restores the golden symbolism of the royal square. Under the deepened space of the arcades wings framing dynamic stretches of the square, the sheltered perimeter path embraces the empty space (Fig. 4).

In the space contained by the three sides of the quadrilateral, marked by the arcades, the axis positions the Triumphal Arch of Rua Augusta, and the equestrian statue centered in relation to the square, creating games of focal points and counterpoints, escapes in and out of the layout, sometimes including in them the remote and symbolic view of the hill of St. George Castle.

A latent equilateral triangle defines the proportion of the space centered on the statue and balanced between the triumphal arch and the turrets that opens to the pier of the two columns, marking the symbolic entrance, of the square and the City. Further ahead, when the river chokes, before entering the ocean, the April 25th Bridge replicates and reactualizes in territorial scale, the entrance and exit portals of the Lisbon City, in the four space directions.

Fig. 5. *Cais das Colunas* situated in *Praça do Comércio* of Lisbon Downtown

As in the Greek amphitheater, the symbolic power of *Praça do Comércio* square resides in it fourth absent and invisible facade that opens towards emptiness, to the pleasure of the contemplative landscape of the river, to the ocean, to the infinite… through the metaphysical portal of the columns, as time and imaginary space machines that expands into "horizons of meaning" (Fig. 5). Both evoke to other cultural memories and project us into the future…

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Garden - The Pursuit of Harmony in the Modern Times

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Abstract. This paper discusses the evolution of residential gardens in the context of modern houses (20th & 21st centuries) charted in the backdrop of changing aesthetic dogma. It aims to demonstrate that despite the changing times, garden designers repeatedly use the same or similar solutions, interpreted in accordance with the spirit and the means available in a given period. Gardens were an indispensable part of residences; more recently and in a somewhat scaled down form they were enjoyed by industrialists, financiers and professionals. The pursuit of beauty in a garden took place in the real and speculative spheres, facilitating harmony in accordance with the adopted cultural dogma.

Keywords: Gardens of the 20th c. · Plants aclimatisation · Garden fashion · Garden city · Technical achievements in gardens · Garden as a status symbol · Garden and landscape

1 Introduction

Modernism brought a change to both architecture and gardens. Demand for residences, in the old meaning of the concept was wavering. In the 19th century, expectations of more numerous, albeit nor so wealthy customers began to change. Although large complexes were still built but they were beginning to give way to smaller estates, on the outskirts of, or near cities. Larger properties used natural landscape features; smaller ones were planned as an internal world.

2 Gardens – How They Were Planned and How They Were Built

England was the country which, because of its closest links with the Far East and South Asia and its growing wealth, played a major role in importing, acclimatising and popularising imported exotic plants. The Royal Horticultural Society gardens, a venue for exhibitions, kindled interest in nature, ornamental plants and crops among the

general public. Joseph Paxton was the person who influenced the shape of gardens in the 19th century[1]. At the same time the young generation of artists changing art aesthetic dogma, gradually modified the preferences of the audience. Landscape painting, which has been evolving since the 18th century[2], became valued and even the paintings on the palace walls in place of medallions, pilasters and colonnades began to depict fragments of natural landscapes.[3]

The bourgeoisie class that emerged in the 18th century already had great financial clout and similarly grand aspirations.

The turn towards introducing native plant material into gardens and creating "idyllic" fragments was spurred by Gertrude Jekyll, painter and designer of many gardens[4]. Working together with Edwin Luytens, an architect and urban planner, they created a type of residential house blended into a garden full of native as well as acclimatized plant species. The visible common spirit of the 19th c. which links the composition of gardens (Jekyll), buildings, interiors and even costumes (Morris, Voysey) defined by the Germans as *Gesamtkunstwerk* permeated the works of artists of that period.

The 20th century was not a period for designing great, residential complexes. Cross-section of societies, way of life and economies have changed and so did laws and regulations relate to urban planning and house building.

Relatively few gardens have survived by villas built in the first decades of the 20th century. An analysis of designs by Alvar Aalto, Mies van der Rohe and Le Corbusier as well as the works of their successors shows a differentiated approach to the plot, landscape forms, and the building/garden relationship. As the "garden city" type districts were created, *"quite small gardens appeared, cut off from landscape views, within the interior of villa quarters which also performed utility functions"*[5]. Increasing numbers of smaller gardens were becoming the subject of designs. On small plots of land, they required "inward-looking" design. The growing importance of the home

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[1] He also designed Crystal Palace, the venue of the 1851 World's Fair exhibition in London, as well as the garden around it.

[2] Landscape painting developed initially in England. In France, in the first half of the 19th century a group of painters, later called the Barbizons, founded an artistic colony whose aim was to paint the surrounding landscapes. Its members included Théodore Rousseau, Camille Corot, Charles-François Daubigny… and Józef Szermentowski, a Pole, in: Frazer L.Ch., The Barbizon School (1830–1870): Expanding the Landscape of the Modern Art Market, The Arbutus Review 8(1), p. 4–14, 2017.

[3] One of the chambers of the palace in Czerniejewo is one such example - the result of an unfinished change in the decor of the palace. Bardzińska-Bonenberg, Założenie pałacowo-parkowe Czerniejewo, Wydział Architektury Politechniki Poznańskiej, Poznań 2008, p. 72.

[4] Gertrude Jekyll designed and modernized gardens of small estates and medieval castles. In her writings she was drawing the attention of readers to combinations of colours, forms and appearance of a garden in different seasons. http://cdn.calisphere.org/data/13030/vx/tf1v19n5vx/files/tf1v19n5vx.pdf.

[5] Czyżewski A., Trzewia Lewiatana. Miasta-ogrody i narodziny przedmieścia kulturalnego, The National Ethnographic Museum in Warsaw, Warsaw 2009.

garden can be followed at subsequent Werkbund exhibitions[6]. Competitions by Warsaw's housing cooperatives of the interwar period provide interesting information as well[7].

Corbusier's Villa Savoye (1928–30), situated on an open oval lawn surrounded by trees is an example of a solution, where the body of a house located on a few hectares of land contrasts with the designed surroundings. Surviving design drawings do not include a garden – the building, according to the architect's will, was exhibited like a sculpture. Le Corbusier presents the surroundings of an earlier, never built Villa Meyer, designed between 1925 and 1926 in a completely different way. On perspective drawings the building was surrounded by trees and shrubs almost pushing against the walls[8]. Villa Stein, also designed during this period, is situated in a non-standard way on an elongated plot. A long access road leads to a house in the interior and the view of the building is framed by deciduous trees planted on both sides of the driveway, directly in front of the house. In Corbusier's project, the front part of the plot, today with well-kept greenery, remained unplanned. The architect placed a group of trees some distance behind the house[9]. As in Villa Meyer, the greenery was drawn only on the axonometric depiction of the design.

Villas designed by Corbusier have openings and terraces affording views of the plot and the surrounding landscape, although in most of his designs they are only outlined. Thus one may conclude that Le Corbusier saw the green surroundings as an insignificant part of the architecture, despite several strong ideological declarations[10]. In his dwellings, Mies van der Rohe was perfecting the design of gardens. The most famous, Villa Tugendhat (1929–30), was designed for friends of the architect. The beautiful location of a hillside plot with a view of Brno imposed the way the building and the terrain were formed and the way the garden was arranged[11].

Villa Wolf, designed by the same architect and completed in 1927, was located in Gubin on the Lusatian Neisse. A terraced garden was formed on a slope. As in Brno, the distant view was "framed" by the windows and became an element of the interior of the house.

Immediately after Villa Wolf, Mies van der Rohe designed two houses for his friends - industrialists. Lange & Esters (1927–29) house complex was built in Krefeld

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[6] At the 1929 WUWA exhibition in Wrocław, designs of a variety of house,s also included plot development blueprints, in: Urbanik J., Wrocławska Wystawa Werkbundu WUWA 1929, Museum of Architecture in Wrocław, Publishing House of the Wrocław University of Technology, Wrocław 2002.

[7] Rozbicka M., Małe mieszkanie z ogrodem w tle w teorii i praktyce popularnego budownictwa mieszkaniowego w międzywojennej Polsce, Oficyna Wydawnicza Politechniki Warszawskiej, Warsaw 2007.

[8] https://aht915.wordpress.com/2016/02/22/utopic-design-in-le-corbusiers-villa-meyer/.

[9] Villa Stein https://twitter.com/ruben_ruheca/status/774552231429435392/photo/.

[10] In the 1925 L'Esprit Nuoveau Pavilion, Corbusier retains a tree, although in reality, surrounded by foundations it would not survive. In Immeubles-Villas block (1922), deep loggias are intensely vegetated in the interior, although the plants will really only be able to live in the daylight zone.

[11] The last renovation of the villa took place in 2010–2012, based on the memories of the owner and her daughters. https://www.iconichouses.org/specials/villa-tugendhat/history.

(Germany), and the flat plot in the villa district of the city inspired him to create a common visual, garden-like interior connected with the greenery of the interior of the district. Rectangular terraces by the houses and a geometric garden extended the interiors and opened towards the park part of the plots.[12,13] The architect provided for a glimpse from the street into the high greenery filling the interior of the district[14]. The way the gardens are designed, penetration of district greenery into the street and street greenery into the plots are characteristic elements of a garden-city ideas, commonly implemented in well-off districts in the 1920s.

In Alvar Aalto's projects, landscape and nature have always been present as a reference point for architecture. This was also true for his industrial projects[15]. The architect designed over twenty houses and residences[16]. A review of the documentation, contemporary and archive photographs show that the "designed" greenery created a natural background and foreground for the buildings and was in line with the Finnish house-and-garden tradition[17].

Villa Mairea is different from those dwellings, a residence was built between 1938 and 1939 for the young Finnish industrialist, Gullichsen couple. It is located in a forest, access to it leads via winding, unpaved road. This residence based on an L-shaped plan of the main building form an inner green 'yard' similar to Finnish farms layouts. Its most important element is the swimming pool, its irregular shape akin to a pond, with aquatic and near-water native vegetation on the banks. The location of Villa Mairea and its relationship to the existing landscape is an example of a new way of inscribing the house and garden in the landscape.

Inscribing buildings into the landscape and minimum of interference with the in-situ situation was a feature of Alvar Aalto's architecture. In the post-war Villa Louis Carré in Bazoches-sur-Guyonne, France, built in 195–1961, the architect adopted similar ideas. On a forest covered steep slope at the top of the clearing he placed a house which also serves as an art gallery. He provided a gravel road to it and did not interfere much with the natural woodland and grassy meadow. The area in the vicinity of the building comprised flat, grassy terraces, running along the contour lines of the plot. Terraces were supported by dark, wooden logs[18].

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[12] https://en.wikiarquitectura.com/building/lange-esters-house/.

[13] About the garden: https://wp.eghn.org/en/haus-ester-haus-lange/.

[14] In 2000 both gardens were thoroughly reconstructed. The part in the hands of the Esters family still has the original design drawings. The plans of the neighbouring garden were not found, but the surviving photographs show that both gardens were similarly designed. https://wp.eghn.org/en/haus-ester-haus-lange/#1446907548030-48d1713e-b0ac.

[15] In the design of the pulp mill in Sunila (1937–39), to a large extent Alvar Aalto kept the in-situ land forms. He inscribed the hall and production constructions into the rocky slope. As cited in: S. Giedion, Czas, przestrzeń, architektura, – narodziny nowej tradycji; Arkady, Warsaw 1968, p. 625–627.

[16] Jetsonen J. and S., 30 homes designed by Aalto from the 1920s to the end of the 1960s, Introduction. https://www.worldcat.org/title/alvar-aalto-houses/oclc/797830489.

[17] Jetsonen J. and S., ibidem.

[18] After the renovation, they were replaced by concrete retaining walls.

Contemporary gardens, regardless of their size, have been influenced by two factors for almost a hundred years. First of all, information about historical and contemporary garden styles, thanks to which iconic designs became widely known and have been "quoted" in subsequent designs. Secondly, for various reasons, gardens have been deprived of individual semantic values associated with the owner, events and their message at the level of current knowledge. The meanings associated with the culture of given epochs and cultural codes were contained in the narrative of sculptures and buildings. Now, Villa Lante, Versailles and other places are understood precisely only by art and garden historians. In contemporary garden designs, motifs that link them with culture and important events are rarely included. At best, the garden becomes a place to display a collection of sculptures or other artefacts collected by the owner.

Large private gardens are often composed of several separate spaces, different in character. This results from the tradition of functionalism: fragments of miniaturised Baroque solutions with sculptures and fountains are coexisting with Gertrude Jekyll-style flowerbeds. "Distant" perspectives are sometimes supported by mirrors…

In recent decades the eco-friendly trend has gained in prominence. A flower meadow in place of a mowed lawn, honey-bearing plants, dense bushes where birds nest, they are all symbols of that trend[19]. It is probably the most important element linking contemporary garden art with ongoing cultural changes and probably one of the ways to create a contemporary garden narrative art. Just like in gardens of old, in addition to the visual experience, other senses are also involved: hearing, smell and feel of the surface of the paths are all part of experiencing the garden composition. The eco-friendly trend takes into account local vegetation, land forms and watercourses. It also allows to embrace the full range of sensations, as was the case in the Renaissance and Baroque.

Today, cities, institutions and associations are the patrons of insightful and innovative efforts. Deconstructivism, minimalist solutions, high-tech elements, op-art, orientalism, earth art, were, and are influential when it comes to the art of large gardens.[20]

New large-area residences that are being built are setting new trends in garden design to a small extent. The difference in the scale and financial means is insurmountable, and sometimes the style in which they are composed has little to do with contemporary culture and art. Barbara Piasecka-Johnson's "Jasna Polana", one of the largest and affluent estates in the USA, was designed entirely in a "fairy-tale" convention, similar to the Populist Architecture trend. The most original contemporary super garden is Xandau, home to Bill Gates' house. The owner employed the latest interactive computer technologies, but it is known that the vegetation on the six-hectare plot is native and the tree specimens that grew there originally were kept.

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[19] The first deliberately wild flower meadow was established in 1850 by Prince Albert at Osborne House (Isle of Wight) for his own children. In 1982 Prince Charles, founded a similar one on 32-hectare Highgrove estate and became a propagator of this type of gardens. https://www.ft.com/content/97f2cb48-eefc-11e2-bb27-00144feabdc0.

[20] This trend can be seen in newly designed gardens residences. Conran T., Pearson D., Nowoczesne ogrody, Hobhouse P. Historia ogrodów, Arkady Sp. z o.o., Warsaw 2007, and fragments of Wines J., Zielona architektura, Tashen/TMC Art., Koeln 2008.

Undoubtedly two European gardens are the realisations representing contemporary, set in culture, original garden ideas. One of them is the Little Sparta garden near Edinburgh, the other is a garden created by the composer Krzysztof Penderecki in Lusławice near Tarnów.

The Little Sparta garden is an example of a space whose authors, and at the same time its owners, pursued a contemporary semantic meaning of a garden inscribed into the hilly Scottish heath. The garden is located in Lanarkshire, Scotland, near Edinburgh, and has been owned and developed by Ian Hamilton Finlay[21] and Sue Finlay since 1966. A garden, considered to be the most important work of contemporary Scottish art, was created on an irregular area of just over 1.5 hectares of heath in the Pentland hills[22]. The artefacts on display refer to antiquity and subsequent significant historical events[23]. It is formed freely, alluding to the romantic tradition, but the method chosen by its designers resembles the technique described in architecture as acupuncture of space[24]. More than 270 works of art have been located in adapted places, among greenery composed in a spot-like fashion. The sites where they are exhibited, according to the designer's intention, are referred to as specific landscapes. Working with stonemasons, sculptors, lettering specialists and other artists, Finlays have created a network of interrelated references: to the sea, ancient art, the French Revolution and World War II[25].

Lusławice, in Lesser Poland Voivodeship, Poland, a site of *Krzysztof Penderecki European Centre for Music*. Penderecki, a world known composer decided to build his Centre for Music there for many reasons. The history, which was gradually uncovered made his enterprise a continuation of cultural, artistic and scientific events that took place there before. The history of a place, which was in a state of devastation in the 1970s and was recreated almost from scratch and inspired the design of the manor garden in Lusławice.

A few preserved architectural elements and knowledge of the events that took place there lay at the core. A manor house and the utility buildings were of historical value and the legacy comprised also a monument to Italian, Faustus Socinus, an outstanding Polish and European philosopher and Arian teacher. One of the most important Arian (Polish Brethren) centres in Poland was established in Lusławice between 1560 and 1664 on this estate. Unfortunately, after a hundred year stay, Polish Brethern became victims of religious persecutions and fled Poland leaving the place. When a plague hit this area, the graves they left behind were destroyed and earthly remains profaned in a hope of salvation from the disease. The successors of this Arian group, who finally settled in the USA knowing the history of Lusławice commissioned a monument to

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[21] A Scottish writer, poet, artist and gardener who died in 2006.

[22] "The most important work of Scottish art" – the result of 2004 annual poll of the Scottish artistic community.

[23] https://www.littlesparta.org.uk/.

[24] Plesińska K., Architektura, sztuka, design - symbioza w przestrzeni miasta, Zeszyty Naukowe No. 49 Architecture, Silesian University of Technology, Gliwice 2009, p. 157–163.

[25] For more on the symbolism of gardens see: Wojciech Brzezowski, Ian Hamilton Finlay i jego Mała Sparta. https://docplayer.pl/32193406-Ian-hamilton-finlay-i-jego-mala-sparta-ian-hamilton-finlay-and-his-little-sparta.html.

Faustus Socinus. The mausoleum at his former burial site was designed by Szyszko Bohusz, architect and conservator of monuments, a leading representative of historicism and early modernism in Poland. The building, in the Art Deco style, refers to the classic proportions in tribute to Italian Arian.

In the second decade of the XX c., Jacek Malczewski, representative of Secession (Young Poland movement) and symbolist painter, one of the most revered Polish painters lived and worked in Lusławice.[26] Landscapes he painted were depicting fields, meadows and woods where unreal and real worlds and beings met.

There was a lot of threads to be followed while saving this land and its complicated history: references to Italian garden motifs, mathematical rationalism of Enlightenment, Classical spirit and Secession, and almost unchanged rural landscape depicted by Malczewski.

There was a lot of threads to be followed while saving this land and its complicated history[27].

The buildings of the Music Centre are nearby, creating a modern counterpoint to historical place and extending it in a cultural sense.

3   Summary - Common Traits in the Composition of Gardens

Designs by the creators of modernism present a diverse approach to the problem: on the one hand, the greenery was to provide a background to display the buildings, and on the other, to form theatrical wings for exposing them.

Architectural trends that emerged from the modern movement in architecture have various sources of inspiration. This applies to the way the buildings were shaped and also how the gardens were developed. Recent literature clearly indicates that the recognised garden designs, just like to-day architecture are composed of the motifs from all historical periods. Just as we can talk about the eclecticism of contemporary architecture[28], where different stylistic traits and materials are used – that same phenomenon is present in garden designs. Designers interpret many formal solutions known from the previous eras, transforming them in accordance with the spirit of our times.

The Table 1 below is a concise depiction of how garden spaces were composed over subsequent historical periods discussed in the paper.

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[26] https://www.it.tarnow.pl/atrakcje/region-tarnowski/ciekawe-miejsca/luslawice-arianie-jacek-malcze wski-i-kompozytor-penderecki/.

[27] https://www.biznesistyl.pl/kultura/oblicza-kultury/2668_30-hektarowy-ogrod-krzysztofa-pendereck iego-w-luslawicach.html.

[28] Bardzińska-Bonenberg T., Bonenberg A., Eclecticism of 20th - century tenement house façades as a reiterating occurrence, In: A house in a city: properties of an architectural thing: monograph. Vol. 1, Publishing House of Cracow University of Technology, Cracow 2016.

Table 1. Gardens by residences and homes – changing traits in compositions.

No	epoch / historical period	garden composition							
		open composition	closed composition	symmetric composition	composition with bold axes	free composition, with the parts geometrically formed	composition with not visible on the plan viewing axes	free, natural landscape	geometric elements freely arranged
8.	Enlightenment /18th c.	■		■		■		■	■
9.	19th century	■				■	■	■	■
10.	Modernism	■				■	■	■	
11.	Contemporary	■	■		■	■	■	■	■

The time perspective makes it easier to assess more distant phenomena than what is happening at the moment. However, selective use of forms from different eras and eclectic compositions thereof, make it difficult to see the general trend set by recognised garden designers at the moment, apart from an ecological view of the resources they transform. Perhaps this road will be characteristic of our times.

The garden is a work of nature and culture and therefore experiencing it involves more senses than most works of art. It reflects the pursuit of beauty, the canons of which, as in the whole culture, have changed over subsequent centuries and decades, accelerating, slowing down and changing for various reasons.

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The Morphology of the Urban Sprawl Phenomenon in the Poznan Metropolitan Area

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Abstract. The aim of the article is to assess the development of the Poznań metropolis from the perspective of urban development. This applies to the compactness of buildings, spatial and landscape diversity. The observed increase in urban sprawl can be interpreted as a weakness of the spatial planning system. The results of our study suggest that there is a lack of understanding of the causes of uncontrolled spatial development, the causes of unplanned expansion on a metropolitan scale, and of effective concepts to counteract this phenomenon. These results show a significant relationship between the loss of arable land and growing urban sprawl. The results of the conducted research provide evidence explaining the process of suburban development and indicate tools preventing uncontrolled development.

Keywords: Poznań metropolis · Urban sprawl · Suburban areas · Quantitative analysis

1 Introduction

The spatial problems of modern cities take on a new face in the era of globalization, technological and demographic changes, and functional and social connections in urbanized areas.

It applies in particular to metropolises made up of large cities and their surrounding areas. The development of cities is an undoubted technical and organizational achievement, it is the object of admiration and fascination, and it attracts more and more new residents, investors, and clients. It is an opportunity for economic development, it gives the opportunity to improve the quality of life of the inhabitants. On the other hand, criticism of complex urban structures is growing, as well as criticism undertaken from the point of view of human needs and aspirations, which, contrary to hopes, have not been satisfactorily solved. Newly emerging conflicts arise from the necessity to reconcile the conflicting interests of various user groups: property owners, investors and developers, local communities, pressure groups that in an institutionalized form represent specific interests (protection of landscape and cultural goods, ecology, etc.), local government authorities responsible for local spatial policy and economic development of individual communes. These groups pursue their own goals in the agglomeration area and exert a specific influence on the form of spatial

development. In this approach, the urbanized area is a place where the interests of many users clash, competing for resources located in the agglomeration. These resources are of different nature and value for each user. These can be a convenient transport connection, access to the existing technical infrastructure, an attractive location associated with a beautiful landscape, a stabilized social environment. One of the most valuable resources of the agglomeration is the area. Changes in land use are considered a manifestation of competitive competition for space. These changes cause characteristic spatial and environmental effects leading to the so-called suburbanization. Suburbanization (urban sprawl) is a common phenomenon in large cities and is most often associated with the dependence of residents on the car. In environmental terms, urban sprawl can be considered the opposite of sustainable development and is the dominant form of spatial evolution in most urban agglomerations.

The article presents the scale of this phenomenon in the Poznań agglomeration and the impact of this phenomenon on the spatial order. Research in this area was carried out as part of the Polish-Chinese project "Future City Lab" at the Faculty of Architecture of the Poznań University of Technology in 2019 and 2020.

In the analyses of the existing urbanization, data from satellite images were used, field studies were carried out in the form of urban and architectural queries, and the results of existing specialist studies were used [1–3]. These publications concern general issues of suburbanization and its specificity, including urbanization, as well as its spatial and socio-economic effects for the Poznań metropolis. Churski [4] considers urban expansion to be one of the most important development challenges for the Poznań metropolis.

This article presents the specificity of the urbanization phenomenon around the city of Poznań and an assessment of the spatial effects it causes. In particular, the purpose of the article is:

a) Identification of development trends on the basis of the direction of spatial development of municipalities included in the Poznań metropolitan area.
b) Recognition of the dynamics of suburbanization around the city of Poznań in the aspect of sustainable development of the metropolitan area.
c) Analysis of losses and benefits for the inhabitants caused by urban sprawl in the Poznań metropolis.
d) Formulating recommendations and recommendations for the spatial development plan of the Poznań metropolis.

2 Materials and Methods

The research concerned the communes around Poznań that are part of the Poznań Province. The research was carried out in the Polish-Chinese experimental research studio "Future City Lab" at the Faculty of Architecture of the Poznań University of Technology in 2019 and 2020. The aim of the research was to identify the phenomenon of urban sprawl in the quantitative aspect, to capture the features specific to the Poznań metropolis. Problems with obtaining detailed empirical data were a significant limitation. The research was based on the imaging of planning documents. It should be noted

that the imaging method is used as a standard in spatial planning for analyzes covering the issues of land use, physiography, cartography and landscape assessments. Imaging in urban planning has a well-established tradition. Modern techniques make it possible to combine visualizations with databases about space and virtual reality. Imaging includes all components of the planning procedure, which consists of: diagnosis, measurement, data analysis, coordination and control.

The conducted tests included:

– diagnosis of resources and the condition of planning documents in the surveyed communes,
– comparative analyzes of the records of studies on the conditions and directions of spatial development in the surveyed communes.

In the course of the research, we found that:

a) Used graphic signs do not fulfill their function as a tool for creating spatial policy in communes.
b) The scales used, the detail of the record, and graphic symbols make it impossible to directly compare the town planning plans of individual communes.
c) Urban plans make limited use of digital graphic imaging techniques. There are no problem analyzes applied to cartographic maps.
d) The inconsistency of the graphic record hampers planning coordination, prevents direct comparative analyzes in the analyzed communes.
e) Graphical signs are not parametrically linked with space databases.
f) The imaging of data on town planning drawings makes it difficult to recognize the dynamics of urbanization processes, changes in land use and the assessment of suburbanization in the Poznań metropolis.

As can be seen, we encountered a significant problem in the direct use of existing urban plans. For this reason, the graphic imaging method has been supplemented with: field inquiries and inventories in the surveyed communes, satellite image analysis, standardization of municipal plans for the purpose of comparison.

The field queries were conducted by students of the Faculty of Writing of the Poznań University of Technology as part of the summer research internship in 2020. For each commune, changes in the manner of land use were identified in the period 2010–2020, broken down into:

– arable land, (area loss - increase),
– built-up area, (area loss - increase),
– green, (area loss - increase),
– road transport roads (surface loss - increase).

These indicators are partial criteria for assessing the urban sprawl phenomenon in municipalities. As a supplement to the above-mentioned quantitative criteria, a qualitative assessment was carried out in the field of: typology of buildings and the standard of public spaces in communes. We have aggregated the obtained data. As a result, we

got an image of the scale and dynamics of the urban sprawl phenomenon in the entire Poznań metropolis. The results were presented on maps and diagrams.

3   Results

The research led to the determination of the scale of the urban sprawl phenomenon in the communes of the Poznań metropolis. The results are presented in the diagrams divided into the following sub-criteria:

In order to synthetically assess the urban sprawl phenomenon in the communes of the Poznań metropolis, the results were aggregated according to the following formula:

$$SP_n = [A_n(a_n) + G_n(g_n) + B_n(b_n) + R_n(r_n)] \, dist_n$$

SP_n - size of urban sprawl in the commune n,
A_n - conversion of agricultural land into land intended for development in the commune n,
G_n - changes in the area of green areas in the commune n,
B_n - changes in the area for development in the commune n,
R_n - road surface changes in the commune n,
a_n, g_n, b_n, r_n - weighting factors for parameters A_n, G_n, B_n, R_n,
$dist_n$ - correction factor taking into account the distance of the commune n from the center of the Poznań metropolis (Figs. 1, 2, 3, 4 and 5).
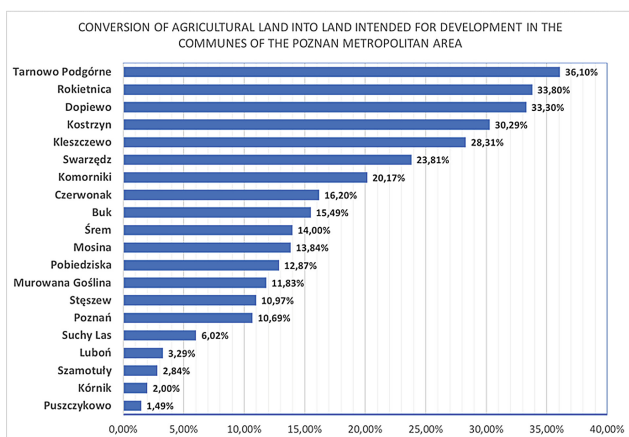
Fig. 1. Converting the area of agricultural land to land intended for development in the communes of the Poznań metropolitan area in 2010–2020.
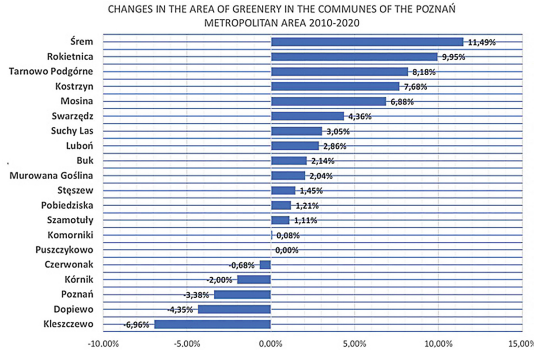
Fig. 2. Changes in the area of green areas in the communes of the Poznań metropolitan area in 2010–2020.
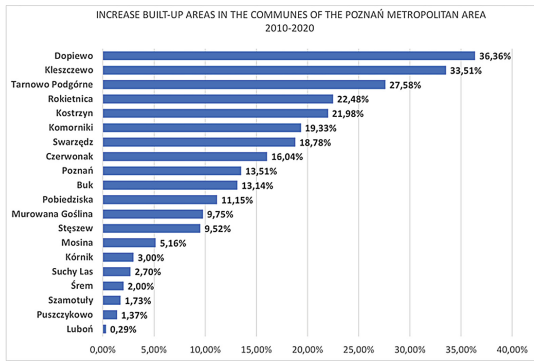
Fig. 3. Changes in the area for development in the communes of the Poznań metropolitan area in 2010–2020.
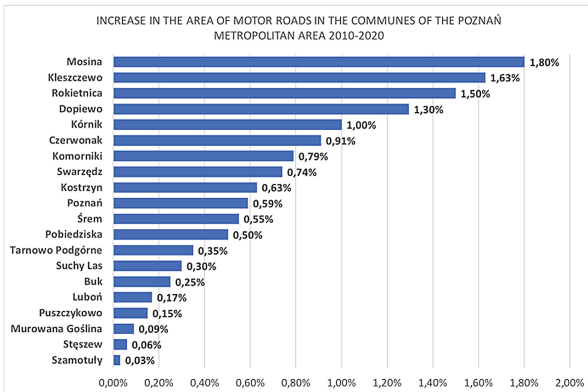
Fig. 4. Changes in the area of motor roads in the communes of the Poznań metropolitan area in 2010–2020.

INTENSITY OF THE URBAN SPRAWL PHENOMENON IN THE COMMUNES OF THE POZNAŃ METROPOLITAN AREA 2010-2020

Commune	Value
Kostrzyn	11,43
Dopiewo	11,39
Kleszczewo	10,10
Komorniki	8,32
Tarnowo Podgórne	8,16
Rokietnica	7,74
Buk	6,03
Mosina	5,36
Pobiedziska	5,17
Murowana Goślina	4,53
Śrem	4,48
Stęszew	4,25
Czerwonak	4,12
Swarzędz	3,71
Suchy Las	1,30
Kórnik	1,10
Szamotuły	1,02
Poznań	0,97
Luboń	0,42
Puszczykowo	0,39
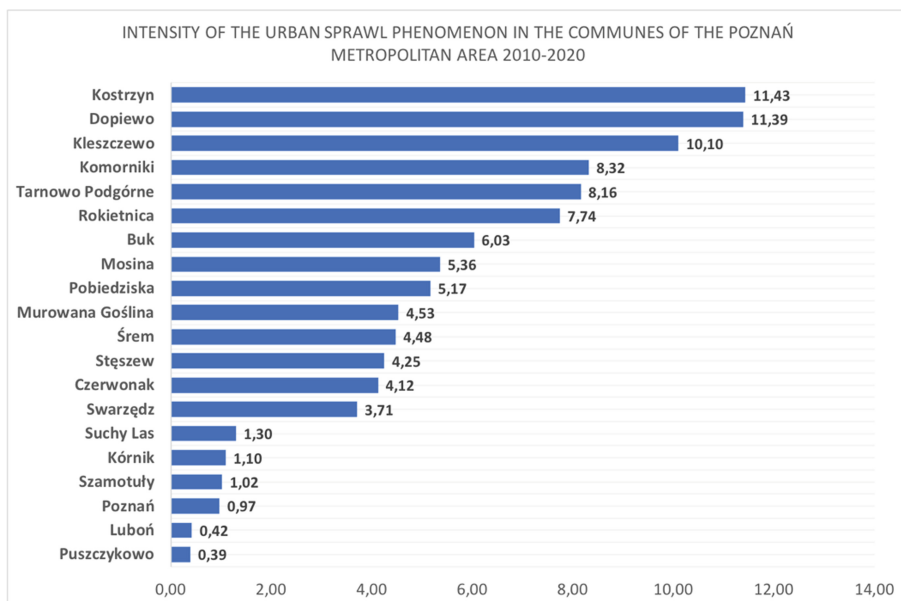
Fig. 5. Intensity of the urban sprawl phenomenon in the communes of the Poznań metropolitan area 2010–2020. Synthetic assessment.

4   Discussion

Research has confirmed that the urban sprawl phenomenon negatively affects the quality of urbanized space, and causes environmental and landscape problems. From an environmental perspective, urban sprawl can be regarded as the opposite of sustainable development, yet it is the dominant form of spatial evolution in the Poznań metropolis.

The negative features of this phenomenon include:

– the disappearance of the physical, readable city limits (destruction of the suburban landscape),
– clusters of chaotic buildings occupying suburban areas,
– building development into rural areas, violating traditional forms of rural architecture by foreign forms, disappearance of identity and cultural tradition.
– too low intensity of development, no elements crystallizing the urban structure,
– increasing chaotic development, lack of coherent compositional formations, urbanization characterized by expressionless vagueness,
– irrational functional structure, limited availability of services (trade, culture, education, health), accessible through the use of a car,
– loss of community ties, anonymity of residence,
– a disproportionately high crime rate (hence the tendency to build monitored gated communities),
– depreciation of public spaces,

- negative impact on the health of residents, increased amount of air pollution, - road blockage,
- loss of greenery, threat to natural structures, defragmentation of forest biocenoses,
- disappearance of species diversity of vegetation.

As a result, negative trends overlap in suburban areas: the ability to sustainably regulate land use ceases, and irreversible damage to the landscape is caused by uncontrolled settlement activity.

The greatest negative changes were diagnosed in the communes of Kostrzyn, Dopiewo, Kleszczewo, Komorniki, Tarnowo Podgórne, Rokietnica. The average size of changes occurred in the municipalities of Buk, Mosina, Pobiedziska, Murowana Goślina, Śrem, Stęszew, Czerwonak, and Swarzędz. The smallest extent of the urban sprawl phenomenon was diagnosed in the communes of Suchy Las, Kórnik, Szamotuły, Luboń, Puszczykowo and Poznań. A disturbing phenomenon is the consent of local governments to conduct such spatial policy. The analysis of planning documents shows that by 2030 the local governments of communes plan to enlarge the areas for development by 31,827 ha. This figure describes the dynamics of the urban sprawl phenomenon in the Poznań metropolis. Built-up areas increase the surface area at the expense of arable land. The overall decrease in arable land by 2030 will amount to 395.79 km^2, which is 15.50% of the area of the entire Poznań metropolis. Other forms of land use show a slight increase: greenery by 61.45 km^2, and the area of motor roads and communication by 26.07 km^2.

On this basis, it is possible to characterize the specific features of the urban sprawl phenomenon in the Poznań metropolis.

a) There has been a degradation of local, historically shaped settlement centers (small towns and villages) as elements crystallizing the spatial structure of the agglomeration area. Śrem, Buk, Stęszew, Szamotuły, Pobiedziska (mostly Murowana Goślina and Kostrzyn) also play such a role.
b) The old, historically shaped spatial module (approx. 10 km) characteristic of the Poznań County, based on a network of small towns and manor and manor farms, was destroyed.
c) The spatial form of the suburbanization process in Poznań takes on specific features. The typical urban sprawl development along the main roads (national and provincial) is transformed into a wedge-shaped model - filling the space between roads leading to the center of the agglomeration. This phenomenon is most noticed in the communes of Tarnowo Podgórne, Rokietnica, Komorniki, Dopiewo, and Kleszczewo.
d) The structure of suburban buildings shows characteristic zoning regularities: The areas located directly next to the exit roads from Poznań are occupied by light industry, business services and the service sector (including large-area trade). The area between the exit roads is intended for residential development.

5 Conclusions

The results of our research are diagnostic. The results can be used to reduce urban sprawl in the Poznań metropolis. In further research, it is necessary to answer the following questions:

Can you find effective planning tools, strategic concepts and spatial policy instruments for stopping the urban sprawl phenomenon around Poznań?

Can new "urban junctions" crystallizing and concentrating the development be formed in the buildings spreading around Poznań?

Can a higher intensity compact building with more attractive free space be offered in place of low intensity, overflow buildings?

What should the model of the compact (coherent) structure of the Poznań metropolis look like?

In the interest of which user groups is urban sprawl developing, and how could these users benefit from the compact structure of the Poznań metropolis?

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Ecological Corridors and Green Space in the City of Poznan, Poland

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Abstract. Green space is widely recognized to be key to sustainable urban planning. The basic functional functions of green corridors have been distinguished: noise insulation, absorption of atmospheric pollutants, enhancing biodiversity, improving the microclimate, and improving the visual quality of the cityscape. In contrast to earlier findings, these results suggest that the best combination of these ecological principles with local planning is the concept of green corridors inside urban areas. These green networks include not only natural habitats but also significantly transformed zones, including settlements. The results of this study suggest that Poznan City green networks are needed on two scales. First, they should be linked to ecological networks at the regional level. Second, green networks are required on a local scale to ensure that greenery is present in urban areas and in consequence improve the quality of life.

Keywords: Green space · Greenery network · Ecological corridors · Poznan metropolis

1 Introduction

The natural environment of the Poznań metropolis is being given increasing value. Residents want to have contact with nature, enjoy recreation and relaxation in areas with high natural values. Strong anthropogenic pressure on these areas can be noticed [1]. This conflicts with the performance of the ecological functions of green areas. Under these conditions, finding a balance between nature and the stress caused by urban activity is a difficult task.

Natural resources are considered in the context of the possibility of sustainable use of greenery, clean water, and air, as well as an attractive landscape and a stable climate. Preserving the values of nature and landscape is associated with the attractiveness of the metropolis as a place to live, work, and rest for residents. In our research, natural resources are treated as a factor in the development of a metropolitan area. Regardless of their aesthetic value, natural resources constitute a unique development capital accumulated over the centuries. It forms the foundation for the sustainable development of the Poznań metropolitan area.

2 Materials. Data for the Concept of Ecological Corridors

2.1 Greenery

The area covered by the project has the following forms of greenery: forests, meadows, buffer strips, bushes, family allotment gardens, botanical gardens and parks. Green areas constitute 37% of the analyzed area, with the predominance of forests, meadows and trees on agricultural land.

In the Wielkopolska Region, forests cover 25.7% of the area. The distribution of forests is highly diversified. Most forests are found in the northern and western part of the voivodeship. The largest green complex is the "Puszcza Notecka" forest with an area of 130,000 ha. The species composition of the forests is as follows: pine 76.1%, oak 8.8%, birch 5.3%, alder 2.5%, candle, beech, hornbeam, poplar, aspen, fir 7.3%.

There are two promotional forest complexes in Wielkopolska: "Lasy Rychtalskie" and "Puszcza Notecka", which promote ecology [2].

An important type of green in the study area are buffer strips. They perform the following functions: constitute water protection, counteract soil degradation, support biodiversity, improve agricultural efficiency, improve the landscape values.

2.2 Water Resources

The Poznań metropolis is located in the Warta river basin. This area is one of the most deficit areas in terms of water abundance in Poland. Lakes are an important element of surface water resources. The largest of them are grouped in glacial valleys. There are 70 lakes in the metropolitan area, which constitute a reserve of water resources. Groundwater is an important element of the structure of water resources. The main groundwater reservoirs are Quaternary aquifers and fragments of sandy Tertiary structures. These resources are the main source of water supply for the Poznań metropolis. The aquifer is formed by sand and gravel associated with river sediments.

The aquifer is on average 30 m thick. The aquifer is fed from the higher aquifers through the so-called "hydrogeological holes". Quaternary renewable resources are estimated at 24,818 m^3/h, and tertiary resources at 2,287 m^3/h, which gives the total abundance for the Poznań Warta River Basin at 27,105 m^3/h. The available resources that do not violate the existing groundwater level are estimated at about 75% of renewable groundwater [3].

The values of resource reserves, which constitute the difference between available resources and the demand for water, are diversified. The smallest reserves of Quaternary reservoirs are found within the city of Poznań (44% of the available resources). The largest reserves are found in the north-eastern part of the metropolis (the Trojanka river catchment area, 96.85%) and in the Biedrusko district (86.71%). Surface and groundwater form an integrated system of water resources. A feature of this system is the deficit of surface waters and the uneven distribution of groundwater. For this reason, proper management of the water system is of key importance for the sustainable development of the Poznań metropolis.

2.3   Animal Migration Routes

The fauna in the study area is typical of other lowland areas of Central and Eastern Europe. A significant threat to the animal world is the isolation of natural ecosystems. It is important to protect their habitats and migration routes connecting between the separated green complexes. Migratory routes for birds and mammals follow the valleys of rivers and streams. There are 9 international and national routes in the river valley: Warta, Prosna, Kanał Mosiński, Obra, Wełna, Noteć, Gwda, Drawa, and Barycz. There are also 58 migration routes for birds with a regional rank and 15 migration routes with an interregional rank. There are 22 natural corridors running through the studied area, connecting areas of valuable landscape in the central, eastern, and south-eastern region [5].

2.4   Peculiarities of Inanimate Nature

This group of objects includes: geological sites (geological sites), palaeontological sites, sites of rare minerals, historical mining remains, documented remains of tectonic phenomena. 58 such sites have been invested in the study area. These abiotic elements of nature are an important testimony to the natural heritage. Despite the centuries of exploitation of mineral resources and the strong pressure of settlement and industry, many valuable objects have survived and deserve protection. The most significant peculiarities are the erratic boulders near Osowa Góra in the Wielkopolski National Park. It weighs over 20 tons and has a circumference of 10.5 m.

2.5   Spatial Diversity of Valuable Natural Areas

The distribution of forms of nature protection in the Poznań metropolis is highly diversified [6]. Hence, the limitations for the spatial development of the region. The concentration of communes with a high share of nature protection forms is visible in the north-west and eastern parts of the study area. Some of the areas under nature protection have protection plans and plans of conservation tasks. These plans concern nature reserves, landscape parks and Natura 2000 sites. They also include: bird habitat areas, nature monuments, documentation sites, ecological lands, nature and landscape complexes.

The following are subject to special protection:

- plant refuges within the European network of areas of particular importance for the conservation of species diversity of all groups of flora and phytocoenoses in Europe;
- bird refuges of international importance, designated to protect rare, endangered species of birds, species with a limited range and places where migratory and wintering birds occur in high concentrations; - refuges of national and regional importance, the protection of which has a decisive impact on the preservation of the most valuable breeding, migrating and wintering bird clusters in Wielkopolska Region;
- areas important for birds during the nesting and migration period designated to protect valuable places for birds.

2.6   Climate

Due to the location of the Poznań metropolitan area, this area is characterized by climatic diversity. It is influenced by the varied topography, height above sea level, distance from rivers and lakes, the type of substrate determining the amount of solar energy absorbed, and the type of land use. These elements have a significant impact on the climate in the urban and suburban areas, in particular on air humidity, air temperature, atmospheric pressure and wind speed. The average annual air temperature in the Poznań metropolis ranges from 8.2 °C in the eastern part to 8.5 °C in the west (average from 1951–2000) [8].

The hottest month is July, while the coldest is January. In recent years, there has been an upward trend in the annual mean temperature, which has regularly exceeded the long-term mean value since then. The expected temperature increase in the next few years in the metropolitan area may amount to 0.19 °C/10 years. Urban development causes that it heats up faster than agricultural areas, which leads to warmer air in the center of Poznań. We have here the phenomenon of a "thermal island", which in the summer has a negative effect on the thermal comfort of residents. The best climate for agriculture is in the municipalities in the south of the region. The growing season here is 227 days a year. In northern regions it is 2 days shorter. The average insolation in the Poznań metropolis is 1,515 h [9]. This value is higher on the outskirts of the metropolis than in the center of Poznań, where a significant part of solar radiation is absorbed or retained by buildings. This phenomenon worsens in the winter and decreases in intensity in the summer months. The statistical number of clear days in the metropolitan area is slightly over 40 days. Only in the northern part of the region does it not reach this value. There is also a slight variation on cloudy days, which are on average 150 days a year. This type of weather usually occurs west of Poznań.

2.7   Wind and Precipitation

Very weak and weak winds prevail in the metropolitan area of Poznań, which together constitute nearly 70% of all winds. Winds from the west are dominant. The area of the Poznań metropolis is one of the poorest areas in Poland in terms of the amount of precipitation. Average annual precipitation totals are 500–530 mm. Only the communes in the east and north of the region are characterized by slightly higher rainfall. There is more rainfall in urbanized areas than in rural areas. It is associated with the phenomenon of water vapor condensation in the air as well as the characteristics of the terrain [4].

3   Results

Research has shown that there is a great potential of nature to be used in the spatial planning of the Poznań metropolis. We have indicated that the natural network is an important factor in the quality of life in a metropolis. We pointed out that the growing value attributed to communing with nature is combined with increasing pressure on nature. Threats mainly lie in the location of housing estates within ecological corridors,

strings of surface waters, and habitats of valuable bird species. Research has shown that a significant threat to the spatial development of metropolises is the deficit of water resources and the noticed climate warming.

The presented solutions are designed to eliminate these threats. Our design concept was to separate multi-functional ecological corridors with the following functions:

a) accumulation of groundwater reserves by 300%: implementation of the sponge city concept in the study area. (water-resilient urban development),
b) increasing the surface water resources by 300% by building artificial retention reservoirs and transport channels.
c) separate areas of ecological regeneration inaccessible to recreation (strictly protected), serving to improve biodiversity in the metropolis,
d) introduction of surface water to the interior of housing estates,
e) inclusion of natural ecosystems in wastewater treatment in cooperation with industrial wastewater treatment plants,
f) intelligent rainwater management based on ecological corridors,
g) the use of geothermal energy to improve the quality of the microclimate,
h) significant changes to land use planning: expansion of collective rail transport corridors, compact buildings, restrictions on car journeys,
i) introduction of water transport corridors for the delivery of goods (Figs. 1, 2 and 3).
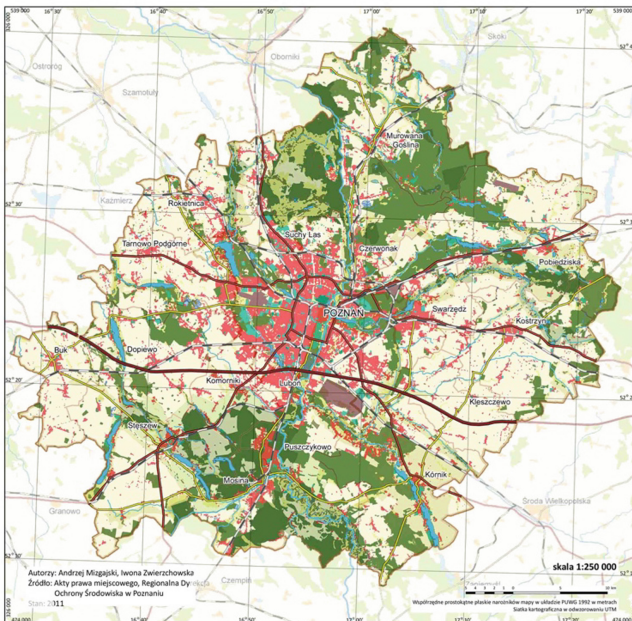
Fig. 1. Poznań metropolis. The existing greenery in the urban structure. Source [5].
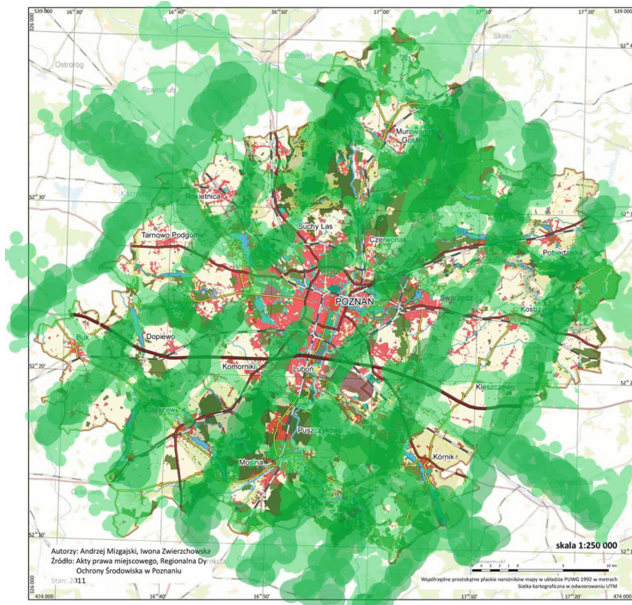
Fig. 2. Poznań metropolis. Design concept for new ecological corridors. W. Bonenberg.
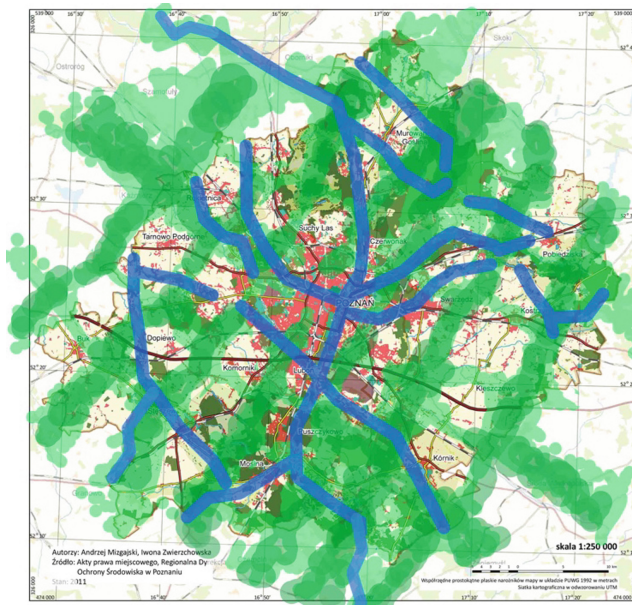
Fig. 3. Poznań metropolis. Expanding the network of surface water on the background of new new ecological corridors. W. Bonenberg.

4 Discussion

Our concept of ecological corridors assumes that greenery is an important component of the urban structure of the Poznań metropolis. It creates a framework that uniquely links the built-up space with the social organization [7].

The state of greenery in Poznań is the result of a combination of natural conditions with social norms and investment activities. The common element connecting these aspects is the search for balance in the urban environment, related to the ability to adapt greenery not only to the utility needs of residents, but also to the desire to find beauty in the surroundings.

Our research has shown that the capacity to naturally restore natural resources has declined sharply. In the area of the Poznań metropolis, a shortage of natural resources is felt. Urban sprawl areas, industrial wastelands, landfills occupy more and more land, destroying not only the landscape values, but also reducing the possibilities of settlement and recreation in the Poznań metropolis. For this reason, the Poznań metropolis becomes unattractive.

Environmental problems result from the fact that increasing inhabitants use more and more natural resources. An important cause of the growing environmental problems in Poznań is defective spatial planning. The biggest conflicts with nature result from the growing car transport, the lack of renewable energy, CO_2 emissions, and the unsolved problem of municipal waste disposal.

Our proposal for ecological corridors is aimed at preventing the collapse of the ecological balance. It puts emphasis on limiting car traffic, collective rail transport, and reconstruction of the urban structure. The most important element of our concept is the orthodontal layout of ecological corridors running through the metropolis. The concept assumes the protection of existing ecosystems and the formation of new natural ecosystems. Based on the concept of the economics of equilibrium, our project emphasizes the need to properly direct changes in spatial development control. This is to reverse the current trends that threaten the natural environment.

We have noticed that the countermeasures currently in use are ineffective. As our analysis shows, regeneration of the natural environment in Poznań is not possible without a new, creative approach to spatial planning. This is related to the concept of bottom-up planning from the perspective of an ordinary metropolitan resident. The health and well-being of the inhabitants is related to the natural environment, primarily greenery, clean air, and healthy water. This relationship of residents with nature has serious implications in the field of spatial planning because it determines the individual preferences and behavior of residents with regard to greenery. The concept of ecological corridors in the Poznań metropolis is an expression of this idea.

5 Conclusion

The relationship "man - natural environment" has now become one of the main factors determining the quality of life in the Poznań metropolis. Greenery is an important component that determines the natural balance. The proposed ecological corridors constitute a significant support for the natural balance in the Poznań metropolis.

Conclusions resulting from the analysis of the natural balance define the importance of ecological corridors for the improvement of the quality of life and the attractiveness of the Poznań metropolis. In this sense, green lanes should be an indispensable element of the "new planning culture" in urban design in Poznań.

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Management of Stormwater Within the Consolidated Public City. The Case of Chelas in Lisbon, Portugal

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Abstract. The need to revisit traditional practices regarding the management of pluvial waters is widely established in literature. Some examples include climate change projections and the associated exacerbation of precipitation extremes and consequent urban flooding, the lack of landscape planning, or even acknowledging pluvial water as the ultimate resource for urban resilience.

Addressing this challenge, several cities have been maturing their relationship with water, namely through urban regeneration projects that explore water's bountiful regenerative and ecological capacities. Yet the challenge is still considerable when facing the need to prioritize and decide on specific interventions within the consolidated city. This article aims to develop a method for identifying the Opportunity Areas (OA) through a particular case-study encompassing the Chelas underground drainage basin. These OA consist of priority areas for urban regeneration that would directly reduce urban runoff and diminish society's vulnerability in the short and long-term.

Keywords: Climate change adaptation · Public space design · Consolidated urban territories · Water cycle · Public space · GIS

1 Introduction

Throughout the years, urbanization processes have caused radical changes in land use. These processes have generally exacerbated the risk of flooding, namely because of the associated increase of overall imperviousness in upstream areas of the hydrographic basin together with the extent of construction within flood-prone zones. Likewise, population number and density, the presence of multiple economic activities, and the optimistic reliance on hard infrastructure [1], has also greatly contributed to the increment of this chronic risk, particularly within the consolidated city.

The management and appropriation of water have been fundamental for the development of human cultures and civilization [2]. Likewise, since ever, distinct societies have lived with floods and have dealt differently with this phenomenon. Due to present uncertainties widely stressed by climate change science, it is today recognized that total flood protection is unrealistic and unwise [3]. Therefore, contemporary practice is progressively focusing on managing flood risk, centering efforts on reducing societies vulnerability over the traditional and simplistic approach to reduce the probability of flood occurrences [4]. In this line of reasoning, adaptation actions, namely when applied in the design of public spaces, can be particularly effective in reducing flood vulnerability.

As previously argued [5], the excessive dependency on conventional stormwater management infrastructures hinders the achievement of the long-term challenges brought by contemporary and state of the art ambitions, such as the specific goals 11 and 13 of the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction or the UNFCCC Climate Change Adaptation framework [6]. Among other arguments for an urging change of paradigm regarding stormwater management [7] are the age, obsolescence, and consequent rupture of existing underground infrastructure existing in old and consolidate neighborhoods. Yet mostly pressing is the need to include uncertainty of future climatic projections in the design methodologies besides the familiar confidence in historical meteorological data.

Although one can easily verify an increased political rhetoric for a wide-spread implementation of green infrastructure within municipalities, effective and consequential actions towards reducing flood vulnerability remain a challenge [8]. To facilitate governance decisions, this research proposes a methodology that identifies Opportunity Areas (OA) for the implementation of flood adaptation actions within the consolidated public city, which enable a more targeted and efficient change towards a more resilient city.

1.1 The Case of Chelas Watershed in Lisbon, Portugal

Flooding in Lisbon is associated with a combination of events that create favorable circumstances for flooding, such as land morphology, the influence of Tagus river tides, the existing drainage infrastructure condition [9], and unplanned soil sealing. More specifically, 28,91% of Lisbon's territory is catalogued as a flood risk area, of which 4,11% in the "High risk" category [10]. Furthermore, more frequent extreme rainfall events are expected for this region in the future [11], leading to even more increased flood risk.

The Chelas valley lies between the historic downtown and the more recent oriental urban developments within Lisbon. The Chelas natural watershed, the second biggest hydrographic basin in Lisbon's Municipality, has 711 ha and drains directly to the Tagus river (Fig. 1).

Today, this area is mostly characterized by social conflict, miscegenation of uses and urban forms, together with an abundance of vacant spaces. The study area is surrounded with contrasting urban morphologies, like the 1950's industrial riverfront of Marvila, the discontinuities between occupied zones of Chelas, and Parque das Nações resulting in part from the Expo'98 intervention in the proximity [12].

Chelas underground drainage system is the second-largest drainage system in Lisbon where, according the 2011 demographic data, 16.86% of the total population is located [13]. The main network includes about 55 km of collectors and a Wastewater Treatment Plant (ETAR - Estação de Tratamento de Águas Residuais) [14]. The recent Drainage Master Plan for the city of Lisbon (PGDL) mostly relies on the creation and optimization of singular, mono-functional, hard-engineering infrastructure focused on draining potentially valuable stormwater away from the urban area. Namely regarding the Chelas underground drainage system, a considerable investment includes the construction of a stormwater deviation tunnel of 8 km long and with an internal diameter of 5.5 m, starting at Alameda das Linhas de Torres, going through Campo Grande, Av. Estados Unidos da América, and ending in Xabregas (at Rua Gualdim Pais) [14].
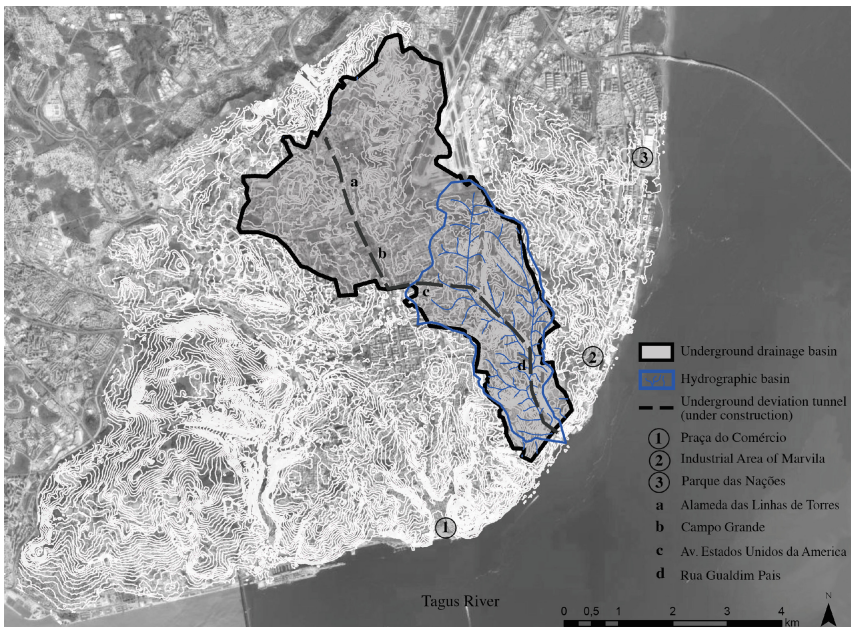
Fig. 1. Chelas hydrographic basin; underground drainage basin; deviation tunnel (under construction) and main urban references.

2   Methodology

The purpose of this research is based on the premise that considering a municipal strategy focused on improving existing resilience [11], all stormwater must be managed before entering the existing underground drainage system, maximizing the river basin's water concentration-time. The main goal encompasses the creation of a Geographic Information System (ArcMAP 10.7 ©ESRI) methodology that guides public

administrations' choices to effectively reduce flood vulnerability through the precise identification of Opportunity Areas (OA).

As such, an initial preliminary study is carried out on the morphological and cultural characteristics of the Chelas territory. The area is interpreted with the support of the following cartography: land morphology; potential permeability [15] (Fig. 2A); imperviousness density [16] (Fig. 2B); flood vulnerability [17]; land use [18] and an initial delineation of a public space network [19] (Fig. 3C). In summary, land morphology enables the understanding of the limits and influence of the superficial drainage when compared to the underground drainage system. Potential permeability interprets physical factors that contribute to higher or lower infiltration rates, namely the geological substratum, soils, land morphology, and slopes. Imperviousness density corresponds to the percentage of sealed area ranging from 0 to 100%. Finally, specific land use data (namely "áreas de estacionamentos e logradouros", i.e. parking lots and courtyards, and "rede viária e espaços associados", i.e. road network and associated spaces), together with the flood vulnerability map elaborated from statistical recurrence of previous flood episodes, served to identify the public space network potentially subject to requalification projects.
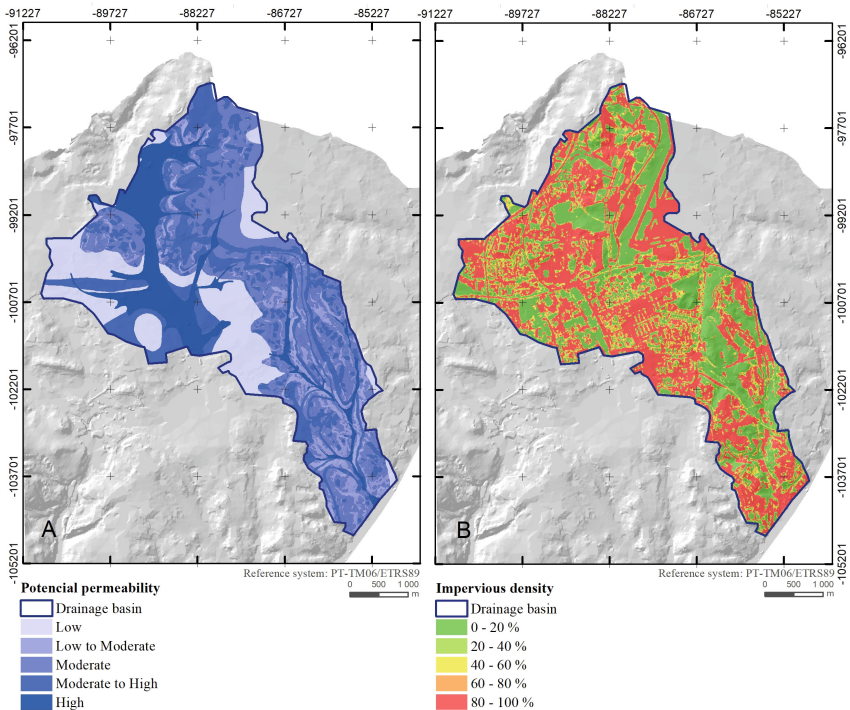
Fig. 2. A: Potential permeability. B: Impervious density.

Subsequently, Conflict Areas (CA) are evidenced by the overlap between imperviousness density and potential permeability. Specifically, these areas correspond to aboveground areas with a high percentage of impermeability (from 40 to 100%) which happen to be over soil with a "Moderate", "Moderate to High" and "High" potential permeability (Fig. 4D).
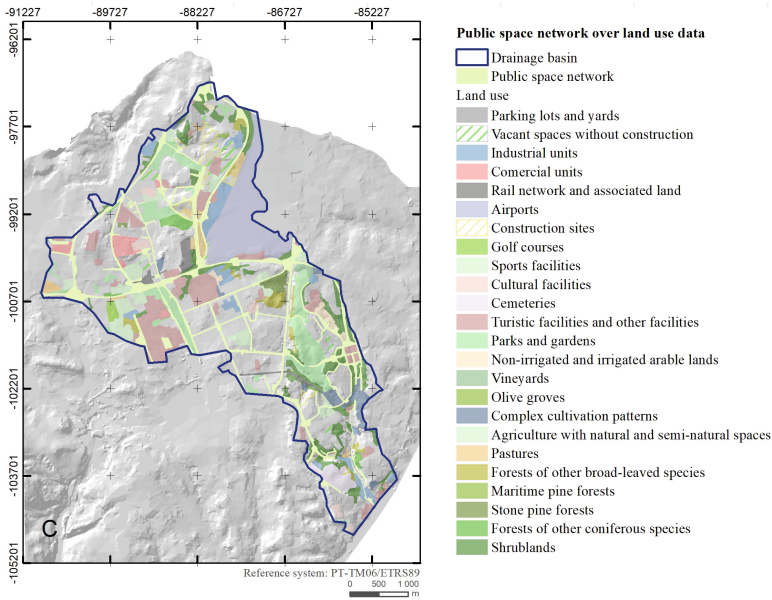
Fig. 3. Public space network over land use data

OA are then consequently identified by the overlap between the CA and existing public space network, bearing in mind the transversal purpose to reinforce existing, planned, or potential ecological and cultural networks. The OA therefore corresponds to the Impermeable Public Spaces (IPS) whose requalification should be prioritized when considering its potential high infiltration rates. (Fig. 4E).

3   Results

Through the conducted methodology it was possible to identify specific OA in which public space regeneration projects could significantly improve stormwater management efforts towards a more water-wise city.

Established methodologies have demonstrated the significance of green infrastructure to retain a minimum of 25 mm height of rainfall from "first flush" precipitation from a given impermeable area (such as New York City's "Green Infrastructure Plan", Philadelphia's "Green City, Clean Waters" Program or London's "Drain London Program"). Not only regarding the technical and infrastructural engineering of green

design (and all its adjacent benefits) but also as an effective method to reduce flood occurrences. Indeed, if the first 25 mm of precipitation could be managed within the area under analysis, over 70% of expected floods could be prevented [20].
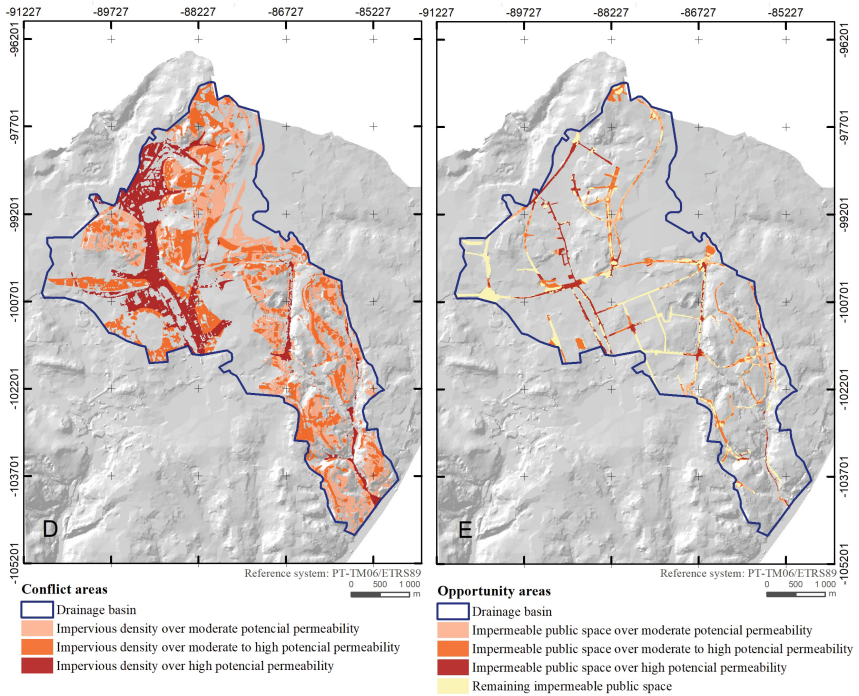
Fig. 4. D: Conflict Areas. E: Opportunity Areas

When applying this method within the differentiated OA, it is possible to verify the stormwater volumes that can be managed (Table 1). In brief, all Impermeable Public Spaces (IPS) over the areas of "Moderate", "Moderate to High" and "High" Potential Permeability correspond to a total of around 130 hectares. If this area is redesigned to manage the first 25 mm of rainfall, it would be possible to retain around 32600 m3 of stormwater. This volume is particularly significant when considering two of the proposed solutions in alternative to the deviation tunnels previously mentioned in the Drainage Master Plan for the city of Lisbon, which included 1) the construction of two underground reservoirs of a total capacity of 60.000 m3 (15.000m3 + 45.00m3), or 2) one reservoir capable of storing 65.000 m3 of stormwater [14].

Table 1. Opportunity Areas (OA) and corresponding priorities for intervention within the Impermeable Public Space network (IPS)

Opportunity Areas	ha (hectares)	Managed stormwater volume (m^3)*	Priorities
IPS over low potential permeability	33.2324	8308.11	B
IPS over low to moderate potential permeability	6.5846	1646.16	B
Total low priority	**39.8171**	**9954.27**	**B**
IPS over moderate potential permeability	41.3509	10337.72	A
IPS over moderate to high potential permeability	48.8083	12202.07	A
IPS over high potential permeability	40.4159	10103.98	A
Total high priority	**130.5751**	**32643.77**	**A**
Remaining IPS network	58.9362		
Total	229.33		

*public space regeneration design must manage at least 25 mm of stormwater runoff

4   Discussion and Final Considerations

This study is primarily focused on the advantages of retrofitting specific impermeable public spaces, namely to reduce pressure in existing underground drainage infrastructure. Regardless, permeable public spaces (with soil sealing ranging from 0 to 40%) must also be considered in a systemic territorial analysis for stormwater management, as their influence in the urban water cycle can be significant.

Within the identified 130 hectares of OA for public space retrofits, different design typologies, with different stormwater management infrastructural purposes (harvest, store, infiltrate, convey, tolerate and avoid) can be applied in light of different urban morphological characteristics [21].

From a social point of view, the incorporation of measures that manage rainwater superficially within the design of public spaces before reaching underground pipes, approximates people with the dynamics of the water cycle and consequently raises awareness while diminishing community vulnerabilities towards future uncertain yet likely severe weather events. Indeed, the design of public spaces that make climate change visible and hence meaningful [22]. In addition, these measures may encompass a wider scope within other sectorial needs such as water depuration, microclimatic melioration, urban salubrity, and/or enhancement of aesthetic public space qualities.

Indeed, cities of the 21st century must face the challenge of extreme climates, which in the case of flood management implies the reassessment of conventional practices [5]. Public administrations are first in line on this challenge, especially in the identification and regeneration of the most suitable areas for consequent and efficient adaptation. In urban territories floods can no longer be considered as exceptional events. This research therefore contributes with the creation of a methodology that helps public

administrations and decision makers to prioritize actions through the identification of most relevant OA within any consolidated public city. This research further evidences, through a particular case study, that public space regeneration projects can successfully contribute to a wiser management of the vital resource of rainwater, while minimizing the severity and risk of recurrent flooding.

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Intermittent Practices in the Contemporary City. The Case of Lisbon

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Abstract. Along with the political, socio-economic and technological changes that emerged in the new millennium, cities have been under significant changes. Values of temporariness and sharing have appeared in different dimensions of the public life, driving urban transformations, disrupting conventional relations between space, time, and use and proving the need to evolve more nuanced discussions on the nature of a city. We call this set of alternative spaces, activities, expressions, and relationships that enable and empower temporariness and sharing in the urban spaces, *Intermittent Practices*. Addressing this complex reality, the present work – part of a recently started research project – aims to reflect about temporariness and sharing as drivers of the contemporary urban changes. It also intends to think about the new challenges that temporary and sharing practices seem to provoke to policy, planning, and governance. Finally, to better illustrate the multiple perspectives of these dynamics as well as their impacts on new architectures (new programs, new typologies, new occupations, new aesthetics) and new ways of living and generating urban space, the text focus on the Lisbon's intermittences, giving a brief example of how, methodologically, the case studies under analysis will be systematized.

Keywords: Intermittent city · Intermittent practices · Temporary uses · Sharing practices · Innovative architecture · Innovative planning

1 Temporariness and Sharing as Drivers of the Contemporary Urban Changes

Over the past years, the patterns of life have changed greatly, including new social power relations, family structures and gender roles, wealth (in)equality, mass migration, ageing population, etc. Meanwhile, new technologies have taken over by establishing how, where, and when we act, prompting questions about privacy and identity [5].

Alongside these factors, cities have been under significant changes, incorporating values of temporariness and sharing in urban processes, disrupting traditional relations between space, time, and use [14].

The vacant and shrinking spaces that punctuate the dense contemporary outskirts have been re-activated with temporary uses. Likewise, the traditional and well-kept public spaces of the historical city seem to be incrementally occupied for unusual and transient activities. This bustle constitutes an infinite catalog with countless articulations: street vendors, veritable alternative bars on wheels; "underground" restaurants; spontaneous cultural events or performativity interventions; garage sales; improvised art galleries in anonymous spaces; parties in abandoned structures; scattered parking spaces transformed into terraces; unoccupied lots for gardening projects; etc (Fig. 1).

Fig. 1. "Praia do Torel" is a pool (in an eighteenth-century font) with beach in the heart of Lisbon. It is only open in the month of August. (© Alessia Allegri)

In parallel with temporariness, a variety of sharing practices are emerging in urban processes [3], driven by a conjugation of social, economic and technologic transformations, which have shifted the attention from the tangible space to the intangible value-added services and sense of community required by an increasingly transient population and which motivated new attitude towards consumption [1].

On a society where permanence and ownership are becoming less important than on previous generations, the crossings between temporariness and sharing – have expression on different dimensions of urban life, giving form to: new expression of housing (e.g. co–living, temporary accommodation); new forms of working (e.g. co-working); shared mobility (e.g. bike-sharing); sharing of goods – physically or through digital platforms – (e.g. creative commerce, collaborative consumption, urban agriculture, community food, clothes sharing); sharing of services (e.g. platforms, such as Netflix, Spotify) and even new kind of urban policies (e.g. soft planning, co-decision), etc. (Fig. 2).

Fig. 2. "Second Home Lisbon", is a co-working space by the Spanish office SelgasCano, inside the Ribeira Market, Lisbon, Portugal, 2019 (© Second Home Lisbon)

All these expressions of the temporary and sharing have huge impacts on architecture and city, generating new typologies and new space occupations which are literally inhabiting the many different urban spaces whose meaning and value they transfigure.

That's what we call *Intermittent Practices*.

These dynamics carry out a temporary rewriting of the spaces they fill, establishing a functional device of the contemporary urban spaces and a fragile, fragmentary, sometimes hidden network that filters into the existing structures of the city, being particularly involved with the dynamics of public life.

Acting as a constellation of shining spots that continually light up and go dark [13], these occupations overlap, mix, interact, coincide or simply replace each other. Although the juxtaposition and/or the replacement of functions is not a new practice, what makes it relevant in these processes is its assumption as an unavoidable contemporary urban issue and spatial experimentation tool [15, 16, 21], on the fringes of the tradition of architecture and urbanism, whose projects are closed, limited in time, precisely shaped according to contingent needs [2, 13].

By challenging the notions of the city as a stable entity, temporary and sharing uses allow: to react *ad hoc* and test flexible solutions [12, 17, 19] to counter uncertainty in urban processes [8] to recover spaces that would otherwise be destined to dereliction [4, 11]. As the social-spatial results are gradually being valued [19], temporary and sharing use interventions are evolving from being place-oriented to being people-oriented [12].

However, as those strategies are becoming more frequent also some negative impacts increase, as shared and temporary uses might: become a means of urban branding on the European cultural discourse [7, 19] normalize the precarious [18] and

the low-or no-cost [20] accelerate gentrification [7, 20] and promoting an uneven distribution of the benefits [19, 20].

Additionally, these new dynamics sometimes generate the politicization on the urban discourse [12], reflecting a tension between their innovative aspects and the search for alternative forms of urbanism, which, in turn, is expressed on the dialectics between temporary use as brand versus temporary use as an activist tool [19], or between sharing city versus cooperative city [16].

2   Re-imagining the City, Planning for Temporary and Sharing Practices

With the focus shifting from addressing problems of space, to also incorporating factors that consider time [1, 14] as well as with the increasing importance of the sharing and participating, a range of alternative forms of planning (tactical urbanism, everyday urbanism, collaborative urbanism, evolutionary planning) have emerged worldwide [6, 20] resonating with small-scale programs (e.g. BipZip in Lisbon) and inevitably entailing a greater role for transient activities.

The fragmentation of the political consensus and the economic recession that began in 2008 - at least in the Western economy - have strongly influenced business confidence and public spending and have been a huge incentive to question the usefulness of many traditional masterplans and, instead, to look for an alternative approach. These new approaches and proposals frequently use and rely on a phased development often as a range of temporary stages along a more flexible path that moves towards a vaguely defined end vision, rather than a fixed final state. Phases packages of small initiatives look better suited to unlock the potential of places now and sequentially, rather than in the longer terms. In them we recognize a clear will or search for new paradigms of planning; freeing up urban areas for the temporary and sharing through bringing greater flexibility to the planning system. By procuring, enabling or cooperating with interim activities it may be possible to stimulate economic activities, change the image of an area, reactivate vacant sites, without significant expenditure and extended timeframes [4].

Applying the approach of a more flexible planning to practical urban design projects inevitably involves close collaboration with the potential users of spaces to define their demands. It also encourages diversity and supports the connections between people.

Hence, a new way of transforming the city seems to have become widespread in recent years: we are moving from the search for a single clarity, with obsessive traits of research of form, to a more open and experimental approach, where the focus is on the inhabitants and people experiences and needs.

Borrowing the tools typical of a laboratory, our cities seem to host "adaptive" urban projects, that is, transformations that change progressively as the experiment progresses and in which we focus on the reactions obtained at each solicitation, probing the possibilities that lie ahead for the subsequent phases. We therefore think of a city as an open system in which happens and coincides, all that is unexpected, anomalous and possible [9].

But in dismantling the elements of an established praxis, the deconstruction does not tell us how to prepare for the next step ahead. To imagine a solid city in constantly balancing with an ever-changing open system is perhaps the biggest challenge of all.

All this shows us that perhaps it is time to move away from the idea of mere planning and "controlling", and embrace a logic of actual designing instead; it is time to think the city as an open project, it alone can determine its function and inclusiveness regardless of macro-planning. But if we were presented today with the challenge of transforming a street and the city as parts of an open system, how could this be done?

A paradigm shift is needed, starting in our profession, as architects, designers, urban planners and decision makers of urban spaces. This shift is already happening, but the role played by urban planners and decision makers needs rethinking too; we have to play a role more of a "facilitator", a "mediator". We must learn to move from the role of experts who impose decisions, to those who try to understand a space and engage its users (and not just inhabitants) in the process. This is the idea of inclusion in the open system, and not only in the street scale, but also in urban processes and urban planning.

In this way, the emergent forms of planning question the traditional ones that seem to be tools with limitations. To overcome these, the traditional tools will need to embrace the concept of *process* and will need to be flexible and adaptive over time, in order to preserve their usefulness and their strength.

Non-planning opens up the possibility of the unexpected, which is a little bit the self-generative form of making the city: the more freedom is left to the new, leaving a modifiable mesh of use, the more that space has the possibility of being a lived space, which can be overwritten, adaptable [1].

This great balance is the challenge of the new planning.

Perhaps, what we would aim to achieve is the hybridizing more and more portions of projects and overcoming the division and the antithesis between temporary and permanent; increasingly including, whenever is possible, portions of project within experimental tactical urbanism or also, understanding how the same kind of flexibility can be applied to permanent projects.

3 Focusing on the Lisbon's Intermittences

Behind this complex reality, the idea of Intermittent Practices will be tested out using the case of Lisbon. The Portuguese capital is a good and unexplored research case study: its functional diversity and complexity make it a privileged laboratory to observe different expressions of temporary uses and sharing practices.

Nevertheless, several fragilities and inconsistencies are detectable in Lisbon: most of those practices are accelerating gentrification and are socially unfair, because they do not reach all population groups [18]. Moreover, in the Portuguese capital, different expressions of these new phenomena occur without an overall perspective, in a pulverized way through isolated interventions, without integrated prevention of the negative impacts.

From a European perspective, although hosting a diversity of experiences of temporary and sharing practices and being a pioneer of their incorporation of public policies [6] (e.g. co-decision: BipZip, Participative Budget, shared mobility), Lisbon is misrepresented in European comparisons.

Of course, we are naturally focusing on Lisbon because it is where our experience and practice are rooted.

Methodologically, we selected a collection of Intermittent Practices based on a taxonomical classification which covers all the aspects of spatial production, at different dimensions of urban life. Projects, actions and services of a non-permanent and of non-belonging nature has been considered.

Such a taxonomical classification allowed us to build an archive of Lisbon's urban processes characterized by temporariness and sharing, which, in turn, will enable us to discuss a selection of cases to be deepened. This database, thus, forms a chart of diverging paths that make use of different operative and conceptual tools (for which a few examples are provided in Table 1).

Table 1. A previous systematization of Intermittence practices in Lisbon

Intermittent Lisbon	where?	how?	why?
OpenhouseLisbon http://www.openhouseworldwide.org/openhouse/lisbon.php	Housing, Culture and Art Action	Networking, Impulsing	Economical, Cultural
Airbnb Lisbon https://www.airbnb.pt	Housing	Appropriation	Economical, Cultural
LACS Anjos and Alcântara https://www.lacs.pt	Working, Leisure and Trade	Subversion	Economical, Cultural
Hortas Urbanas CML www.cm-lisboa.pt/off2k19/cidade-educadora/rede-portuguesa/hortas-urbanas	Working, Leisure and Trade	Appropriation	Social, Ecological, Economical
Casa do Impacto http://mais.scml.pt	Activism and Community Use	Impulsing	Social, Ecological, Economical
Torel Urban Beach https://www.facebook.com/JardimdoTorel/?rf=143754609024832	Working, Leisure and Trade	Subversion	Social
Cozinhas Popular Mouraria https://www.facebook.com/CozinhaPopularDaMouraria	Working, Leisure and Trade Culture and Art Action Activism and Community Use	Impulsing	Social, Cultural
A Peixaria Centenária. A Banca na Peixaria https://peixariacentenaria.pt	Working, Leisure and Trade	Appropriation, Subversion	Economical, Cultural, Social
Comingout, e se o museu saísse à rua? http://www.museudearteantiga.pt/exposicoes/comingout	Culture and Art Action	Subversion, Impulsing	Cultural
Condominio festival https://condominiofestival.wordpress.com	Culture and Art Action	Subversion, Impulsing, Networking	Cultural
GIRA https://www.gira-bicicletasdelisboa.pt	Mobility	Impulsing, Consolidation	Ecological, Cultural
Heat the Street https://www.facebook.com/heatthestreet	Activism and Community Use	Impulsing	Social
Repair Café https://www.circulareconomy.pt/repair-cafe	Activism and Community Use	Impulsing	Social, Economical
Fruta Feia https://frutafeia.pt	Activism and Community Use	Impulsing	Social, Economical

Systematize the Intermittent Practices has been a big challenge, not just because there are so many ways of organizing these dynamics, but because interestingly, the boundaries between so many of the phenomenon that could help to organize the reflection are becoming burred. In fact, the blurring of traditional distinctions between land use type and activities, and the interaction and overlap between the factors that are driving temporary end sharing activities are ideas that run throughout the project and are one of the key characteristics of Intermittent Practices. Many of the dynamics that are studied could have found a natural and logical home in more than one category. The same, of course, goes for many of the case studies that illustrate them.

Ultimately, considering the *modus operandi* of the Intermittent Practices that do not have a range of elements that simultaneously support their continuity. On the contrary, they are structured around a central purpose, which, when active, defines its complexity, but also its periodicity, its material composition, its patterns of occupation, its 'actors' and, in many cases, its place in the cultural meaning of its society.

Following this reflection, it was easier to systematize Intermittent Practices in clusters of cases configured according to three big questions: where, how and why.

"Where" refers to the realm of an action: i) Housing; ii) Working, Leisure, and Trade; iii) Culture and Art Action; iv) Mobility; v) Activism and Community Use.

"How" refers to the means through which this action is achieved: i) Appropriation (taking something for your own purposes, either legally or illegally, short or long-term); ii) Propelling (generating impulses for the programmatic profiling of a place or actions); iii) Consolidation (turning something into a permanent or regular practice); iv) Subversion (using existing policies, guidelines, buildings, etc., for purposes other than those for which they were designed); v) Networking (core group that builds its projects around its networks).

"Why" refers to the dominant motivation behind a taxonomy's action: i) Economic; ii) Ecologic; iii) Cultural; iv) Political; v) Social.

It is important to point out that this collection is not meant to be definitive, but rather evolving. A mapping like this, which focuses on the realities that respond to continuous changes, is, by definition, in progress.

4   Discussion and Expectations

After the phase of mapping, the next step will consist on a process of connection of the Intermittent Practices. Studying them as an integrated circuit of practices will allow an assessment on its impacts, synergies and potential to catalyze innovative and transformative actions in the city. In an educational plan, it will permit to explore the Intermittent Practices as a pedagogical tool [10], helping students and practitioners to overcome the idea of a static program by reframing the project as a process of change [8]. In a cross-cutting results plan and in the context of the contemporary Lisbon, this circuit will reveal the de-multiplications of Architecture, as discipline, and to perceive the changes on the profession itself, particularly in the last years [22]. Behind this complex and new reality, it is important that Architecture can reinvent itself and even lose prominence, in an integrated way with other disciplines and generating operational tools that can contribute to a sustainable urban development, paving the way for creativity and the implication of communities in the decision processes.

In light of today's pandemic reality, this research seems even more appropriate.

We strongly believe that design supported by the concepts of temporality and sharing and understood in the deepest sense of the term - design that knows how to listen to society, give voice to demand, challenge consolidated points of view, reconfigure, when necessary, productive and bureaucratic processes -, must establish itself as the starting point for all forms of innovation.

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Construction of Visual Reverse Logistics System of Solid Waste from the Perspective of Smart City

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Abstract. In the early stage of the implementation of the urban garbage classification system, due to the lack of understanding of the garbage life cycle and the urban solid waste treatment system and other cognitive schema defects, this paper explores the construction method of the visual reverse logistics system of urban solid waste through the optimization design of urban garbage cans and the construction of visual information platform based on the concept of intelligence and informatization from the perspective of the smart city. Based on the system design and the theory of reverse logistics system, the stakeholders and process nodes in the urban solid waste treatment system were sorted out; By improving the hardware facilities and building a visual information platform, the user-oriented interaction process is more complete, and the visual reverse logistics service blueprint of solid waste is further optimized, and feasible system construction methods are proposed.

Keywords: Smart city · Solid waste · Visualization · Reverse logistics

1 Introduction

Our urban space is in the era of being wrapped by networks and digital information. Intelligence and informatization are the development trend of cities in the future. The construction of a smart city in the future is inseparable from the ubiquitous information flow, which is composed of the sensor module, analysis module, and execution module. In the context of smart cities, how to promote the implementation of waste classification policy through the effective use and transmission of information is the focus of this paper.

2 Construction of Cognitive Schema of Solid Waste Life Cycle

2.1 Overview of Cognitive Schema Theory

Cognitive schema has a very important influence on people's information acceptance, and people's cognitive schema determines their choice, integration and understanding

of information [1]. J. Piaget pointed out in the "Assimilation-Adaptation" theory that people expand their original cognitive schema by accepting new external information; at the same time, with the change of environment, people will adjust and construct new schema, so as to complete the information reception and processing in the new environment [2]. In the process of "Assimilation-Adaptation", the cognitive schema of the subject will gradually develop from primary schema to advanced schema [3].

2.2   Analysis of Cognitive Schema Under Waste Classification Policy

In the existing research literature on garbage classification behavior of urban residents, it is found that garbage classification behavior patterns are mainly divided into "external force-driven" and "internal force-driven". "External force driven" is based on the external environment and strong policy constraints, while "internal force-driven" is based on their subjective identification of behavior. Based on the "internal force-driven" behavior pattern, citizens' willingness to implement garbage classification is higher than that of "external force-driven" [4]. "Internal force-driven" is largely affected by the cognitive schema. Through the existing publicity and education of waste classification, the public has a basic understanding of the method, significance and purpose of waste classification, that is, they have established a primary cognitive schema of the urban waste management system. The existing primary schema can help the public to establish a subjective identity for the "garbage sorting" behavior. However, the driving force brought by this identity occurs before the "garbage sorting" behavior. When the public classifies the waste correctly, they do not get the corresponding response information, and lack of behavior perception control for garbage sorting.

Behavioral perceptual control is an important part of building "internal force-drive". Behavioral perceptual control refers to the degree of individual control over certain actions or behaviors, including internal control, such as individual ability, skills and information mastery, as well as external control, opportunity, resources and cooperation with others. It is found that the satisfaction of recycling behavior plays an important role in the sustainability of waste classification behavior [5]. Therefore, how to show the feedback information of personal waste classification behavior to the public, enhance the public's behavior perception control, and thus complete the high-level cognitive schema of waste classification (as shown in Fig. 1), and promote the occurrence of classification behavior under the "internal force-driven" is the focus of the research.
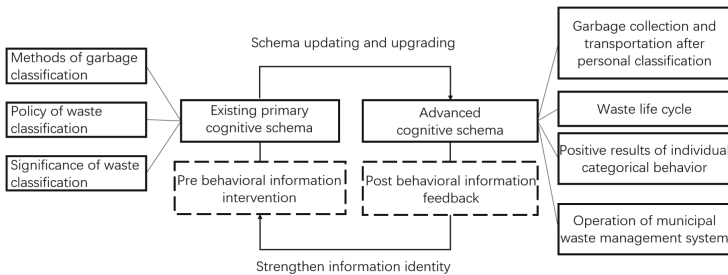

Fig. 1. Optimization of cognitive schema under waste classification policy

2.3 Construction Method of Cognitive Schema of Solid Waste Life Cycle

Based on the analysis of the existing cognitive schema, when the citizens complete the waste classification behavior, they do not have the information channel to further understand the behavior results, which leads to the specific impact on the behavior, the lack of cognition about the direction and treatment status of waste, that is, the lack of construction of the high-level cognitive schema of the waste life cycle.

By analogy with the product life cycle, we propose the concept of the waste life cycle, which mainly includes three parts: collection and transportation of waste after being classified and discarded by individuals, treatment process, and treatment results. The existing garbage classification in urban public space is mainly dry garbage and recyclable garbage, which does not involve the classification of wet garbage. Therefore, the research object of this paper focuses on the life cycle of solid waste.

The information involved in the life cycle of solid waste includes the collection process, transportation process, and treatment process. The information of the collection process can be completed based on the sensor feedback of the garbage can, while the waste treatment process involves a large number of complex industrial processes, and the specific details are difficult to collect, so it will provide reference information based on the existing relevant knowledge. The information collected in the process of cleaning and transportation can be realized by positioning sensor system, and it has high similarity with the processing method of logistics information. Therefore, based on the concept of reverse logistics, this paper will focus on the analysis of the information collection and visualization method in the process of cleaning and transportation after waste classification.

3 Reverse Logistics Management System of Municipal Solid Waste

3.1 Definition and Concept Branching of Reverse Logistics

In the general sense, reverse logistics is a government-led circular economy policy. It is social engineering to comprehensively plan the non-reusable materials produced by all production and economic activities in the whole society, so as to maximize the utilization of resources, which often involves the national administrative power [6].

According to China's National Standard Logistics Terminology, reverse logistics is divided into recycling logistics and waste logistics. Waste logistics refers to the recycling of goods that have lost their original use value in economic activities to upstream enterprises. It involves goods used but damaged by consumers, goods out of date due to product upgrading, and goods that can continue to be used but have poor economy, etc. After processing, these goods are converted into raw materials, and then enter the industrial chain cycle again. This time, the goal of this process is to maximize the utilization of resources, and the enterprises are in the active position. Most of the motivations come from the consideration of their cost reduction, the implementation of the government's mandatory policies, and winning the public's favor [7].

3.2   Definition of Visual Reverse Logistics System for Municipal Solid Waste

The visualized reverse logistics system of urban waste involved in this study does not include the role of enterprises involved in conventional reverse logistics. Instead, urban waste recycling and transportation and other related affairs are carried out by the relevant urban environmental health management departments. Urban waste, known as domestic waste in the general sense, is the solid waste produced by urban residents in their daily life or in the activities serving daily life, as well as the solid waste which is regarded as domestic waste according to the provisions of laws and administrative regulations. Recycling the renewable part is more in line with the connotation of waste logistics. Therefore, the urban waste reverse logistics in this study is all referred to waste logistics.

The definition of the characteristics of the visual reverse logistics system of urban waste in this study is as follows: Contrary to the traditional product supply chain, the visual reverse logistics system of urban waste refers to the planning, management and control process of effective organization, management and actual flow of raw materials, final products and related information in a certain cycle from the place of consumption to domestic waste treatment institutions, such as sanitary landfill, domestic waste incineration center and composting plant, for value recovery or reasonable disposal [8]. All links of the process include the improvement of resource utilization, the recycling of existing products, and the secondary treatment of metabolic waste [9].

3.3   Construction Method of Reverse Logistics Management System for Municipal Solid Waste

Based on the analysis of classified garbage cans in public space, this research plans to design the corresponding visualization reverse logistics system of municipal solid waste according to the operation process of reverse logistics, to communicate with urban residents, urban environmental health management departments and relevant garbage collection and transportation operators, to form a complete visualization platform of municipal solid waste life cycle, and to integrate the perspective of circular economy into the reverse logistics management system of municipal solid waste (Fig. 2).
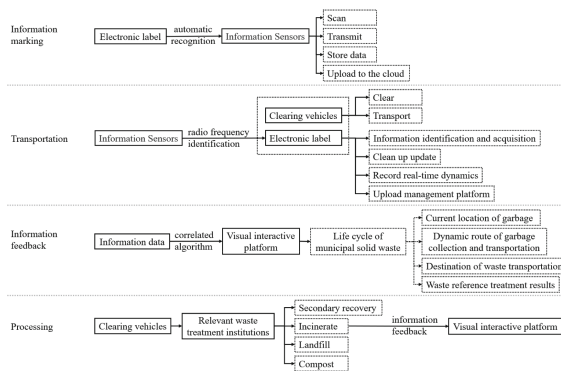

Fig. 2. Construction method of reverse logistics management system of municipal solid waste

3.3.1   Information Marking

The key point is to embed the electronic tag in each garbage can, so that the information sensor on the cleaning vehicle can automatically identify the management information of the garbage can and carry out accurate information feedback. Electronic tags, like people's identity, can scan, transfer, store data from the tags and upload the information to the cloud through Internet of Things technical equipment. The cloud will automatically analyze and build a sound reverse logistics management information system.

3.3.2   Transportation

This stage is mainly the cleaning and transportation of solid waste in the garbage can by the clearing vehicle. In the process of transportation, the information sensor previously installed in the clearing vehicle uses radio frequency identification technology to identify and obtain the information of the electronic tags of each recycling bin, update the cleaning situation, record the real-time dynamics in the process of transportation, and upload it to the urban waste information management platform.

3.3.3   Information Feedback

Based on the data-driven principle and the method of visual feedback on mobile phone, the relevant information data of urban waste detected are fed back to urban residents through the visual interactive platform by using relevant algorithms. The platform presents the life cycle of urban waste, including the current location of waste, the dynamic route of waste clearance, the destination of waste transportation and the result of waste treatment reference.

3.3.4   Processing

After the vehicles are transported to the destination, relevant waste treatment institutions will recycle, incinerate, landfill and compost all kinds of municipal solid waste. The relevant waste treatment reference information will be fed back to the users who continue to pay attention to the waste life cycle.

4   Improvement of Hardware Facilities in Reverse Logistics Management System of Municipal Solid Waste

4.1   Improvement of Hardware Facilities Based on ETC Principle

The basic principle of Electronic Toll Collection System is to realize microwave short-range communication (DSRC) depending on the onboard electronic tag (OBU) installed in the vehicle and the microwave antenna in the toll station, using Internet for background settlement processing so as to achieve the purpose that vehicles can pay tolls without stopping at the station [10].

According to this principle, we decide to install hardware facilities in transportation vehicles and garbage cans, and use RFID technology to transmit data. Firstly, the storage position of the electronic label is preset on the garbage can, and the MFRC522, a kind of data reading and writing module, is installed in the transport vehicle. RFID

technology, also called radio frequency identification technology, is a type of automatic identification technology of non-contact data communication between reader and electronic tag [11]. After the installation of this device, when the garbage collection vehicle arrives at the location of the garbage can, the data reading and writing module inside the garbage collection vehicle will automatically read and record the relevant information of the garbage can (such as the collection time) through the electronic tag on the garbage can and bind it with the information of the transportation vehicle as a tuple. When the vehicle arrives at a destructor plant, the module will also read data through the electronic tag of the plant and store the information about the plant into the tuple mentioned above (as shown in Fig. 3).

Fig. 3. Working process of hardware facilities

The internal data reading and writing module of the vehicle is based on 51 single chip microcomputer. A chip STC89C52 is used as the central processor, and MFRC522 is used to record the collection and transportation with the help of IC card. Data is transmitted to the platform via the communication module of the vehicle. STC89C52 is a CMOS (complex metal oxide semiconductor) 8-bit controller produced by Shenzhen Hongjing Technology Co., Ltd. Its instruction code is fully compatible with the 8051 single chip microcomputer. Furthermore, it has faster speed, lower power consumption and stronger anti-interference ability. MFRC522 is a highly integrated contactless read-write module developed by Philips, which can read and write data for IC card and work normally without direct contact between users and the system (Fig. 4).
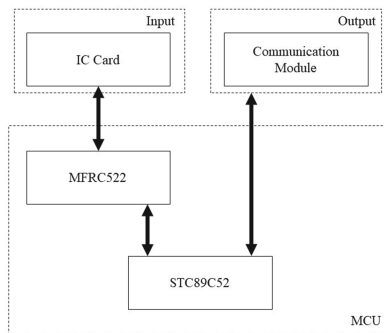
Fig. 4. Schematic diagram of data reading and writing module of garbage removal vehicle

4.2   Data Acquisition System of Municipal Solid Waste Reverse Logistics Management System

In waste reverse logistics engineering, data can be divided into two categories: static data and dynamic data [12]: (1) Static data: It is the information database of the trash bin, including the basic information of the type, capacity, material and time of the trash bin, as well as the assessment of the use status of the trash bin. In the process of system initialization, the basic attributes of garbage can are input through the software configuration function, and the usage condition is saved in the operation process of garbage system. (2) Dynamic data: mainly derived from monitoring data during the garbage transport and disposal phase, obtained from real-time monitoring sensors installed on garbage transport vehicles, using different data acquisition modes for different types of sensors: conventional analog signal acquisition mode and dedicated server acquisition mode (e.g. ETC).

4.3   Interactive Method of Municipal Solid Waste Reverse Logistics Management System

For the public, information is mainly obtained by QR code scanning, and each garbage can will be attached with a QR code label. When the public classifies the garbage, they can scan the QR code to obtain information about the waste bin where they throw rubbish and decide whether to pay attention to the status. If they determine to do so, the data platform will continuously feedback the life cycle of solid waste storage from the garbage can, while users can obtain it on a visual interface, including cleaning time, current moving position of the cleaning vehicle, the transfer station which the rubbish arrives at, final possible treatment results and the positive significance to the environment, as is shown in Fig. 5.
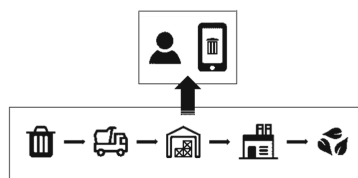
Fig. 5.   Schematic diagram of interaction method

5   Conclusion

Through the hardware optimization of the garbage can, based on RFID technology, it becomes an important node to connect the public with the information exchange of the clearing and transportation system. With the help of the Internet of things data platform under the smart city, this paper puts forward a feasible method for the construction of the visualization reverse logistics system of urban solid waste. After completing the waste classification behavior, the citizens can obtain the follow-up solid waste life

cycle information through simple interaction with the garbage can, hoping to promote the citizens' perception and control of waste classification behavior and establish a high-level cognitive schema of the urban solid waste treatment system.

The effective implementation of the visualized reverse logistics system of solid waste from the perspective of smart city needs to start from a more comprehensive system design perspective, such as how to improve the construction of the smart city to realize the smooth operation of hardware facilities; how to show the citizens a more complete life cycle of solid waste; how to encourage the citizens to actively interact with relevant information. These problems will be important research directions in the future.

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Tourism Image Perception of Country Parks in Shanghai Based on Web Text Analysis: A Case Study in Pujiang Country Park

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Abstract. This paper studies the tourism image perception of Pujiang Country Park in Shanghai based on web text analysis. The software Rost Content Mining is used to carry out high-frequency word analysis, semantic network analysis and sentiment analysis on the visitors' online comment text. The conclusion shows that the visitors' tourism image perception includes four aspects: featured scenic spot, environment, activity experience, facilities and service. It also shows that the visitors generally have a positive perception, but the causes of negative attitudes can't be ignored. Finally, suggestions are put forward for the optimal design and management of country parks in Shanghai.

Keywords: Country park · Web text analysis · Tourism image perception

1 Introduction

With the development of economy and society and the improvement of living standards, people's demand for leisure and recreation activities is becoming more and more normalized and diversified. Parks and green spaces, including country parks, are becoming more and more important places for people's daily outdoor activities. The concept of the country park was born in England in the early 19th century [1]. The new version of Standards for Classification of Urban Green Space in China gives the definition of green space: It is green space located at the edge of urban area, which has a certain scale and is mainly based on the natural landscape of the countryside. It also has the functions of being close to nature, leisure and recreation, science education and so on, which has the necessary service facilities [2]. Since 2012, 21 country parks have been planned and constructed in Shanghai. They are characterized by good ecology, countryside landscape and local characteristics, providing more abundant outdoor recreation experience for the public.

Since Hunt triggered the upsurge of the study on tourism image in the 1970s, there has been a lot of interpretation of tourism image. Generally speaking, tourism image is the general impression and comprehensive evaluation of the various elements of a tourism destination [3]. With the rapid development of the Internet, more and more people express their recreation process, feelings and evaluation on the network. These massive, open and intuitive network data can fully reflect the tourism destination

image. At present, many scholars have applied them to the study of tourism image perception, and the application of web text analysis is becoming more and more mature. The research results related to parks and green space in China also help planners and managers to improve the design and service [4–6].

As a new type of recreational space, the country park is still in the stage of exploration and development in China, and few scholars have studied its tourism image perception. This paper takes country parks as the research object to expand the research field of tourism image perception, and to provide theoretical support for the optimization and development of country parks. This paper studies the tourism image perception of country parks in Shanghai based on web text analysis, taking Pujiang Country Park as a case. The software Rost Content Mining is used to analyze the visitors' online comments, to obtain their deep impression, intuitive feeling and comprehensive evaluation of the park, and to form the tourism image perception of Pujiang Country Park. Finally, suggestions are put forward for the optimal design and management of country parks in Shanghai.

2   Research Object and Method

2.1   Research Object

Pujiang Country Park in Shanghai is one of the seven pilot country parks in Shanghai. It is located in Pujiang Town, Minhang District, Shanghai, adjacent to the Huangpu River. It is a suburban forest country park characterized by countryside, art and autumn scenery, with forest recreation and waterfront leisure as its main functions. The first phase of the park was officially put into trial operation on July 29, 2017, which covers an area of 5.82 square kilometers. The park is divided into five theme areas: 'Vitality Forest', 'Miracle Garden', 'Willow Garden', 'Forest Recreation' and 'Riverside Stroll' [7].

2.2   Research Method

Web text analysis is used to analyze the text from the network systematically, comprehensively, objectively and quantitatively. It can transform qualitative information such as words and images from the network into quantitative data. Through the combination of qualitative and quantitative research methods, it can effectively obtain the visitors' real impression and evaluation. This paper uses the software Rost Content Mining with its functions of word segmentation, word frequency analysis, social network and semantic network analysis, as well as sentiment analysis, to process the collected comments and get the tourism image perception of Pujiang Country Park.

2.3   Data Source

First, according to the reliability and accessibility, this paper takes the visitors' online comments on Ctrip and Mafengwo, two major OTA platforms in China, as the data source. Then the comment text of Pujiang Country Park from July 29, 2017 to

December 1, 2019 is crawled. After that, 164 detailed, complete and real effective comment texts are obtained by manually eliminating the irrelevant and repetitive ones, as well as pictures and scenic introduction. Finally, these text materials are saved as TXT document format to prepare for software analysis.

3   Result and Analysis

3.1   High-Frequency Word Analysis

Table 1. Top 60 high-frequency words.

Word	Frequency	Word	Frequency	Word	Frequency
park	103	Shanghai	12	building	7
Miracle Garden	54	punch	12	kid	7
big	46	facility	12	place	7
free	43	nice	12	fresh	7
ticket	34	parking lot	12	drive	6
good	33	garden	11	flower sea	6
photo	28	great	11	Huangpu River	6
beautiful	27	open	11	fine	6
flower show	23	barbecue	11	play	6
castle	22	parking	10	worth	6
country	22	bicycle	10	urban	5
metro	22	fantastic	9	grass	5
visit	19	landscape	9	Vitality Forest	5
child	15	environment	8	plant	5
tent	14	parent	8	style	5
convenient	14	feature	8	nature	5
weekend	13	next time	8	flower	5
scenery	13	design	7	art	5
charge	13	air	7	family	5
area	12	suggest	7	row	5

Through Rost Content Mining, the comment text is mined and high-frequency words are obtained. Some of the words related to landmarks or meaningless are filtered out. The top 60 words are selected and sorted into the high-frequency word table (Table 1). It shows the visitors' general feeling of Pujiang Country Park.

The table shows that 'Miracle Garden', 'flower show' and 'castle' are in the top 10. It indicates that the visitors are deeply impressed by the featured scenic spot. At the scenic spot Miracle Garden, there is a fairy tale style castle with large area of gorgeous and colorful flowers. The flower show held there in spring has attracted many visitors.

It is not only the main attraction of Pujiang Country Park, but also echoes the artistic feature of the park. The frequency of 'free', 'ticket' and 'charge' is also high, which indicates that the visitors pay more attention to the cost of the park. Words such as 'photo', 'punch', 'child', 'tent', 'barbecue' and 'row' show the visitors' activities in Pujiang Country Park. Many visitors attracted by the flowers are absorbed in taking photos in this popular park. Parents and children also come here for leisure and play. The various activities provide visitors with diverse experience. 'Metro', 'convenient', 'weekend', 'drive' and 'urban' indicate that the park has convenient transportation, and many urban visitors go to the park on weekends. The two words 'parking lot' and 'bicycle' show the visitors' attention to the internal and external traffic facilities of the park. Words such as 'air', 'fresh', 'grass', 'plant' and 'nature' indicate that the ecology and environment is good and the natural landscape is beautiful. But the frequency of such words is relatively low, and they do not show the characteristics of country parks. Words such as 'good', 'beautiful' and 'nice' show that the visitors are generally satisfied with Pujiang Country Park. The scenery and environment provide good conditions for visitors' leisure and recreation.

3.2   Semantic Network Analysis

Fig. 1. Semantic network analysis diagram.

Through Rost Content Mining for semantic network analysis, the semantic network analysis diagram is formed (Fig. 1). The collinear relationship of high-frequency words shows the visitors' core impression and cognition of Pujiang Country Park. The semantic network analysis graph is in the form of center outward divergence. The words connected by line segments are connected. The more times a word is linked, the more frequently it appears. And the closer a word is to the center word, the closer relationship they share. 'Park' and 'country' are located at the core, which are the most direct embodiment of the function and character of Pujiang Country Park, and also the most concerned content for the visitors. 'Garden', 'free', 'good' and 'convenient' are

located at the sub core. It shows the further development of the cognition of the core. It also indicates that the visitors' evaluation of the park is relatively positive and good. The outermost words are the further divergence and enrichment of the content of the core position and sub core position. This three-tier structure system shows the visitors' needs layer by layer, which is the key point of the follow-up construction and development of the park.

3.3 Sentiment Analysis

Table 2. Sentiment analysis table.

Sentiment classification	Proportion	Intensity	Proportion
Positive	82.84%	Low	27.22%
		Medium	23.67%
		High	31.95%
General	5.33%		
Negative	11.83%	Low	7.69%
		Medium	1.18%
		High	0.59%
Total	100%		100%

The sentiment analysis of Rost content mining reflects the visitors' attitude by analyzing the proportion of positive, general and negative emotions, and also reflects their overall impression and satisfaction to Pujiang Country Park. The Sentiment analysis table (Table 2) shows that the visitors' perception of tourism image of Pujiang Country Park is generally positive. In the park, visitors can not only enjoy the fairy tale world in Miracle Garden, but also relax, exercise, have barbecues and so on with their families and friends. With its beautiful environment and convenient transportation, the park is a good place for urban visitors to have leisure and recreation. Therefore, 84% of the visitors hold a positive attitude. However, 11.83% of the visitors are negative. Unreasonable ticket charges and tight parking space make their recognition of the park relatively low. Overall, the visitors' attitude towards Pujiang Country Park is good, but there are still some problems affecting their satisfaction.

3.4 Composition of Tourism Image Perception

Featured Scenic Spot. Words such as 'Miracle Garden', 'flower show' and 'castle' have been mentioned many times in the visitors' online comments. It shows that Miracle Garden, as a featured scenic spot in Pujiang Country Park, has a deep impression on the visitors. Most of the visitors go there to take photos and get in a good mood. However, the other scenic spots seem to be less popular. The frequency of 'Vitality Forest' and 'Huangpu River' related to the scenic spot Riverside Stroll is far behind. Therefore, a key point in the follow-up construction and operation is to take

full advantage of the leading role of Miracle Garden and promote the development of all the scenic spots by highlighting characteristics and keeping balance, so as to avoid ecological imbalance, resource waste and other problems.

Environment. 'Air', 'fresh', 'grass', 'plant', 'nature' are high-frequency words to describe the environment in the Pujiang Country Park. It shows that the park has a good ecological environment and beautiful natural scenery, and the visitors are satisfied with the flower landscape, pleasant forest and countryside space in the park. However, the frequency of such words is the lowest. The visitors' attention is not high. It is because the natural characteristics in the park are not prominent, and the artificial traces are too obvious to make the park similar to urban ones. Overall, Pujiang Country Park provides a space and environment for visitors to go back to nature, but lacks the landscape characteristics of the countryside.

Activity Experience. The vast space and diverse landscape of Pujiang Country Park provide an environmental basis for visitors' leisure and recreation, and the setting of the related facilities makes visitors' activities various and entertaining. The frequent appearance of 'photo', 'punch', 'child', 'tent', 'barbecue' and 'row' not only echoes this point, but also reflects the visitors' sense of identity. Young visitors can walk around the colorful fairy castle and take photos there. Family visitors can go to the children's amusement park and enjoy their time together. Friends can have barbecues, row boats and have picnics to get close to nature and relax. Overall, Pujiang Country Park meets the visitors' need for outdoor leisure and recreation activities.

Facilities and Service. In the aspect of transportation facilities, high-frequency words such as 'parking lot', 'drive' and 'urban' indicate that many urban visitors prefer driving to Pujiang Country Park, so parking is their particular concern. The visitors' comments show that the problem of parking difficulty has existed for a long time and has not been solved. In the aspect of catering facilities, some visitors think that the price is high, the quality is low, and there are too few restaurants, so they have to prepare their food in advance by themselves. In the aspect of service, 'free', 'ticket', 'charge' show that the issue of charge is concerned by the visitors and causes some dissatisfaction. Some comments show that the ticket price is too high and the staff mislead visitors to buy extra tickets. Overall, the visitors are concerned about the facilities and service of Pujiang Country Park, and their recognition is not high.

4   Conclusion and Suggestion

4.1   Conclusion

This paper studies the tourism image perception of country parks in Shanghai based on web text analysis, taking Pujiang Country Park as a case. The software Rost Content Mining is used to analyze the visitors' online comments, to obtain their deep impression, intuitive feeling and comprehensive evaluation of the park, and to form the tourism image perception of Pujiang Country Park. The conclusion shows that the visitors' tourism image perception of the park includes four aspects: featured scenic spot, environment, activity experience, facilities and service.

Among them, the visitors have the most profound feelings and impressions on the featured scenic spot. Miracle Garden is the main attraction, but its coordinated development with other scenic spots has become an issue to be discussed. The ecology is good and the scenery is beautiful in the park, but the visitors' attention is relatively low, which is related to the non-prominent countryside characteristics and obvious artificial traces. The activity experience meets visitors' diverse needs of outdoor leisure and recreation, and gains high recognition. Facilities and service are concerned because of their close relationship with visitors' experience, but there are many problems in transportation, catering, service and other aspects, which cause dissatisfaction of some visitors. Overall, the visitors have a positive perception of tourism image of Pujiang Country Park, but their negative attitudes can't be ignored. It needs to be gradually improved and solved in the follow-up construction and management.

4.2   Suggestion

Highlighting Local Characteristics and Promoting Coordinated Development.
Pujiang Country Park has created Miracle Garden as the most important attraction, which attracts many visitors with flowers and a fantastic castle. However, other scenic spots are relatively cold. The data analysis also shows that the visitors are not deeply impressed by other scenic spots and their characteristics. In the long run, it will cause some problems, such as heavy burden on partial environment, rapid decline of visitors' interest, low efficiency of resource utilization and so on. In order to give full play to the recreational value of country parks, it is necessary to make each scenic spot highlight its own characteristics and develop in coordination. Country parks have the characteristics of large area and diverse land properties [8], which provide favorable conditions for characteristic building. On the basis of excavating characteristics of the site, other scenic spots can combine popular elements with traditional culture to enrich the forms of leisure and recreation with artistic landscape, interesting experience, creative activities, lively celebrations and so on. In this way, a charming country park will be created.

Creating Countryside Characteristics and Protecting Ecological Environment.
Country parks in Shanghai are the core of the rural land arrangement. By consolidating good natural resources, inheriting the local culture and providing appropriate service facilities, they create a good place for the public to have leisure and recreation. Many country parks use trees as landscaping materials to maintain their natural and wild state. However, the visitors are not impressed by the natural environment in Pujiang Country Park because of the obvious artificial traces and non-prominent countryside characteristics. This problem needs attention. The countryside characteristics should be highlighted in the design and construction of country parks. Natural and wild landscape can be created by low-maintenance, high ornamental and native plants to meet the visitors' needs to go back to nature. At the same time, the protection of the ecology and environment needs to be taken seriously, which is related to the fundamental purpose of the construction of country parks.

Improving Facilities and Service and Raising Management Level. Facilities and service are important factors affecting visitors' satisfaction, which need to be effectively

optimized to improve the visitors' feelings. In the aspect of facilities, the common problems of shortage of parking spaces and catering facilities should be solved as soon as possible. At the same time, other facilities such as the sign system, rest facilities and barrier-free facilities also need attention. In the aspect of management, when exploring the mode of operation and management, country parks should care about the visitors' recreation experience. In the face of the contradiction between public serving and revenue needs, the park should actively explore new sources of benefits. In addition to developing itself, the park can also reasonably introduce social projects. This not only enriches the recreation experience, but also increases the revenue. It is also necessary to set relevant standards to ensure the service quality of the staff.

Excavating Cultural Context and Shaping Human Space. In addition to the excellent natural conditions, country parks inherit the local cultural context and historical features. They have human landscape resources represented by rural settlements and cultural relics [9]. Therefore, the country park is not only an ecological space, but also a cultural space. However, none of the visitors' comments have anything to do with the culture or history of Pujiang Country Park. It shows that the cultural atmosphere of the park is not obvious, which makes the difference between urban parks and it small. Therefore, the integration of cultural should be concerned. Besides integrating the local culture into the design of material appearance, country parks can rely on the advantages of abundant rural resources to implant the projects of farming experience, agricultural sightseeing, handicraft making and so on. This can not only enhance the attraction of the park on the humanistic level and enrich the recreation experience of visitors, but also drive the local development.

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Guidelines for the Master Plan of Landscape Rehabilitation in the Heritage Center of the Jipijapa Canton

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Abstract. The rapid urban growth of the Jipijapa canton of the Manabí province due to its constant dichotomy of its commercial and service activities of small and large companies caused its colonial architecture to change. This has physically, economically and environmentally deteriorated the dynamics of land use with different commercial activities that are gradually transforming the history of what was Jipijapa. This work selected a route where the houses that have been preserved by their owners are located from Simón Bolívar Street, Colon, Nueve de Octubre, which are located in the center of the canton and nearby houses on Parrales and Guales streets, Víctor Manuel Rendón and Rocafuerte, streets with great vehicular and pedestrian flow and with great commercial movement. For the preparation of the present work, techniques and methodology were used, including the observation of the heritage houses and their current state, surveys of the elderly, who keep memories of these heritage buildings. The objective is to establish the guidelines of the urban rehabilitation master plan, which allows to reactivate, enhance and take care of cultural landscapes and historical aspects, social, economic and recreational aspects where there is an environment accompanied by nature and the daily development of the human being advancing in synergy of the canton to establish new functions that are pleasant for the inhabitants and the environment, intervening critical points of the canton to trigger changes and renew areas.

Keywords: Master plan · Landscape rehabilitation · Heritage houses · Cultural landscapes

1 Introduction

The Jipijapa canton is located south of the Manabí province and its population growth has changed the dynamics of land use with different commercial activities that are gradually transforming the history of what was said canton.

This landscaping master plan will be used as a tool for reinserting and improving urban environments to recover many degraded cases in multiple spaces related to nature, where architecture and public space are located, seeking to improve the physical and spatial aspects of the urban area, maintaining its character and essence [4].

On the other hand, a historical study was carried out by the State University of the South of Manabí where houses dating from the years 100 to 150 were evidenced,

cultural heritage assets, with 17 buildings, an urban complex and 2 urban spaces which little by little. little are being consumed by commerce, in 2017 through an event of ministerial agreement No. DM-2017–019-019, it mentions the interest of conserving these urban properties and public spaces but currently there are no incentives on the part of the authority in charge [13].

2   Background and Statement of the Research Problem

The center of the city of Jipijapa was the main meeting point and from there the city was born; This space has gradually been transformed into a space governed by vehicular and pedestrian chaos, environmental, visual and auditory pollution; the streets have destroyed sidewalks and with different obstacles in the way, to this is added the issue of deteriorated electrical lighting and cables hanging by the ton.

Jipijapa has a hectic commercial movement that is developed in the patrimonial center of the canton where there is permanent formal and informal commerce, these businesses place their products on the sidewalks and in turn there are informal merchants that occupy the streets, forcing the pedestrian and the vehicle to walking through the same space, alternating their gait between car and pedestrian, generating chaos [8].

Added to this is the environmental pollution due to the negative impact of commercial activity, as well as the carbon dioxide emitted by the cars that frequent the site, the noise of the vehicle horns and the bad education regarding the waste generated by this great mass of inhabitants, who come to carry out their different activities at a meeting place of a lifetime. In this place, activities are carried out that become the main source of the economic boost, which in recent years without prior classification has registered large volumes of waste. Therefore, these wastes are the main pollutant in the city, with its highest concentration in the downtown area [3].

Regarding the urban green area index, Jipijapa presents a deficit at the cantonal level, in the polygon to be intervened in the heritage center, on the banks of the river and few percentages of green areas in some blocks, while the surface of Jipijapa is 71,344.56 m2, and its inhabitants add up to 85,682 per inhabitants [6].

For its part, the municipality of the canton does not assume the problems described to face the various realities of the canton, so strategic decisions must be made with friendly solutions for its inhabitants and its environment with environmental urban guidelines that will change the prospect of the city [1].

3   Formulation of the General Objective and Specific Objectives

3.1   Overall Objective

Propose guidelines for the master plan of landscape rehabilitation in the heritage center of the Jipijapa canton for the improvement of public space, preserving the historical memory of the city and recovering part of its cultural landscape.

3.2   Specific Objectives

- Analyze the current situation of the heritage center of the Jipijapa canton.
- Determine the green index of the canton to recover the landscape memory.
- Investigate the historical, cultural and landscape memory in the elderly population.

3.3   Theoretical Foundation

The plan begins by identifying how the canton's heritage center is currently, respecting traditions, recovering spaces to socialize and integrate people, designed in a habitable, pleasant and comfortable public space for the user who comes to perform various activities [7].

Cities grow and their environment changes little by little until reaching an exhaustive point of this transformation, in which problems arise and solutions are sought to rescue what exists and with new trends in urban rehabilitation, related to the form and function of services of mobility, commercial services and habitality to create better proposals [7].

Master Plan. It is a planning tool that allows to reverse the current state of a space, whether it is deteriorated by its elements or green spaces, changing it to a recovered public space [5].

Cultural Landscapes. The recognition of the landscape as a tourist attraction and the historical ensembles form the landscape interest that is restricted to exalted spaces of recognized heritage value, becoming a key element to know the cultural dimension of the territory [12].

Cultural Heritage. It begins to identify monumental assets of past times and is given a value for their conservation and protection, representing the identity of a people. This goes hand in hand with the right of people to enjoy cultural heritage. While identity is attributed to what people have in society, which allows them to feel like one more member of it, resulting in a correct development for the human being, which allows them to practice their traditions, customs and participation in culture for human dignity [2].

Urban Landscape. It can be mentioned that the urban landscape is the image of a place or a symbolic, cultural or social reality that it expresses, linked to the perception that the observer has when contemplating beauty from their visual environment, the result of a natural order that can be induced by various elements of the ecosystem [11].

Public Space. It is an appropriate space for different individuals where a diversity of socio-economic, political and cultural activities are carried out, of symbolic construction for the city and of links between the citizen and the street as a meeting space. The commercial image has been added to these processes, where the public is equal to conditions of social inequality [9].

4   Methodology

The methodological approach of this document starts from the analysis of secondary information, regarding the subject, organizing the information based on quantitative and qualitative data from public and private institutions. In addition, an observation study was made, collecting photographs of the current Jipijapa Heritage Center, where each of the activities that take place in Simón Bolívar, Colon, Nueve de Octubre streets that are located in the center of the canton and houses were identified. nearby in Parrales and Guales, Víctor Manuel Rendón and Rocafuerte streets.

Research Focus. The research approach is mixed, not experimental, since it will be quantitative and qualitative, where observed variables were used as shown by their natural context, with a descriptive and explanatory study to be later analyzed and it will be proposed where you want to go. Within the method, a survey file and an observation file will be used to detail how the canton is currently [10].

Techniques. Collection of bibliographic information, information was acquired by the data that support the research, organization of information, collection of specific information on site, interview with Municipal official, environmental police station.

Instruments. Observation sheet, it was used for the recognition of the place, Photography, Survey sheet via Question pro, surveys were carried out to 96 inhabitants to obtain the perception, knowledge, culture and needs of the people.

5   Discussion

As part of the results, 96 older adults between 65 to 81 years of age were surveyed, where they were asked through two referential images, which I must specify that; An orderly, clean city was observed, full of vegetation, dazzling landscapes compared to an image of a disorderly city flooded with garbage, vehicular chaos and without vegetation, an image that was a real photo of one of the streets to study of the heritage center to which The respondent chose the first image, which was accepted perceiving its substitutability in the face of the visual, thus the next question to be discarded with 70% affirmation these people mentioned that the streets that made them feel comfortable, happy and calm were the streets wooded.

Among the recommendations given to the GAD of the canton are; Preserve colonial architecture as part of the architectural cultural identity of the canton. Jipijapa through the physical restoration of heritage buildings, which may well be used for tourist businesses, as is the case in Cuenca where heritage houses have been converted into boutique hotels, restaurants and various businesses with affordable rental prices for informal traders. The native species that exist in the sector are conserved and not damaged in the relocation process, looking for modern technological systems. That, urge the National Police to enforce the ban on parking on public roads to avoid disorder and congestion. That, the parking of vehicles is organized on underused vacant lots. The commissioner enforces the provisions of the law with financial fines to those who harm the canton.

6 Conclusions

At present, the canton of Jipijapa, especially the historic center, has urban, cultural, environmental and social deficiencies. The infrastructure from its streets and avenues to the sanitation networks make Jipijapa an uninteresting city to guarantee a quality of life for the inhabitants. The different shops and businesses are presented in a disorderly way, which denotes a chaotic and unattractive city to be visited.

It is necessary for a city, especially the urban space in the heritage center of Jipijapa, to move to a new cultural landscape rehabilitation relevant to public space to have a modern and socio-environmentally responsible vision, which provides solutions to its needs and provides a better quality of life for the inhabitants. There is evidence of a lack of planning as a result of overpopulation in the canton and in neighboring cities, therefore, a master plan is necessary for the organization of degraded public spaces and that they meet the objectives of habitability and comfort for users.

The recovery of the green space within the study site is also proposed, with the incorporation of 10,869.81 m^2 of green surface, which means 21.43% in relation to the total area of the canton. In this way, the current index of 1.69% of existing green areas is exceeded. In short, the preliminary project promotes an efficient space, capable of generating an adequate and harmonious setting for public life and indissoluble with nature and that can become the engine for the satisfaction of the collective needs of the population.

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Future City Lab. An Analytical Tool
for Predicting Urban Development Trends

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Abstract. Experimental research laboratories foster innovation and facilitate the transition from theoretical to applied research. The article presents results of research by Future City Lab, a Polish-Chinese experimental research laboratory. It discusses challenges which contemporary urban planning is facing in light of problems such as climate change, CO_2 emissions, environmental degradation, urban sprawl as well as social and housing problems. The results of Future City Lab research on development visions for urban structures aimed at improving the quality of life in cities are presented against such a background.

Keywords: City of the future · Forecasting · New trends · Future City Lab

1 Introduction

This inherently exploratory article presents the results of research work of Future City Lab, a Polish-Chinese university experimental research laboratory. Future City Lab has been engaged with research at Poznań University of Technology's Faculty of Architecture since 2018. The research spans both conceptual and design work carried out together with master degree students as well as theoretical works ensuing from cooperation with specialists in the fields of sociology, economics, cultural studies, nature conservation and climate protection. The Future City Lab interdisciplinary research group also includes urban planning, architecture, systems engineering, transport, telecommunications and computer science specialists from Poland (Poznań University of Technology) and China (Chongqing Jiaotong University).

The main focus of this article revolves around a review of the conditions which are central in determining a vision of the city of the future as a place able to unite interested parties around common ideas of utility, safety, health, nature conservation and energy saving.

In order to fully appreciate the importance of Future City Lab it is necessary to define the basic characteristics we consider desirable in new urban structures. In other words, it is about transforming the conventional city concept into a futuristic city, using 100% clean energy, providing a pollution-free, healthy and sustainable environment for its residents. Neighbourhood communities organised around nature, will be free from

cars and carbon emissions. Pedestrian traffic will define life in the City of the Future, with essential services such as schools, doctor's surgeries, leisure facilities as well as green spaces all within a five-minute walk. Artificial intelligence will be used to forecast changing needs of the residents.

Our research perspective refers to the characteristics listed below.

a) City of the Future is a creative business-oriented environment, using science, knowledge, talent and creativity of its residents to further economic development;
b) City of the Future as a place where social integration of residents around generally accessible public services is crucial;
c) City of the Future as a city where high-tech industries and science play a key role in long-term development;
d) City of the Future as a city that invests in social capital, thus creating a community open to innovation;
e) City of the Future as a place for sustainable social and environmental development, guaranteeing the use of renewable natural resources;
f) City of the Future as a city which nurtures its heritage and traditions, able to use cultural diversity to strengthen its attractiveness and competitiveness.

Our research perspective focuses on presenting Future City Lab results within the scope of a new city of the future definition, mapping of development trends and new urban design strategies.

2 Materials and Methods

A fundamental problem with predicting the future of cities is associated with the answer to the following question: does the future of cities depend on the will and creativity of urban planners or on the independent development processes of urban organisms?

The main directions for forecasting the future are related to this question.

2.1 Extrapolation of Trends

This type of forecasting entails analysing future spatial, demographic, economic, environmental and political changes on the basis of analogous phenomena in the past.

Such forecasting uses information on the so-called external factors (the magnitude of which cannot be influenced) and internal factors (which can be shaped). The analyses look at the future relationship between internal and external factors and their impact on forecast phenomena.

In forecasting research, the most commonly used models include: classical and adaptive trend models, causal-descriptive models, autoregressive models, simple models and recursive models [6].

Statistical and mathematical tools are used, such as genetic algorithms, artificial neural networks, Markov chains, cellular automata, linear and non-linear regression.

In such urban planning studies, empirical methods borrowed from demography, sociology, economics and physical geography are most commonly used. Hypotheses

about the future are formulated on the basis of observations of the phenomena studied, guided by the principle of evolutionism. These analyses essentially consider the situation up to the start of the research and are in fact diagnostic in nature.

The use of extrapolation methods in urban planning is often subject to criticism. Many authors have stressed that city planning entailing the building of development scenarios on the basis of identified past phenomena is a misunderstanding. It is as if though the forethought associated with the construction methods for defensive walls of medieval cities was to be used to build defence strategies of Renaissance and Baroque cities. Anne Lise Kjaer emphasises that "the future is not a place we are heading towards; it is a place we are creating" [5].

2.2   Normative Methods

In normative forecasting, defining future development goals and objectives, i.e. the target state we want to achieve is the starting point.

Whereas the aim of extrapolative forecasting is to predict the future on the basis of knowledge of the historical course of analogous phenomena, normative forecasting entails "a priori" determination of a future goal and then, subject to the "going back in time" principle, finding ways to achieve the assumed goal.

The normative approach defines the future in some form and then sets out what needs to be done to achieve the desired outcomes. This means that a forecast should not be determined on the basis of existing trends (often leading to undesirable consequences), but with reference to predetermined development scenarios that are desirable and realistically achievable. Future goals most often stem from social, political, cultural and economic needs [4].

An important element of this approach the definition of relationship between new technologies and the needs of residents (including public participation in decision-making processes).

Scenario methods are a specific combination of extrapolative and normative methods. The scenarios establish a set of possible visions for the future based on a diagnosis of existing phenomena and the effects each scenario will have on a specific area of the urban fabric. The probability of each scenario occurring and the impact it will have on the city us determined using statistical tools. The desired scenario is selected through comparisons with competing scenarios. Actions necessary to see the selected scenario through are then defined [7]. Type of forecasting entails analysing future spatial, demographic, economic, environmental and political changes on the basis of analogous phenomena in the past.

2.3   "Arts-Based Research" in Forecasting Development Trends

Auxiliary use of the original Arts-Based Research method in defining visions of future cities [3] yielded interesting results. The proposed method starts from the premise that new trends in artistic sensitivity and art very often outpace developments in urban planning, technology and the social sciences. In particular, the relationship between art and urban planning acquires inspirational qualities. Throughout history, there have been many examples where urban planning has delivered solutions arrived at through

the transfer of artistic experience to the world of urban planning. Antonio Sant'Elia's 1914 artistic visions of future cities are a good example. They materialised in an astonishing manner decades later in the development of American city centres.

The Arts-Based Research method aims to use emotional sensitivity and metaphorical thinking to search for new development trends under prevailing considerable uncertainty. The Arts-Based Research method is based on a combination of synectics and creative stimulation. The method comprises four levels:

The method comprises 4 levels:

LEVEL 1: generating ideas, creative interpretation, visualisation of a future state.
LEVEL 2: detecting and emitting signals, cross recombination of trend image, mapping of forecasting illusions.
LEVEL 3: implementation of signals, graphic compression, design representation.
LEVEL 4: Creative evolution and transformation of a trend, forecasted image of reality.

The method was applied in the research on future visions for residential estates. Third-year Poznań University of Technology architecture students took part in the research. Type of forecasting entails analysing future spatial, demographic, economic, environmental and political changes on the basis of analogous phenomena in the past.

2.4   Trend Mapping

However, there are drawback to classical heuristic forecasting methods. The problem lies not in innovation effectiveness as such, but rather in the uncertain reaction of future users to emerging innovations.

Buckminster Fuller, whose insightful Dymaxion House and Wichita House designs, despite their technical innovation, failed to appeal to customers and became a financial failure for the designer and manufacturer, found this out the hard way in the first half of the 20th century. A similar fate befell the futuristic Dymaxion Car designs, whose innovative aerodynamic shapes were spurned by buyers despite their outstanding fuel consumption figures. According to Berkun: "it is a myth that people love innovation: they only prefer it when new trends have been accepted by others" [2].

Fashion, defined by Simmel as imitation of a given example which satisfies the need for social adaptation, is often overlooked by forecasts [8] Such imitation is a source of satisfaction associated with not feeling alone in one's tastes and with finding external confirmation of one's preferences. In this sense, fashion emphasises one's belonging to a group and helps social adaptation. Consumers incessantly analyse prevailing opinions, feedback and assessments of new solutions before deciding to use something truly innovative. Forecasting is therefore not only about technological innovation, but above all about the accuracy of predicting the reaction of residents (consumers) to new solutions.

This is where use of new methods based on trend mapping using social network analyses comes to the fore. It entails forecasting consumer needs using methods drawn from psychology, sociology and innovation in order to formulate development forecasts and to search for new design solutions acceptable to residents. This research can

also be interpreted as a kind of heuristic operator in forecasting trends reflecting the desired lifestyle, the subject of residents' aspirations and preferences.

Futurology fans as well as professional urban planners and architects draw inspiration from the World Wide Web.

Its supporters link this model to the growing significance of the Internet. They point out that truly innovative trends are coined on online forums [1]. This applies to lifestyles, attitudes and behaviours that are created by ordinary members of online communities. The internet facilitates mass propagation of ideas and which find millions of followers in a very short time. This type of trend diffusion exhibits the following properties:

– the propagation of innovative solutions depends on whether they are clear and easy to understand; novelties are more likely to propagate if they are readable and understandable,
– functionality, widespread social acceptance and better aesthetics are advantageous for innovative concepts.

Under these conditions, bottom-up innovations are easily assimilated and propagate on a mass scale. This reflects the fact that residents are often sceptical about the "top-down" official concepts put forward by the authorities (politicians, urban planners, scientists) and instead create their own models, which are an inspiration for futuristic solutions. And bottom-up diffusion of innovation defining the vision of future cities ensues.

Altogether, such "bottom-up" visions constitute a colourful reflection of urban creations on the web, made by enthusiasts and artists laying out future urbanisation plans.

The reach of such "bottom-up" urban planning on the web is quite considerable, and most importantly it shapes the tastes of the younger generation – future investors, managers and residents. For this reason, the use of web "Trend Mapping" to find emerging trends in urban planning is justified.

Future City Lab conducted an ad hoc experiment to search for new trends using this method. Architectural degree students at the Poznań University of Technology during their final terms before graduation were part of the research.

The research aimed to determine the influence of modern media (World Wide Web) on the emergence of future trends in urban planning. The experiment comprised of an internet search, the results of which were then used by students to identify future development trends in urban design. The research yielded a classification of identified trends as well as an attempt to describe them.

The following emerging urban development directions were mapped on the basis thereof: Urbanism of Digital Games, Interactive City Planning, Open Source City Planning, Recycling City Planning, New Expressionism, Micromalism, Biomorphic City Planning, Generative City Planning, Digital Morphogenesis, Homeostatic City Planning. Fractal Urbanism, Umbrella Structure Urbanism, Ecological Morphology Urbanism, Emergent City Planning, Immersion City Planning and Experience Design, Urbanism Based on Multimedia, Vernacular Urbanism, Agile City and Food Urbanism.

3   Discussion

In relation to the presented results, it is worth mentioning that cities, the most permanent components of our civilization, have endured for centuries, while countries fall or are overrun. Cities associated with globalization, where communication networks connect the communities of residents, are synonymous with modernity, the avant-garde and inventiveness. It is because of cities that globalization is spreading so rapidly all over the world. Wellington Web, the Mayor of Denver, pointed out that "the 19th century was a century of empires, the 20th century was a century of nation states, and the 21st century will be a century of cities".

Since late 18th century, the development of industry has resulted in a mass influx of rural population to cities. In 1900 only 13% of the global population lived in cities, whilst in 1950 the share was 29%. According to most estimates, today more than half of the world's population lives in cities.

By 2050, the share of the world's population living in urban areas will increase to 75%, which means there will be 2.5 billion more people residing in cities, which is more than the present population of China and India put together. It is evident that Asia and Africa are seeing the largest growth of urban populations. The tendency has been clearly visible since 2015.

The number of megacities has tripled since 1990, and it is predicted that in 2030 the number of urban agglomerations with more than 10 million inhabitants will increase to 41. Every week, the total number of city residents increases by 1.3 million. 80% of economic growth is generated in urban areas. It is estimated that by 2030, the capital associated with to the construction industry in cities will increase to 7 billion dollars. 70% of global energy is consumed by cities. The carbon dioxide emissions index is of a similar magnitude.

Cities generate around 1.3 billion tonnes of waste per annum, and the disposal costs stand at approximately 205 billion dollars. The amount of municipal waste in 2025 is expected to increase to 2.2 billion tonnes. And although cities are widely regarded as levers of economic development, they have many common problems which they are struggling with. These include: disproportionate social and economic stratification, poverty, insecurity, shortage of water, food and housing, unemployment, environmental pollution, negative impact of cities on climate change.

One should also pay attention to the specific problems faced by cities in different parts of the world.

In Western Europe, the main problem centres around demographic collapse, migration and integration of immigrants.

In Asia, we have to deal with the uncontrolled growth of cities, the weakness of planning at the regional and local level, environmental pollution, and management of urban resources.

Urban sprawl, social exclusion, access to basic social and health services are the main problems faced by American cities.

In South America, we have to attend to overpopulation of cities, unequal economic development leading to social tensions, political instability, lack of universal access to education and social services, low state of public safety and substandard buildings.

In Africa and the Middle East lack of water, food shortages, security and civil protection, armed conflicts, population migrations and political instability are the main issues.

Taking into account these problems, analyses carried at Future City Lab have delivered the answers to the following questions: How should future cities be designed? What materials will be required to construct future cities? What technologies will the cities of the future use? How should one go about creating a resident friendly city? How to provide people with work, housing, an appropriate standard of living, health care, privacy, security, clean environment and how to ensure they have a real impact on urban policy? What will modernity be like and will it always be associated with Western culture?

Our research at Future City Lab indicates that to achieve this, cities of the future should be flexible, which means that they should exhibit the following characteristics:

a) Sustainable development, achieved through social and economic stability, effective, multifaceted governance of the urban environment.
b) Be resident oriented (attention focused on residents). This is based on "bottom up" planning or priority approach to the psychophysical needs of residents, including elements such as life satisfaction, physical health, mental state, level of independence, education, social relations and cultural diversity.
c) Efficiency, attractiveness and dynamics necessary to attract investment, stimulate entrepreneurship.
d) Accessibility, which provides an opportunity for local communities to participate in all aspects of city life. An accessible city affords its residents fair access to the entire spectrum of available services.
e) Resilience to crises and shocks, flexibility and competitiveness. Such a city easily adjusts to its surroundings, has a large adaptation potential to the changing social, economic and cultural conditions. This means the ability of communities, institutions and businesses to survive crises and shocks that threaten the urban economy, infrastructure and the environment.
f) Good management, i.e. the city makes optimum use of its resources to successfully implement short and long-term development programmes.
g) Responsiveness, facilitating city management through a suitably developed digital infrastructure, serving to respond to emerging problems and making appropriate decisions in real time.
h) Appropriate planning and management of urban resources.

4   Conclusions

The presented overview of trends within the scope of creating visions of future cities allows one to make the following statements:

– cities will play an increasingly important role as a site of economic development, technological progress and cultural changes,

– cities are facing with many environmental, social, transport and infrastructure problems; more often than not they are poorly planned and managed,
– methods of solving these problems will shape visions of future cities,
– there is no single vision for the city of the future; we are dealing with many competing models, whichever one prevails depends on the residents' lifestyles, local culture, traditions and the inhabitants' sense of identity,
– in design concepts for future cities, empowerment of the residents and personalisation of space will play an important role,
– new technologies will play a key role in shaping spatial forms and lifestyle in the cities of the future.

Therefore, one can define a city of the future thus: cities of the future are places where new technologies (communication and IT) will be linked with technical and social infrastructure, architecture, everyday use items, as well as institutions and organisations in order to effectively solve environmental, social, cultural and economic problems of the future.

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Emotional Space in Urban Planning

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Abstract. The aim of this work is to contribute to our knowledge of emotional maps in spatial planning. The maps show the spatial distribution of residents' feelings related to the perception of public spaces. This work aims to validate the theory that the suitability of a site for various functional purposes depends on the emotional preferences of users. Users of space (investors, residents, tourists) are guided in their spatial behavior by emotions rather than cold calculation. This phenomenon, well known from marketing theory, is also reflected in the built environment. The basic research method is an architectural and urban query in the area of communes of the Poznan metropolitan area, Poland.

Keywords: Emotional maps · Spatial planning · Public spaces

1 Introduction

The subject of our research was the use of geo-urban centric technology in the diagnosis of urbanization processes. A research example is the Poznan metropolitan area. The research is aimed at seeking answers to the question whether contemporary urbanization processes lead to the strengthening or weakening of the importance of the metropolitan center in its spatial development. The problem is not obvious. Commonly, there are views that the center (downtown) is significantly eroded, and urbanization activity is shifting to suburban areas [1, 3]. You can also meet with opposing views, which emphasize the importance of the metropolitan center as a catalyst for activity, especially in the field of culture, art, science, and creative industries. To solve this problem, we used the geo-urban centric method to study urbanization processes on the selected example of the Poznan metropolitan area. The Poznan metropolis is the city of Poznan and the suburban area, including 17 communes of the Poznan poviat. The Poznan metropolitan area has an area of 2,162 km^2 and has 879,000 inhabitants with an average population density of 406 people/km^2. The inhabitants of the metropolis accounted for 2.5% of the country's population and 26% of the population of the Wielkopolskie voivodship. The Poznan metropolis is one of the seven most urbanized areas in Poland, next to the agglomeration: in Warsaw, Kraków, Gdańsk, Łódź, Wrocław and Upper Silesia. In Poland, there are no legally sanctioned administrative boundaries of metropolitan areas around large cities. For research purposes, such boundaries are determined on the basis of demographic, functional, social, economic

and transport criteria. The boundaries of the Poznan Metropolitan Area adopted in this study are commonly used in many scientific and planning studies [5]. In recent years, the metropolis of Poznan has experienced significant functional and spatial transformations. In the Arctic, we present an original approach to spatial development planning. We study trends in urban activation using an original method. This method differs from the previously used planning approach in that it analyzes development trends on a "bottom-up" rather than "top-down" basis, as is the case in the previous planning approach. Our research is based on the analysis of the expectations, assessments, and opinions of ordinary users of space (residents). For this purpose, the team of authors used the Geo-Urban-Centric method. The method was developed at the Institute of Architecture and Spatial Planning at the Poznan University of Technology in 2019–2021. Our research was to answer the following questions:

- what are the current trends in preferences regarding new places of residence in the Poznan metropolis?
- what are the trends in locating services for residents and business of the Poznan metropolis?
- what are the trends in the location of recreation and leisure spots in the Poznan metropolis?
- whether the above trends strengthen or weaken the importance of the center. To what extent does the downtown build the urban cohesion of the Poznan metropolis?

2   Materials and Methods

The aforementioned approaches to public spaces were evaluated in relation to the Poznan metropolis by using elements belonging to them. It has been assumed that the attractiveness of public spaces is related to emotional value, which in the form of a view, sign, symbol, situation, or event, is assessed by consumers [6]. Urban interiors are attractive to receivers in various degrees. The art of landscape composition is able to emphasise qualities such as picturesqueness, uniqueness, atmosphere, for which the consumer (e.g. tourists, client, investor) is ready to pay a given price. From the economic point of view, the beauty of streets and squares, intimate scale, interesting urban composition, architectonical detail, presence of water and greenery acquire further meaning and have an impact on property prices. Economic analysis includes a concept of emotional values as an important factor influencing the attractiveness in terms of investments and quality of life in the city.

2.1   Maps of Emotional Values

The emotional impact studies were carried out using an expert method as part of a query covering the area of all municipalities of the Poznan Metropolitan Area. In each commune an analysis of the feelings evoked by the appearance of public spaces was performed. As part of extensive field studies, psychographic queries to assess emotions were carried out, as well as photographic and drawing inventories constituting documentation of the research (7,000 photos). The results of the research were presented on

psychographic maps of communes and on a collective map of emotional values of the entire metropolis. Our research goal was to develop a human judgment factor that exhibits natural emotional responses related to the appearance of public spaces. The human factor was represented by a control group of sensitive architecture students of the Poznan University of Technology. The group consisted of 46 people and was divided into independent teams of 2–3 people carrying out assessments in 18 municipalities. We call the members of these teams experts. Experts were tasked with providing data for diagnosing the quality of public spaces. The quality of public spaces was measured by the emotions they evoke among the evaluating experts. A diagram of the division of labor into groups is shown in Fig. 1.
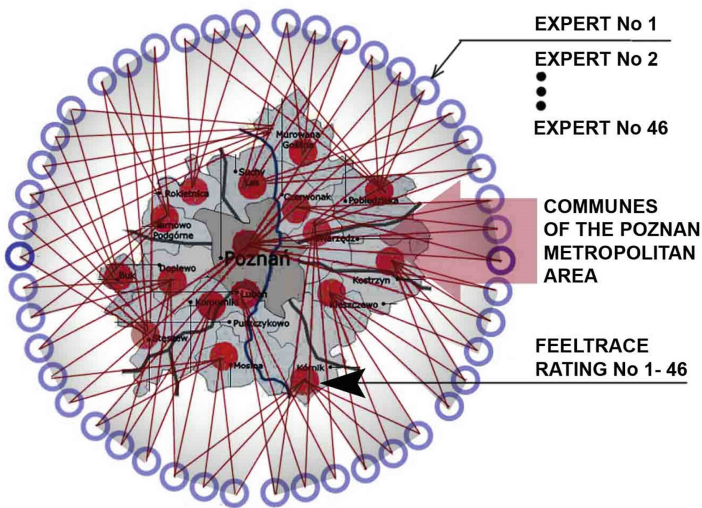
Fig. 1. Scheme for assessing public space for the modified Feeltrace method

Each expert was to set threshold values from a set of emotions, taking into account the subjective level of emotional intensity. The ratings of individual experts working in the team were mathematically averaged. Two independent teams of experts worked in each Poznan commune. The final assessment was the result of the assessments of two independently working teams of experts. In this way, unified assessments of emotional interactions were obtained. These assessments were of an intersubjective nature, reliably representing the diagnosed feelings.

Assessments of 10 different emotional states were established on the basis of the modified Feeltrace method. Emotions were presented as points in a two-dimensional space [2].

Emotional space was represented by a circle on the screen of a laptop computer. The inside of the circle represented a set of ratings assigned to different emotions. The

circle was divided into two perpendicular axes: vertical and horizontal. The vertical axis stands for an active or passive relationship to place, from very active (top of axis) to very passive (bottom of axis). The horizontal axis signified a positive or negative emotional impact of public place (from negative on the left to positive on the right). The evaluation consisted in moving the cursor around the circle so that the position of the cursor indicated the level of activation combined with negative or positive feelings. Experts used a portable laptop to mark their emotions. Moved by the cursor in a space defined by two dimensions, activation (very passive to very active) and sensation (very negative to very positive). This method was used to assess public places in the studied area. The resulting set of possible emotions was as follows: anxiety, anger, disgust, depression, sense of pleasure, delight (exciting), hope (optimism), calm, boredom, curiosity (Fig. 2).
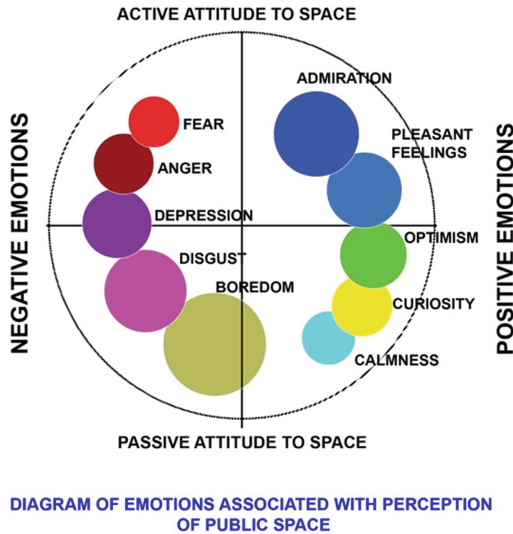
Fig. 2. A diagram of emotions associated with the perception of public spaces. Based on [2].

3   Results

Each assessed public space was characterized by geolocation data. As a result, the assessed public spaces could be mapped onto the map of the Poznań Metropolitan Area. The research was carried out in 2019–2020. The emotional map was prepared using MapInfo Professional (Fig. 3).
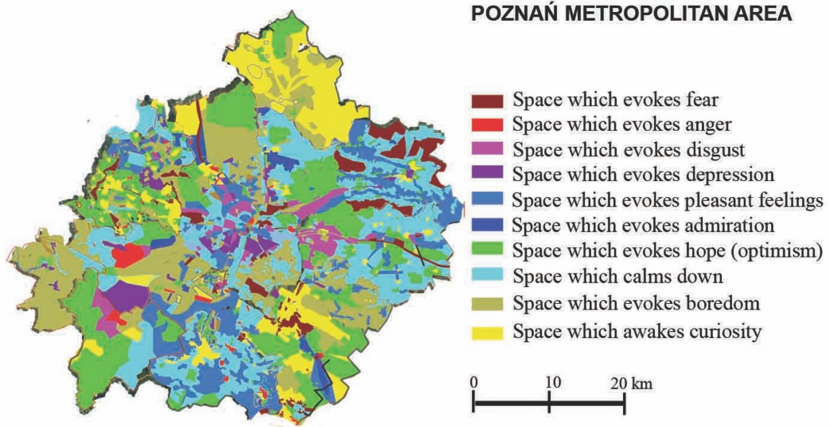
Fig. 3. Map of emotional values of the Poznan metropolitan area.
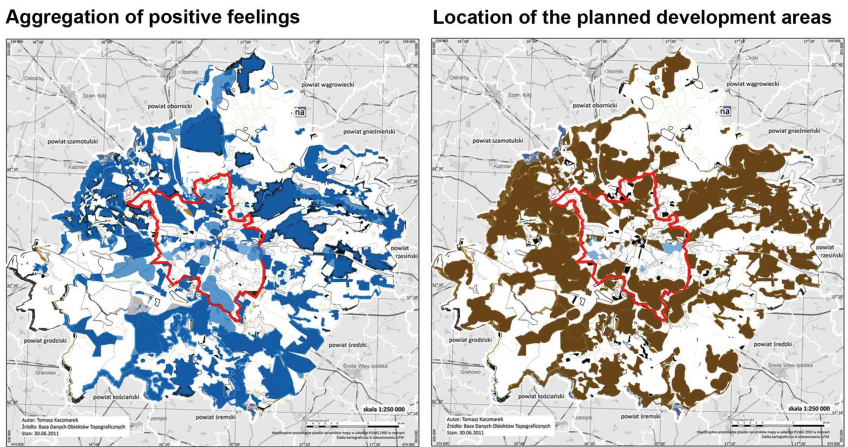
Fig. 4. Poznan metropolitan area. A map of positive feelings compared with the map of the location of the planned development areas.

4   Discussion

The data collected from this study suggest that emotional maps are needed to diagnose the quality of public spaces in the Poznan metropolis. They constitute a valuable diagnostic material for making decisions in the next steps of spatial planning. One of the advantages of this approach is the assessment of the quality of space from the perspective of an ordinary user of space, and not from the top-down perspective of city planners.

Our model is based on the dual representation paradigm. In this model, emotional stimuli are processed by two different layers: cognitive and perceptual. The cognitive

image aims to match patterns and is useful for activating the appropriate emotional stimulus. The cognitive model assumes that our interpretation is critical. How we interpret the environment, in which we find ourselves, influences the emergence of appropriate emotions in us, and these in turn will determine our behavior [4]. A perceptual image is a reduced set of basic characteristics that are "significant" to the subject in the sense that they form an emotional basis for specific decisions (eg, choice of direction of movement, choice of color, etc.).

The perceptual model is based on sensory data available in the environment. The results of the insights are passed to the brain to create more abstract representations. There are the following stages of the perception process: perception, perception, identification, and recognition. Sensory stimulus organizing perception evokes specific emotions, thanks to which we make these and not other choices [7]. Against this background, the vector of approval, vector of desire, vector of dislike, and vector of boredom appear. Related to this are emotional maps that reflect the usefulness of space in the human mind. From this point of view, the emotional map can be considered the basis for spontaneous spatial decisions.

In the study various emotional states were attributed to Poznan public spaces. The presented analyses are based on an assumption that people's investment decisions and spatial behaviours depend on their feelings towards urban environment. Urban composition, harmony, and spatial order can influence behaviours in an effective way. Beautiful surroundings require beautiful behaviours and positive actions, they have an impact on human emotional development, activate cognitive and identification processes. For a man beauty is a source of satisfaction. And contrary: monstrosity triggers negative behaviours in people who live in a degraded environment, it repels, makes people feel unfavourably towards certain places. Between beauty which has a positive impact on consumers and monstrosity which has negative emotional consequences there are a number of transitional states. We can differentiate spaces which cause: fear, anger, disgust, depression, peace, boredom or curiosity, happiness, and admiration.

It is known that the behaviours and investment decisions of space users are based on emotions rather than cold calculation. This phenomenon, known well from the theories of marketing and advertising is reflected also in urban space, which may evoke negative or positive emotions.

5   Conclusions

Following conclusions have been made based on the study:

– various areas of the city show clear segmentation of feelings related to the quality of public spaces.
– preparation of a map of emotional values may constitute a base for the direction of public space development, first of all, to formulate a functional and utility program with clear design priorities.

It needs to be emphasised that the study has a form of preliminary survey analyses. It was carried out by expert method by architecture students taking part in summer holidays urban training in July 2019. Undoubtedly, these analyses need to be

supplemented by surveys carried out on representative groups of residents. Therefore, the results of the study need to be approached with care; this applies especially to the detailed interpretation. General conclusions however, achieved by the aggregation of positive emotions (happiness, admiration, hope), neutral emotions (peace, boredom, curiosity) and negative ones (fear, anger, disgust, depression) seem to be very interesting. It is worth to notice the map (Fig. 4), showing spatial segmentation of positive emotions towards public spaces. It might be noticed that the spatial distribution of positive feelings correlates with the plans to allocate these areas for future development included in the study on the conditions and directions of spatial development of the city. It means that the city authorities have ascertained correctly that the clients are interested in potential new attractive investment areas and included them in the spatial development plans of Poznan. The question is whether this strategy of developing attractive public spaces will bring real benefits? Will it not, in the long run, decrease the attractiveness of the city?

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Transport Accessibility as a Factor of Spatial Development on the Example of the Poznan Metropolitan Area, Poland

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Abstract. The study assesses the impact of transport development projects on the urban expansion of metropolitan areas in terms of spatial cohesion and functional efficiency. The scope of research includes: analysis of transport needs in terms of adaptation to the functional and operational specifics of the location area, the impact of the urban sprawl phenomenon on the transport system in downtown areas. Existing transport plans were criticized and we believe they do not solve the most important problems. A new future-oriented concept of the transport system of the Poznań metropolis was presented. The obtained results are important for the development of the spatial development strategy of the Poznań Metropolitan Area.

Keywords: Transports · Comb layout · Metropolitan areas · Development

1 Introduction

Transport accessibility is a key factor shaping the development of the city. The spatial development of the city causes an increasing demand of the inhabitants for passenger transport. Spatial planners have to ask themselves about the further directions of activities aimed at better integration of vast urbanized areas. The biggest challenge is to change mentality and break away from the stereotypes that have dominated spatial planning for the last 50 years. In Poznań, this led to a situation where only every fourth inhabitant uses public transport. The number of passenger cars in Poznań per 1,000 inhabitants exceeds the rates achieved in large European metropolises such as Berlin or Hanover.

In the current situation, the road network in the city of Poznań is very crowded. The average travel time by car from the outskirts of the metropolis area to the center of Poznań is from 1.03 h (Wągrowiec) to 0.80 h (Nowy Tomyśl). Most of the roads leading from regional traffic to Poznań are not very predictable due to the state of motor congestion [8].

The key elements of the existing road network in the Poznań metropolis include:

- weak links with the northern and southern areas,
- small transport of people and goods, cargo by rail,
- congestion of the road network in the central area of the metropolis.

Currently, the motorway junction in Poznań is based on the 2nd communication frame, which is the direct border of the downtown area. A third collision-free communication frame is planned to distribute traffic within the city [3].

Road traffic safety in the Poznań metropolitan area is a significant problem. Low automotive culture and low quality of road infrastructure are the causes of road accidents. There are a lot of cross-traffic junctions through the city. Intensive development near roads and the lack of a separate network of bicycle paths make the situation even worse.

The railway system crosses Poznań along the north-south axis. In the southern part of the city, the railway tracks run on the ground level, turning into a deep trench in the central part of the city, and then the tracks run along the embankment. This creates an unfavorable spatial situation [9].

There is a lack of rail and road viaducts. In the city area, there are street crossings with railway tracks on one level. This applies to streets with heavy traffic within the area of the entire railway junction [7].

For many years, attempts have been made to include railways in the city traffic. Currently, there are 64 stations and railway stops in the area of the Poznań metropolis. However, a relatively small amount of passenger transport is handled by rail [5]. For many years, plans have been made to expand the existing railway network and increase the frequency of trains.

There is no integrated public transport system linking bus, tram, and rail transport. It is necessary to build new stops and parking lots in the Park & Ride system [2]. Currently, travel time by public transport is longer than for a passenger car.

The changes in the distribution of places of residence, changes in the labor market, and demographic changes had the most significant impact on the traffic structure in the years 2000–2020. During this period, there was an increase in the number of inhabitants in municipalities neighboring with Poznań by 30%, and a decrease in the number of inhabitants of Poznań by 10%.

The above data indicate that in the years 2000–2020 40% of the population Poznań changed its place of residence, and a significant part of them ended up on the outskirts of Poznań. In new housing estates, there are basic commercial, educational and health services. This forces residents to use cars.

This process contributes to the increase in car traffic and the high demand for public transport.

There are weaknesses of transport in the metropolitan area [4]:

- Extensive urbanization of the suburban zone of the Poznań metropolis.
- Shortage of basic services in suburban zones.
- Lack of control of the spontaneous urbanization of neighboring communes around Poznań.
- Ineffective revitalization of Poznań districts, resulting in (resulting in) the choice of places of residence outside the center of Poznań.
- Lack of a public transport development plan of a metropolitan nature.

The above-mentioned problems were the reason for undertaking our research on alternative scenarios for the development of transport in the Poznań metropolis. We assumed that the transport structure is an integral part of the spatial development of the

metropolis. New transport concepts should provide a new vision of the Poznań metropolis as an attractive place to live, work, and rest for 1 million inhabitants.

2   Materials and Methods

Our concept of transport development was prepared in the Polish-Chinese experimental research studio "Future City Lab" at the Faculty of Architecture of the Poznań University of Technology in 2020. The study was based on the following materials:

a) A study of the conditions and directions of spatial development in the city of Poznań. Direction of communication development,
b) Transport plan for the Poznań agglomeration 2021 http://www.plantap.pl,
c) Plan for the sustainable development of public transport for the city of Poznań for the years 2014 - 2025. Update. (Annex to Resolution No. VII/88/VIII/2019 of the Poznań City Council),
d) Spatial development plan for the Greater Poland Voivodeship. Wielkopolska 2020 + (Marshal's Office of the Wielkopolska Region in Poznań. Poznań 2019),
e) Spatial development plan for the functional urban area of Poznań. Poznań Metropolitan Area (Marshal's Office of the Greater Poland Voivodeship in Poznań. Poznań 2019).
f) Transfer junctions as the main element of the integrated public transport system in the Poznań agglomeration [4].

The research used the "Arts-Based Research" method developed at the Faculty of Architecture of the Poznań University of Technology. It is a method of heuristic forecasting of city development [1]. The method assumes that new trends in art and artistic sensitivity very often outpace achievements in urban planning, technology, and social sciences. In particular, the links between art and urban design gain inspiring values. The history of urban planning provides many examples of solutions that were created by transferring artistic experience to the world of urban planning.

The aim of the "Arts-Based Research" method is to use emotional sensitivity and metaphorical thinking to search for new development trends in a situation of high degree of uncertainty.

The Arts-Based Research method is based on a combination of synectics with creative stimulation. The method consists of four levels: The method was applied to research the future vision of the Poznań metropolitan area transport network. Students of architecture from the Poznań University of Technology were included in the research.

3   The Results

A design concept for the Poznań metropolis based on an original comb layout for transport was prepared. The aim of our concept is to create a human-friendly sustainable built environment that attracts new residents, tourists and creative industries (Figs. 1, 2, 3, 4, 5).
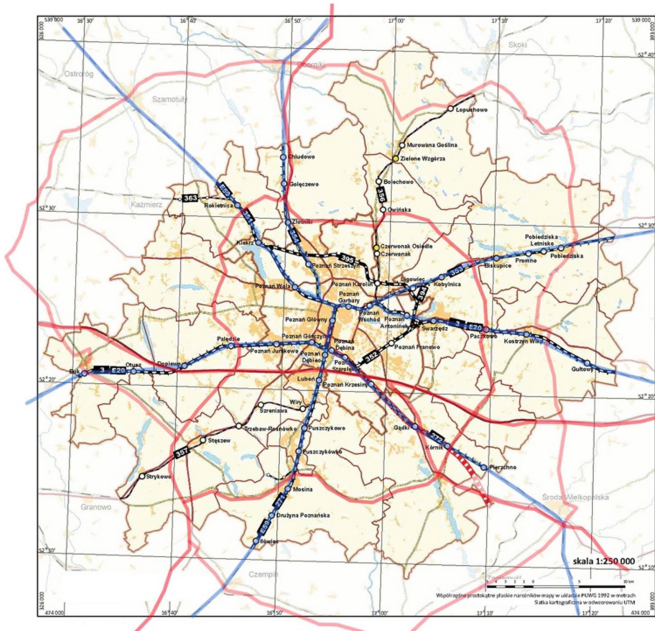
Fig. 1. Poznań metropolis. Layout of the existing transport network. Source [4].
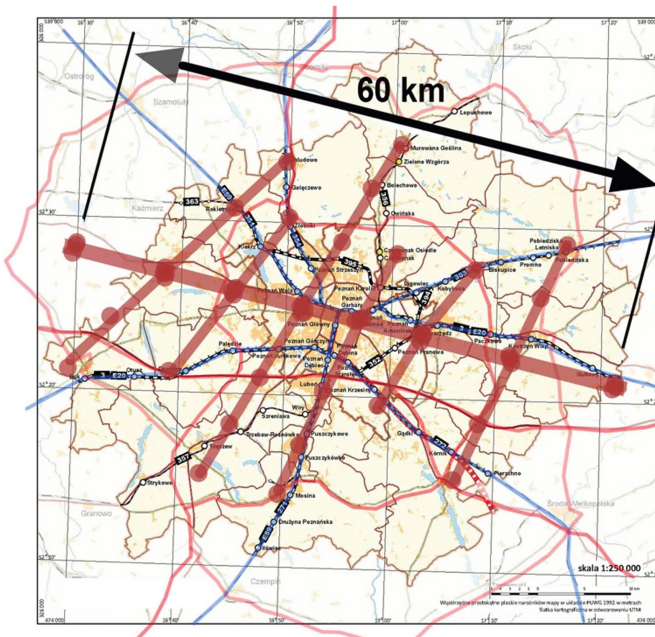

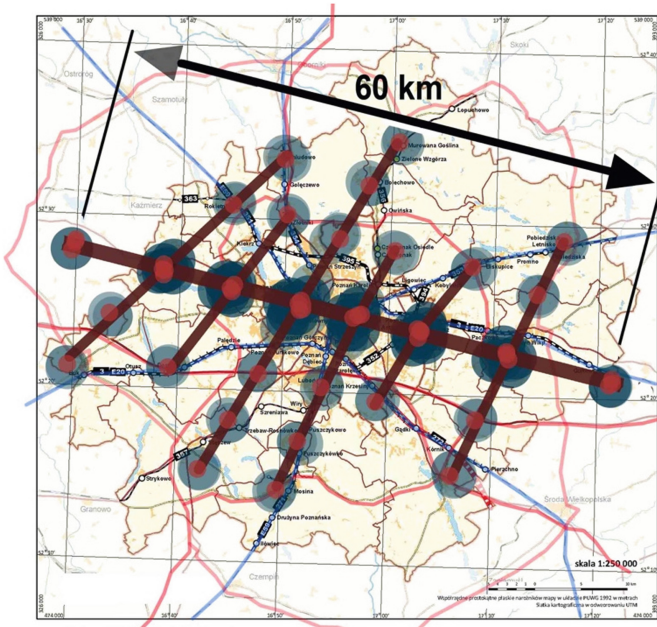**Fig. 2.** Poznań metropolis. The concept of a new comb transport system.

Fig. 3. Poznań metropolis. Compact development around the nodes of the new transport system.
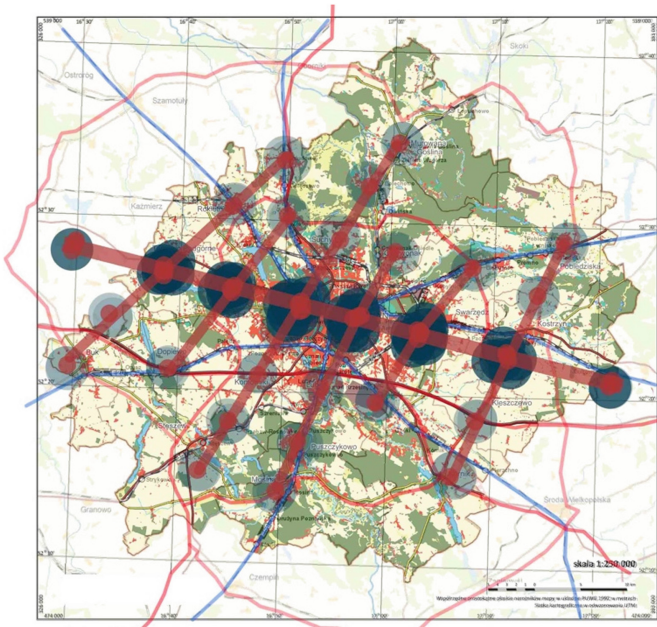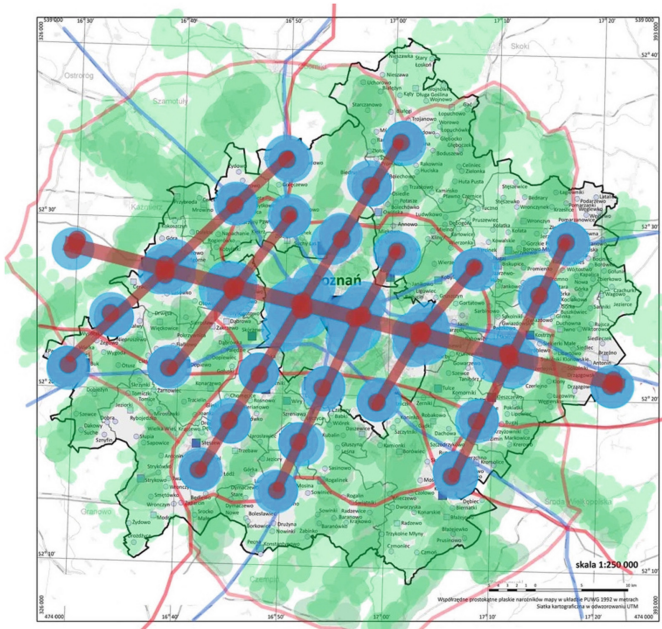

Fig. 4. Poznań metropolis. The concept of the new transport system on the background of the existing network of nature.

Fig. 5. Poznań metropolis. The concept of a new transport system. Access to green corridors within 10 min.

4 Discussion

The developed design concept refers to contemporary visions of sustainable cities. An example is the new city of NEOM The Line in Saudi Arabia, and experimental settlement units in China [6]. The analysis of the existing planning documents of the Poznań metropolis and the city of Poznań leads to the conclusion that traditional methods of transport development are ineffective and do not provide a sustainable environment for living, working, and relaxing. This leads to a decline in the attractiveness of the metropolis, which results in the migration of the most talented and creative residents.

The existing concepts of transport development lead to the deepening of the urban sprawl phenomenon, landscape degradation, and an increase in CO_2 emissions. The agglomeration is entirely dependent on external supplies of energy and food for residents and production plants. Air pollution, noise, and communication stress negatively affect the quality of life of the inhabitants.

Our concept presents a diametrically different vision of the Poznań metropolis based on a comb system of overground rail transport. Our design concept is characterized by the following features:

– transport services for residents based with public rail transport with a collision-free flyover above the ground,
– liquidation of passenger car traffic,

- Poznań metropolis as a place of residence for 1 million inhabitants,
- 300,000 jobs in the city,
- a city intended for pedestrians,
- all basic services such as schools, clinics, recreational facilities as well as green spaces are within a ten-minute walk,
- fast public transport that allows you to reach the city center in 20 min.
- dedicated transit traffic in the metropolitan area,
- elimination of passenger cars from the city area,
- sustainable management of water resources,
- 30% of the food produced in the metropolitan area,
- no emission energy supply from renewable sources.
- production based on knowledge and high-tech, will provide 40 million dollars of revenue to the gross domestic product.
  The comb-shaped rapid transport system is the urban skeleton of the metropolis. In the vertical section, the transport system consists of three levels:
- the basic level is intended for pedestrians; there are apartments, businesses, basic services, water reservoirs, and green areas,
- the underground level provides all the infrastructure necessary for the operation of basic urban functions; there is also a branched system for obtaining energy from the ground (heat pumps),
- the level above the ground is the "transport backbone" of the metropolis; its length is 60 km; fast rail transport on a flyover ensures collision-free transport connections with compact housing estates; it is expected that the maximum duration of transport connections will not exceed 20 min.

The metropolis will be powered by 100% clean energy from the earth, providing its inhabitants with a pollution-free, healthier, and sustainable environment. This concept aims to attract the most creative and talented people from Europe. The project is to be an economic engine that uses science, knowledge, talent, and creativity for economic development. The metropolis is to produce green hydrogen, superconductors and metamaterials, quantum technologies and intelligent medicine are to be developed. The goal is to export these technologies and processes that will be developed at the Poznań University of Technology and smart factories located in the city. Industrial, logistics and R&D centers will be integrated through digital networks connecting people, machines, and products. We are talking about Industry 5.0 (cooperation between robots and humans).

5   Conclusions

Our research has shown that decisive action should be taken towards a new philosophy of accessibility in urban areas, which should become a force attracting new technologies and new creative residents. As our analyzes have shown, the existing transport development projects are ineffective and do not ensure a sustainable environment. This leads to a decrease in the attractiveness of the metropolis, which results in a decline in the population. The existing concepts of transport development lead to the deepening of

the urban sprawl phenomenon, landscape degradation, and an increase in CO_2 emissions.

Based on the presented analysis, our vision of future development is a good basis for a public debate with the participation of urban planners, architects, engineers, economists, politicians, and journalists shaping public opinion.

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The Impact of Building Information Modeling Design System on Traditional Urban Design Methods

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Abstract. Implementing BIM technology can improve construction efficiency and the industry level and transform the construction industry from an extensive model to an intensive model. The leader of the change is "design." The emergence of new things has certain advantages over traditional things and has also produced a certain impact. The transformation of traditional design methods under building information models is mainly reflected in various aspects such as tools, thinking, methods, and expressions. It is foreseeable that this change will gradually stimulate the entire industrial system's re-innovation and mechanism from the initial project practice level. But will this new design technology completely replace the traditional urban design method? This paper will use the questionnaire survey method to study this topic to find the development direction for later industry research.

Keywords: BIM technology · Urban design · Traditional design methods

1 Introduction

Before the advent of CAD, urban architects and engineering designers used a ruler, lowered their heads, and outlined the buildings' blueprints one by one. The appearance of CAD much liberated the designer's labor. The emergence of BIM is destined to be another significant change. BIM's brand-new digital model system has a full life cycle role in urban design. Compared with traditional two-dimensional design methods, BIM has advantages in many aspects. More and more countries and the design industry have begun to use BIM as the primary design system, but will BIM completely replace the CAD for two-dimensional drawing in the future? What is the attitude of design practitioners in the construction industry toward BIM?

In countries where BIM is well developed, such as the United Kingdom, BIM is being promoted by the government, and many urban design projects are using BIM. However, in other countries with slower development, BIM is still very slow in accepting BIM, such as China and Poland. As an architect and educator, to fundamentally find the problems of BIM development and future research directions, professional designers and educators in the construction industry in China and Poland were invited to conduct a questionnaire survey.

2 Comparison of BIM and Traditional Urban Design Methods

BIM has a Full Life Cycle Effect on Urban Design. BIM has brought a second revolution in the field of engineering design. The application of BIM is not limited to design time but runs through all phases of the entire project life cycle: design, construction, and operation management; BIM can enable all participants in the project Professional team information sharing, architectural design professionals can directly generate 3D models, BIM in the entire project from upstream to downstream groups, to achieve information management throughout the project life cycle [1].

At present, the construction software has converted from 2D drawing to 3D simulation and accumulated the construction data and professional knowledge contributed by each professional field designer through the entire building life cycle. These data are stored to form a building Information model; other fields can obtain the required data and the building's information to be processed from the building information model to achieve data sharing and information reuse.

Hence, BIM is a database. Because of the building's life cycle, all the data and information exist in it. It is also a knowledge base gathered by accumulating designers' knowledge and experience in various professional fields. Therefore, the construction industry gradually integrates graphic and non-graphic information into this model to meet the entire life cycle's needs [2].

The BIM model results from establishing a 3D geometric model and an information model at the same time. The "building information" includes the design of the architectural space and the construction project's operation. The "model" refers to the description of the process and the simulation of the construction work. It can be said that BIM is a set of information models describing the building construction life cycle [3].

The Different Design Processes. In the traditional design process, the models and software used by each professional designer are usually different.

For example, in an ordinary urban design project, the architectural plan designer will use his drawing software and architectural design model in the early design stage. Structural designers usually refer to the architectural design's two-dimensional drawings to construct a structural design model and perform analysis and calculations in the structural model. If there is a conflict with the architectural design during the structural design process, they can only feedback on these issues to the architect. Modify accordingly [4].

On the contrary, the design process of BIM is entirely different. Both architectural designers and structural engineers are designing based on the same BIM data model. In the early stage of building design, structural engineers can participate in the design and do simulation calculations through BIM models. According to the structural design calculations and results, the BIM model has been directly modified accordingly. Simultaneously, the building model has a correct model that is automatically updated according to its calculated structure.

Urban design, from conceptual design to construction, will inevitably encounter many situations that must be coordinated and continuously revised. The traditional design process requires continuous communication to modify the drawings one by one, correct the 3D files, and compare the drawings with different related personnel, which consumes human resources. It is also difficult to execute the design effectively and accurately. Suppose urban design information comes from other platforms. It will not achieve complete information conversion, especially now that urban design projects are becoming more complex, and the design process based on BIM can effectively improve the above shortcomings. BIM integrates all information into one file. Based on the BIM model parameters, all data is also two-way related, with strong linkage.

The advantages of BIM over traditional architectural design are as follows:

- **BIM's 3D simulation visual design improves the quality of urban design.** Traditional urban design mainly uses two-dimensional floor plans for design communication, and two-dimensional images cannot directly present three-dimensional design images in the designer's mind. All relevant designers can only read the drawings repeatedly to understand. Simultaneously, because each designer's professional level and professional direction are different, understanding two-dimensional image reading will also be different. In large-scale urban design projects, many complex graphics will cause cognitive differences and communication risks.

  Conversely, when using BIM software for three-dimensional design, designers of various disciplines can visualize three-dimensional design images of planning, architecture, structure, hydropower, and urban facilities in detail. Through various professional BIM model inspections, you can avoid possible collisions or errors, detect in advance, and make a preventive response. You can also use animation or virtual live scene simulation to discuss what the results of future urban projects will look like, reducing design changes in subsequent stages and reducing the chance of design errors, and significantly improving design quality.

- **Combining BIM's simulation analysis and calculation functions to improve the benefits of urban design.** The most significant difference between traditional CAD drawings and BIM building information models is that traditional 2D drawings can never be intelligently analyzed and simulated. The 2D conventional CAD representation drawings are very similar to manual drawing, except that it is automatically realized by computer technology. Two-dimensional images use points, lines, annotations, or annotations to represent the form of building information. Although they are also digitized data, they are not necessarily useful information unless it can be calculated. These data must be artificially interpreted or estimated to get the information in the map file. In the BIM information model, the relevant information provided can be linked to the stored database. Therefore, in the BIM information platform, designers of various professions can use this design information and use the BIM digital model platform for analog analysis and Calculation.

- **Data integration of 3D models and evaluation of urban design projects.** In the BIM information model, each model component and each component created in the job can show 3D and 2D shape, size, and other appearance data and contain relevant information about the object. The efficient collaborative work provides the most

consistent information from design, construction to construction, and project management. Under this collaborative working method, each related project's participants can experience the later design results firsthand, and this BIM information model plays a considerable role in the entire design process. The information model integrates various relevant information about urban design and simulates the specific calculation information of urban design projects to accurately assess each design method and method during the design period.

3   Questionnaire

We have concluded that BIM has played a very outstanding role in urban design through the previous chapters. Using BIM to simulate the urban design, the designer can get all the relevant information of the designed project using the BIM analysis and evaluation. Through the BIM design platform, design projects can get the following benefits:

- Improve information coordination among relevant practitioners.
- Improve productivity.
- Minimize the risks and errors of design projects.
- Reduce expenditure and reduce investment.

As a pioneer in the use of BIM in the United Kingdom, his BIM development represents the reality of the world's BIM development at a certain level. Therefore, we can get a lot of inspiration from the British BIM survey report.

NBS in the United Kingdom began conducting a National BIM Survey in 2011 and conducted online BIM questionnaire surveys for construction industry practitioners in the fields of construction, engineering, and surveying. It has been 10 years so far. The survey results clearly show that the British government has achieved remarkable results after ten years of hard work since the white paper's publication on promoting BIM in 2011.

- In 2011, only 13% of people said they knew and were applying BIM. The survey in 2020 shows that it has steadily reached about 73%.
- In 2011, 43% of people said they had never heard of BIM, but in the 2020 survey, only about 1% remained.
- The survey on the application situation and outlook of BIM shows that 50% have already applied BIM as the main design tool, and 90% said that they will start to apply BIM within five years and will use BIM as their main choice of work [5].

So, after the emergence of this new design method, what kind of influence and effect will BIM have on traditional urban design methods? Will BIM's digital design system completely replace traditional design methods?

This chapter will use the questionnaire to conduct research.

Questionnaire Section One, About the Respondents

1. Your education level.
2. How long have you worked in the architectural design industry.
3. Your profession field.
4. Your knowledge of BIM.
5. Have you used BIM; How long has it been used?
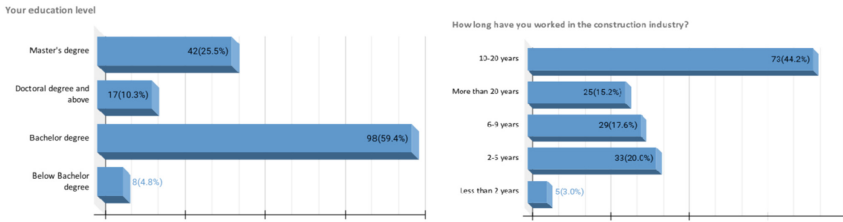
Fig. 1. Respondents' education level and work time in the construction industry.
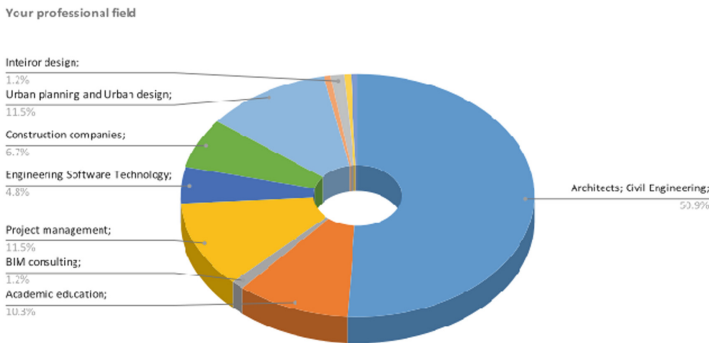

Fig. 2. The professional fields of the respondents.

The questionnaire was directed to specific designers, mainly in China and Poland. The questionnaire survey lasted one month and received a total of 165 responses. From Fig. 1, Fig. 2, Fig. 3 that 95.2% of the respondents have an undergraduate degree or above, and 69.2% have worked for more than ten years. Respondents' professional fields are mostly architecture and engineering design, followed by urban planning and urban design. Among them, 38.8% have good BIM knowledge, and 0.6% have never heard of BIM. In the use of BIM, 28.5% of people have never used BIM. It can be seen from this information that BIM is known to many people in the design industry, and more and more designers are beginning to use BIM, but there are not many designers who have experience and use it well.

Questionnaire Section Two, About the Respondent's Opinions. In urban design, the BIM design method is compared with the traditional two-dimensional design method.

1. BIM can save more time in the design phase.
2. The collaborative design of BIM makes the communication between related professional designers easier.
3. BIM design method can avoid the possibility of design errors.
4. BIM design method can reduce more design costs.
5. The analysis ability of BIM can make the cost estimation of the project more accurately and help the decision-maker to evaluate the design project.
6. BIM simulation visualization can more effectively express the designer's design intent.
7. Urban design projects involving BIM can make it easier for the client to understand design projects.
8. BIM evaluation method can analyze the advantages and disadvantages of different design schemes more accurately and provide accurate data support.
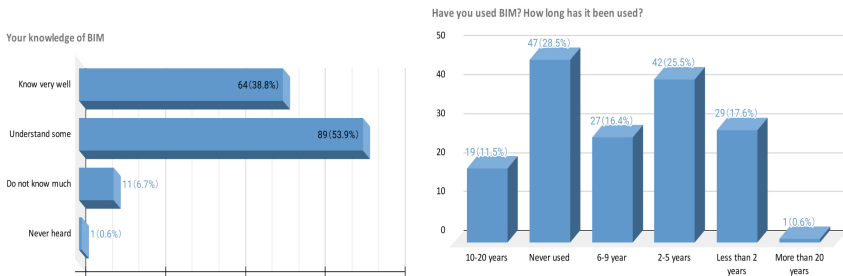
Fig. 3. The respondent's knowledge and work time on BIM.

It can be seen from the questionnaire survey results Fig. 4 in this section that, compared with the traditional two-dimensional design method, more than 84% of the respondents agree with the advantages of BIM in many aspects. But about 21% of designers believe that BIM cannot save design time and design costs.

Questionnaire Section Three. The impact of BIM on traditional two-dimensional design methods, comments from respondents.

1. BIM's digital information design method is and will continue to change the entire construction industry. What is your opinion?
2. BIM will change the way the entire design industry operates. What is your opinion?
3. Do you think BIM will completely replace the traditional two-dimensional design method?
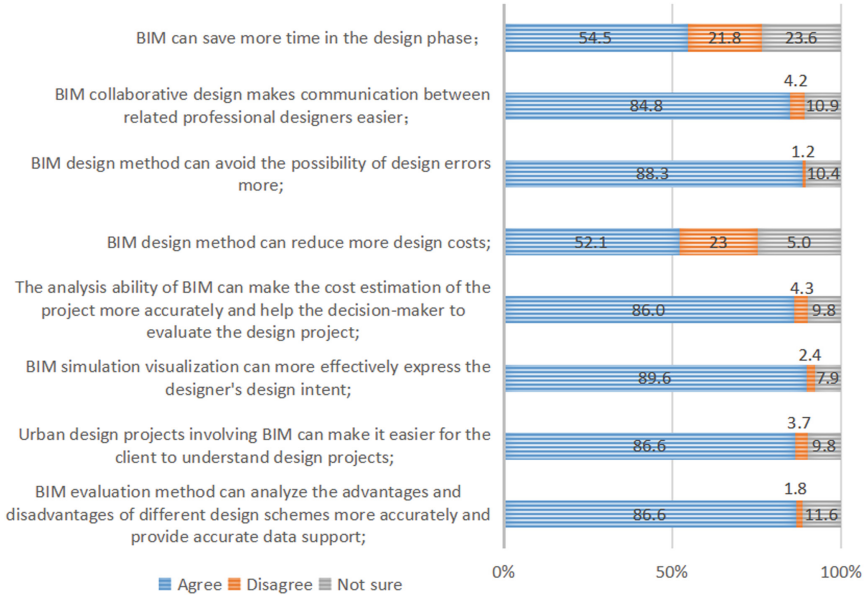
Fig. 4. Comparison of BIM and traditional two-dimensional design methods, comments from respondents.
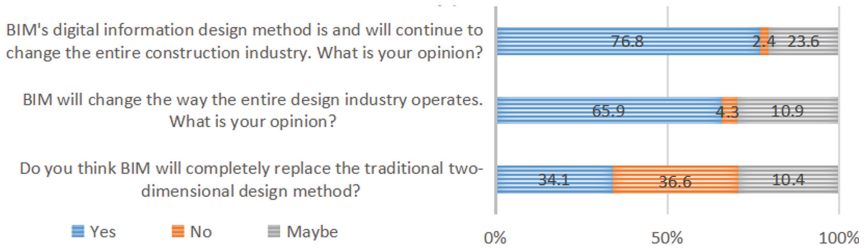
Fig. 5. The impact of BIM on traditional two-dimensional design methods, comments from respondents.

The questionnaire results in Fig. 5 shows that most designers believe that BIM will change the entire construction industry. But only 34.1% of designers think that BIM will completely replace the traditional two-dimensional design method.

4   Conclusion

BIM technology integrates three-dimensional models, and digital information changes the methods and concepts of traditional two-dimensional architectural design and improves information loss and disconnection in various links of architectural design, construction, and operation. The successful application of BIM technology in

construction engineering shows significant advantages in spatial modeling capabilities and process control capabilities as a brand-new and integrated working mode. BIM has had a significant impact on the traditional two-dimensional design method, but this influence is positive. At the same time, BIM also brings good development opportunities for urban design. If we want to have a better application effect of BIM technology, we still need our continuous exploration and practice.

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Public Space as a Metropolitan Network. Making the Bridge Between Policy and Design in Lisbon Metropolis

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Abstract. The article presents the research framework for "MetroPublicNet - Building the foundations of a Metropolitan Public Space Network to support the robust, low-carbon and cohesive city: Projects, lessons and prospects in Lisbon", a FCT funded three-year project initiated in 2021, which aims at mapping, decoding, assessing and discussing the result of 20 years of public space improvements in Lisbon Metropolitan Area (LMA). MetroPublicNet's main hypothesis is that public space, if conceived and shaped at the metropolitan scale, offers the possibility to interconnect and integrate various fields in search for synergic responses and can serve as a platform to assess urban policies and to strengthen territorial design practices. With a strong emphasis on human factors and societal engagement, the project is implemented in permanent interaction and open communication with institutional partners, practitioners, and society.

Keywords: Public Space Network · Metropolitan development · Urban policy

1 Introduction

In the wake of Lisbon's International Exhibition in 1998, Portuguese urban regeneration and rehabilitation strategies had a significant impact on the upgrade of public space in Lisbon Metropolitan Area (LMA), with hundreds of projects delivered. Especially under European Union (EU) funding frameworks, many public space projects have been delivered under the rationales of environmental resilience (i.e. water and flood management, green corridors, urban agriculture), sustainable mobility (i.e. transit systems, bicycle and walkable paths, traffic and parking control) and social inclusion (i.e. social housing neighbourhoods and precarious settlements, new local facilities), widening the scope and relevance of public space to contemporary urban form.

In sprawling territories, facing considerable problems of ecological fragmentation, urban dispersion and inefficient mobility, such as Lisbon's, a metropolitan approach is needed to articulate various systems and to promote a better-balanced distribution of resources and opportunities. This is a fundamental scale to coherently shape synergic,

continuous and connected networks, such as green infrastructure and transport. The same applies to public space as a transcalar and multidimensional structural network.

The article presents the research framework for "MetroPublicNet - Building the foundations of a Metropolitan Public Space Network to support the robust, low-carbon and cohesive city: Projects, lessons and prospects in Lisbon", a FCT[1] funded three-year project initiated in 2021, which aims at mapping, decoding, assessing and discussing the result of 20 years of public space improvements in LMA. MetroPublicNet's main hypothesis is that public space, if conceived and shaped at the metropolitan scale, offers the possibility to interconnect and integrate various fields in search for synergic responses and can serve as a platform to assess urban policies and to strengthen territorial design practices.

The article is organized in five Sections, starting with this Introduction. Section 2 presents the project's conceptual framework, Sect. 3 its Research Plan and Methodology and a concluding Section outlines a number of open questions that will be addressed during the research.

2   Conceptual Framework

The conceptual framework articulates four main fields of literature and policy guidelines, bringing together: a network-oriented approach to public space, a framework for urban and research public policy, a territorial contextualization and a social engagement perspective.

2.1   Public Space's Role as a Network

Public space is acknowledged as a structural urban and territorial system, which provides a range of socially valuable services and a central concept in contemporary discourse in urbanism, spatial planning and architecture, especially in Europe [1, 2]. As dramatically sensed through COVID19, public space is an essential realm where people thrive and bond together in society. Public Space engages with the political dimension, the governance apparatus and the discursive narratives associated with its planning, management and social role, raising the need to develop critical insight regarding its recent development [3, 4].

Public space can also be conceptualized as an infrastructure of the metropolis [5], an operative element to tackle complex urban territories and to articulate multiple networks and urban fabrics [6]. Public space can thus play various roles: ordering expansions, reconstructing the unplanned city, (re)structuring the metropolitan city [7]. Its mapping as a spatial structure can help trace its evolution and highlight critical territorial tensions [8].

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[1] FCT – Fundação para a Ciência e Tecnologia, I.P., Ministério da Ciência, Tecnologia e Ensino Superior, Portugal, project reference. PTDC/ART-DAQ/0919/2020.

2.2   A Relevant Focus of Urban Policy

Public space is acknowledged in EU Urban Agenda as fundamental in integrated and cohesive responses to today's structural urban changes and societal challenges. Fields in which this response has been discussed – with contributions from MetroPublicNet team – include: 1) climate change and nature-based solutions [9], waterfronts and water sensitive urban design [10, 11], urban agriculture [12]; 2) spatial integration of road infrastructure [13], promotion of accessible, walkable and transit-oriented development [14]; 3) neighborhood connection and accessibility [15], multi-functionality and commercial vitality [16].

Recent public space interventions in Europe have been developed as responses to these challenges, pursuing various strategies, spatial configurations and scales of intervention [17, 18]. Nevertheless, there is still a significant research gap in territorialized linkages between public space design rationalities, specific societal challenges and EU/national/metropolitan/local policy tools, which the project aims to address.

On the other hand, planning frameworks in which hard (normative) and soft (project-oriented) tools intermingle in fuzzy configurations, along with new management processes (i.e. public funding criteria, local partnerships in project management and community-based maintenance and keeping), require innovation in policy and design tools [19]. The contributions of regional design [20] and territorial design [21], both calling for more spatialized, mapped and designed approaches can offer valuable insight into new tools in this field.

2.3   Public Space in Lisbon Metropolitan Area

LMA shares relevant spatial patterns with many European metropolises, namely those of fast, intensive and discontinuous growth in the second half of the 20th century, and its problematic results in terms of fragmentation and splintering [22, 23]. On the other hand, it also shares a pattern of structural change in its territorial dynamics, with a decrease of greenfield urban growth, and a rise on urban and territorial requalification and regeneration projects, especially in the past 20 years [24, 25]. Urban policies have accompanied this trend not only through normative planning tools - with greater restriction to urban sprawl – but also by actively promoting urban projects framed under the scope of sustainable development and societal challenges [26].

In line with EU policy agendas and funding frameworks, and with the involvement of various levels of government and different sectoral actors, many public space projects have been delivered in LMA under the rationales of environmental resilience, sustainable mobility and social inclusion [27]. Municipalities are key players in setting up programs targeted at urban heritage districts, environmental qualification and promotion of soft mobility [28]. Public space projects started to be seen as parts to be progressively assembled into wider urban and territorial networks [8, 28, 29]. They are also delivered in heterogeneous and hitherto peripheral locations, other than historical districts [24], acknowledging the metropolitan diversity and the need to foster territorial cohesion and a balanced urban development.

However, existing literature didn't establish a systematized approach between public space upgrade, their rationales and impact at metropolitan level nor on its future

development prospects. MetroPublicNet will contribute to bridge this gap, using Lisbon as a relevant, complex and dynamic research object, with potential interest for the national and the international knowledge and practice-oriented fields.

2.4   A Bridge Between Research, Policy and Society

Portuguese territorial policies [30] aim at the promotion of integrated and systematized territorial knowledge, communication and dissemination processes, namely through ICT, between administration, urban agents and citizens. To pursue this aim, significant experience and lessons can be taken from Barcelona Municipality and Metropolitan Area (i.e. [17, 31], where consistent dissemination on metropolitan public space projects is in place, together with other initiatives such as CCCB's European Public Space Prize and its online database (publicspace.org/works). Other international sources of interest include Project for Public Space (pps.org). INFOGET and Atlas Digital are two tools currently being developed by LMA; many municipalities in LMA have online GIS sites (i.e. LX Dados Abertos), mostly focused on urban planning and services location; however, they have limited information on public space projects.

MetroPublicNet can offer a valuable contribution for monitoring integrated territorial development and to deepen the engagement between policy-making and research regarding public space in line with the priorities of ESPON [32] and JPI Europe Strategic Research Agenda [33].

3   The Research Plan

The project focuses on LMA's public space improvement experiences to assess and discuss its rationales and impacts, particularly under a metropolitan perspective. Additionally, the project explores innovative territorial design practices in search for synergic responses and as a contribution to building a metropolitan identity.

While acknowledging public space complexity, the project engages with three rationales associated with the sustainable and integrated use of land and territorial resources: 1) blue & green infrastructure, 2) walkability & active mobility, 3) neighborhoods connection & cohesion. The implementation of public space projects under these rationales requires a systemic and coherent approach which relates with other established networks (i.e. ecological, transport, urban facilities), considering it as an opportunity and a potential tool to improve responses, especially in metropolitan territories. Intrinsically, its contribution may go beyond LMA and contribute towards a founded perspective for the urban policy, planning and design across borders.

Therefore, the project pursues three main objectives:

– A contribution to the national and European discussion regarding territorial policy and design at the metropolitan scale, particularly on the role of public space as a tool for metropolitan integration and identity-building;
– A contribution to the critical assessment of public space improvement projects in LMA in regard to 1) their framing under key societal challenges and 2) their contribution to build coherent and integrated territorial networks;

– A contribution to public space design and policy recommendations and guidelines, through collaborative partnership between the university, administration and civil society.

The project's temporal framework (1998–2020) and spatial focus (LMA) provide a rich and diverse ground to learn from. It is a period during which LMA faced a transition from a long-standing development model based on sprawl to a compact and regeneration-based planning model; on the other hand, LMA has been a testbed for various urban development policies, namely those with EU funding, requiring critical assessment and evaluation for future adjustment.

Public space is subject to diverse fields of jurisdiction and planning, management and financing frameworks. In this regard, public space data will be collected from various levels and sectors of public administration, namely i) central administration and state business sector and ii) the 18 LMA Municipalities and municipal/intermunicipal companies.

MetroPublicNet will be developed through a research flow in which four stages sequentially developed in time are in permanent interaction and feedback between the research's object and conceptual core (the Metropolitan Public Space Network) and a continuous ring of open communication with partners and society. The four linear steps (Map & identify, Characterize & understand, Analyze & discuss, Design & recommend) will be focused on the research object (LMA public space improvement projects in the past 20 years), while the conceptual core will establish the link with stakeholders, community and state-of-the-art scientific knowledge. Communication is therefore acknowledged as a transversal and vital component to promote a dynamic and interactive flow of information between the project team, its partners, academic institutions and the civil society.

The research plan is organized in six tasks:

Task 1 - Conceptual framework and methodological assessment - will refine the conceptual framework in line with international literature and to make the research's operational and methodological adjustments, in cooperation with institutional partners, experts and consultants.

Task 2 - Mapping public space improvement projects in LMA - is regarded as the project's backbone in terms of data collection and systematization. It aims at building the comprehensive archive of public space projects that will allow subsequent discussion and feed the online, open-access and geo-referenced database on public space improvement projects in LMA. This database provides an evolutive map of interventions and can be used to draw multiple sets thematic maps and layered data, and define a dashboard based on indicators powered by the georeferenced database.

Task 3 - Case study insight - will analyze in depth a selection of public space improvement projects as case studies, focusing on its rationale, planning and development process, its local scale spatial and systemic characteristics and its larger integration in territorial networks.

Task 4 - Decoding the rationales, synergies and impact of public space projects - provides a multi-method assessment and critical discussion on the public space case

studies' (task 3) rationales, synergies and potential contributions to the development of a MPSN.

Task 5 - Territorial Design toolbox for a Metropolitan Public Space Network - develops a forward-looking perspective regarding the lessons learned from the experience on LMA's public space improvement projects. It is a design-oriented exercise in which the hypothesis of a Metropolitan Public Space Network is tested, discussed and framed in its key components, further systematized in policy recommendations. This toolbox is two-fold: 1) a future looking, spatialized and design-oriented exercise to explore scenarios regarding the building of a MPSN; 2) a policy-brief with a set of recommendations and guidelines to inform territorial policy.

Task 6 - Dissemination, public engagement and development of institutional partnerships - is aimed at the promotion of diverse and robust communication channels and outreach between the scientific community, the institutions and society, in order to facilitate information and knowledge exchange and to maximize the impact of MetroPublicNet.

4   Conclusion and Open Questions

After two decades of important changes in the urban and metropolitan landscape in Europe and, specifically in Portugal's capital metropolis, it is still unclear to which extend public space interventions are effectively contributing to tackle urban challenges in a systematic and coherent way at the metropolitan scale. Therefore, the critical question of this research is whether public space should be conceived and shaped at that scale, in order to provide an integrated and coherent network, capable of efficiently responding to the challenges of urban robustness, low-carbon mobility and territorial cohesion.

From this point of departure, three other questions unfold:

1) to which extent did recently delivered public space projects incorporate specific policy and disciplinary rationales and respond to emerging societal challenges?
2) if conceptualized, planned and designed at a metropolitan scale, can public space maximize territorial synergies and integration?
3) can the identification and conceptualization of a MPSN be an opportunity to build a missing and socially identifiable metropolitan identity?

Aiming to bring light to these questions, the project is committed to scientific and societal impact by improving the link between public space qualification initiatives, metropolitan integration goals and key national and European development agendas.

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Revitalizing Traditional Villages Through Adaptive Design Strategies: Selected Case Studies of Chinese and French Traditional Villages

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Abstract. Traditional villages still play an important role because of its historic value and cultural Identity under the global urbanization wave nowadays. How to preserve the heritage culture and regenerate the traditional villages is a key issue to be concerned during rural revitalization process. In this paper, the adaptive design and experienced strategies will be clarified in this paper based on the selected case studies. The case studies from Chinese Traditional village named Shuiyucun and traditional village Espelette from France will be analyzed in the research. It is essential to analysis from the aspects of spatial planning, design methods,architectural style, layout of yards and non-material forms of cultural heritage in the traditional villages as well as heritage preservation, and fork religion,rural regeneration as well as sustainable development of the traditional villages. The experience of developing rural tourism and rural planning concept as well as smart design methods could be used as the guidance of regenerating traditional villages in China and in Europe.

Keywords: Traditional village · Adaptive design · Rural architecture · Strategy · Locality

1 Introduction

With the rapid urbanization growth during the past decades in China, which has highly raised up the big challenges to the rural areas. The big problem of rural decline suffering less population in turn challenges the urbanization sustainability in China. By investigating China's new-type urbanization strategy, it draws concerns about future rural development which is less mentioned in the plan. It calls for realization and actions to revitalize the countryside so as to be adapted to China's new-type urbanization plan [1].

Strengthening the Publicity and Promotion of Organic Agriculture is supposed as a good example for boosting rural revitalization in France. Development of ecological agriculture, tracking and assessing development status, promoting information

exchange and coordination, the French government established Eco-Agriculture Development and Promotion Agency in 2001. After the establishment of the institution, it actively played its function of uploading and releasing, which promoted the connotative and normative development of ecological agriculture [2].

Recognizing and strengthening the role of Rural community is long term strategy to keep rural areas developing in Europe. It may be concluded that the rural development experience in the European Union currently responds, more than in the past, to the two functions – sectorial and territorial, which the rural areas need. Hence, the multiplicity of functions and possible guidelines for rural areas should be given more positive relationships that are mutually enhanced [3].

One of the priorities of traditional village protection is to protect the most common landscape pattern of harmony between man and nature. Environmental quality of the village. The most basic strategy of control is site selection and traditional Feng Shui model. The landscape pattern formed. Current development and protection of traditional villages Research, mainly focused on qualitative value research, evaluation system, tourism development, village spatial form and layout, and building.

Research on the combination of qualitative and quantitative single objects. The architecture of traditional settlements has been a living and invaluable testimony to the historic memory of each place [4].

Traditional Architecture, as a complex of the inhabitants vibrant manifestation to express how identity and sustainability are in accordance with nature, surrounding environment and culture.

Lots of traditional villages in China have been developed in different ways through various ways in order to realize the rural revitalization. In the process of development, it focused on solving the problems of the loss of labor in the traditional villages, the backward development of rural productivity, and the declining of traditional culture [5].

With the point of natural environment adaptability based on the village layout, In the process of rural revitalization in many regions of China, conservation was carried out for its landscape features with traditional Chinese characteristics and ecological wisdom. Regeneration is not only the protection of the traditional village landscape, but also adaption with micro-climate in the site including ecological wisdom.

It outlines the future challenges in fostering a strong rural innovation system. The rural innovation system proposed makes direct contributions to the literature of rural studies, innovation system, and public policy, and offers both China and the world a new perspective for realizing rural revitalization, anti-poverty and global sustainable development [6].

2   Study Area and Data Collection

The case studies were collected from the traditional villages which are facing to the modernization and declining in China and in France separately. The Shuiyu village from Northern of China is selected as the case study. In the research, Espelette located in south-western France is taken as the case study in this paper.

Most of the examples were collected and been analyzed by the design works from the students in field of Architecture from Poznan University of Technology based on the Rural Architecture design projects.The traditional villages pilot areas were chosen according to the grant "Research on Ecological Protection and Rural Landscape in Ancient Villages in the Countries Along the Belt and Road Initiative—The selected Case Study and Comparison of Ancient Villages in China and Poland". Regarding to the Chinese traditional villages,the pilot area for research and design were focusing in northern region of China.

The both sides of the case studies were tried to be applied into the project how revitalize the traditional rural areas where are facing the declining of population and economy because of big movement to the cities.

3   Results

3.1   Revitalizing the Traditional Village Through Special Local Agro-Products

Espelette is very attractive because of its traditional houses style with popular red peppers hanging which formed an unique landscape in rural area. As red pepper is the main agriculture products in local region and Espelette is known for its dried red peppers while the local residents smartly adapt the special local products into the housing decoration. From the spatial layout analysis, we can see the inhabitants and main public buildings for service are located in the centrum of the village while it is surrounding by vast agriculture fields as we can see from Fig. 1.

The local red pepper can be used as whole or ground to a hot powder but also used as decorating the local houses which form a unique landscape as shown from Fig. 2 and Fig. 3.

By means of promoting the local agro-products during the process of revitalizing rural area, it is no doubt a very smart strategy to develop the agro-products and rural tourism as well.

Although rural tourism has been developed in many rural areas in China, but combination with real local products and tourism is still a very good way to be promoted and developed.

The inter-relationships between tourism and agriculture can bring a good income for local farmers and the inhabitants who are living on renting and business.

In a word, it is beneficial to promote such model in agricultural activity in order to realize the real rural revitalization.

RESTAURANT ● HOSTEL ● TOURISM ACTIVITIES ● SCHOOL ● SUPERMARKET ● CHURCH

**Fig. 1.** Function analysis of existing buildings in Espelette Drawn by M. Zhou

Fig. 2. The hotels with hanging red peppers in Espelette forming the edible landscape source: from Google map street view.

Fig. 3. The houses with hanging red peppers in Espelette forming the edible landscape source: from Google map street view.

3.2   Analysis of Spatial Planning of the Traditional Village

The spatial planning of Shuiyu village was analyzed during the deep research and analysis in the village. The layout of the village is very clear with the cross axis based on the south valley in blue color and the river drawn in blue color as it is shown in Fig. 4 *and* Fig. 6. the Nanling Ancient Commercial Road and the water system are clearly distributed in both sides of the village. The layout of the village combined with the natural terrain which is corresponding to the traditional Chinese paten of *Fengshui* the shape of a *Yin* and *Yang* fish. The overall architectural style is distinguished along with the axis in the village Shuiyu. It showed us from Fig. 5 and Fig. 6 that traditional courtyards and old houses are mostly located in in Eastern Street and they are well preserved, but most courtyards are vacant until nowadays. And there are less traditional residential houses are located in western street but it is valuable to keep them from historical resources. Among all we found that modern buildings and houses are located in middle street and southern street of the villages based on the basic street layout. The texture is simple and clear divided into 6 rows according to elevation. The preservation of wooden architecture and maintaining its value can be achieved through conservation, adaptation, renovation and reconstruction (Fig. 7).
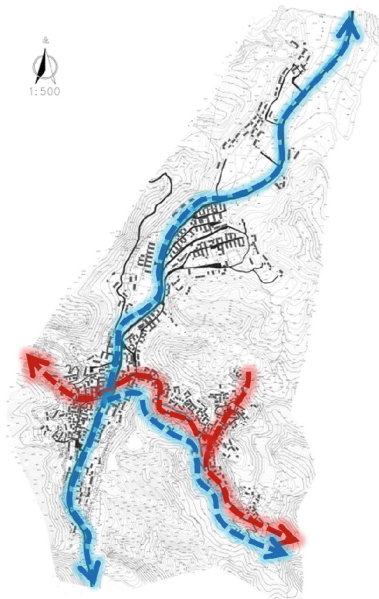
Fig. 4. Analysis of Shuiyu Village based on the Axis Cross red color is representing the South Vally Cross Blue is repressing the river

Fig. 5. Analysis of the main streets in Shuiyu village Source from ling qi research team
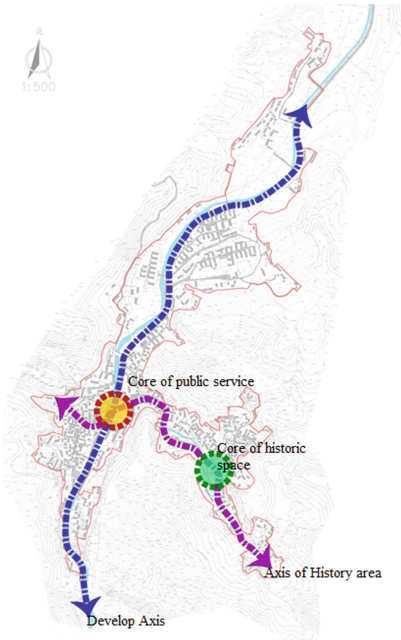
3.3 History Preservation and Local Culture

Based on an important historical and cultural node in Jingxi, Shuiyu village is located in the joint of historical and cultural corridor in Western Beijing and it is an important period of Fangshan local Cultural Route as we can seen from Fig. 6. Comprehensive evaluation of a type of courtyard refers to courtyards with well-preserved courtyard morphology, historical features, and enclosure.

According to Chinese rural historical preservation reference, comprehensive evaluation of existing courtyards has been done in Shuiyu Village.

They are divided into four different types. In term of historic value and culture identification in good condition, the courtyards are considered as Class I Countyards. The courtyard morphology, historical style, and enclosure are general, and are in harmony with the overall style of the village. It refers to courtyards that can be renovated or reorganized as the first-class courtyard as shown in from Fig. 6 and Fig. 7.

The courtyard layout, historical style, poor enclosure, or environment, mainly includes a large number of modern residential buildings, which are named to be classified Class II.

If there is no historic value and quite bad locations, hoses courtyards are considered as Class III as shown from Fig. 7.

Fig. 6. History and local culture related with tradition analysis based in Shuiyu Village

Fig. 7. Bookstore built in Xiadi village in Pingnan county, Fujian province. The bookstore

3.4   Adaptive Design Related to Local Religion and Tradition

The local inhabitants have been controlled by the local religion for long time and the temple is the most often place going to pray or meeting point, which is actually kind of tradition in many villages in China.

During rural revitalization, how to preserve the religion and relief is a quite hard problem to solve? And how to preserve and renovate those old temples in proper way are deserved to be rethink? In the research, the abandoned temple in the villages is analysis and adaptive strategy is proposed as the renovating historical building inn rural area and it is deserved to be respect and give big concern to it.

This Ning Temple in Shuiyu village is located in the center of village along the river. As we can see from Fig. 8. It was built in Qing dynasty and occupy 152 m². Niang temple is the place where villages pray for goodness and health for the children and they believe the female god will protect their children in daily life. The Niang Temple was built from local wood and it is still preserved well in the basic structure with a pitched roof. The adaptive design is combing the convenient location and good materials as well as the traditional layout of yards.

The yard can provide the public space for villages to have meeting and some events. More greenery plants are suggested in the adaptive design in order to form as a small rural park based on the new renovated temple. The concept is adapting the

backyard surround by row of pine trees and front yard face to the river, which is repressing good fortune corresponding to traditional Chinese *Fengshui*.
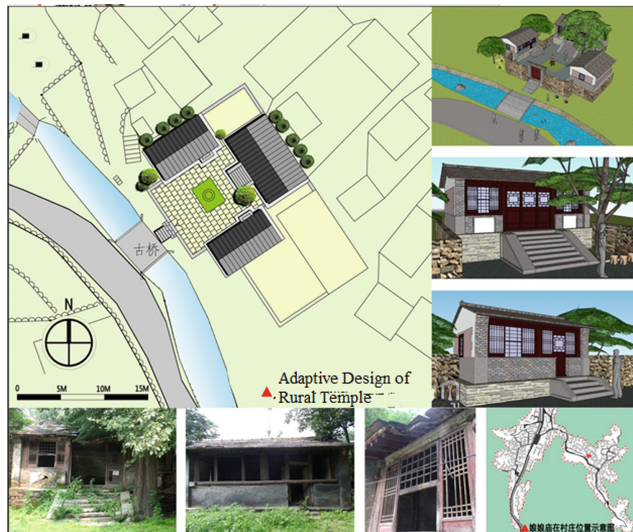
Fig. 8. Traditional rural timber buildings in Shuiyu village and modern houses uses the adaptive design based on the structure of old houses. It was drawn by Ling Qi research team.

4   Conclusion

Through the analysis of spatial planning on traditional village Shuiyu and Espelette, the initial idea of layout in the village reflects the willingness of original inhabitants connecting to nature or historical places. It is essential to preserve the original smart concepts and adapt the actual conditions to be modified in order to achieve the sustainable development together with the local inhabitants and its' own characteristics. Special buildings or courtyards which represent culture identification, tradition, fork religion had been elaborated in also in this paper. The research also shows us that the rural architecture is smartly adaptive into the modern design with the aspects of using local materials, culture identity, tradition and fork religions as well as intervention of modern culture. The cases studies in the paper have proved that regenerating rural design projects are quite often considering those aspects as the tradition, folk culture, customs, villagers' creation, history and fork religions and many other factors into. The identity of Chinese culture is deeply rooted in the countryside, and it is also the key factor to revitalize rural life through culture identity. We have also realized that it is important to understanding the complexity and flexibility of local villages having interaction with the rural cultural governance and modernization as well.

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Gentrification in Medium-Sized Ecuadorian Cities in the Current Context of Territorial Planning: Literature Review

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Abstract. This article reviews the literature on the study of the gentrification phenomenon with emphasis on the mutation that it has experienced from the 1960s to the present, differentiating its various consequences that depend not only on the country analyzed but also on the scales of the city from which the problem develops. Through this analysis, a prior theoretical framework is developed that is capable of supporting the effects of this phenomenon in intermediate cities of Ecuador in a context of territorial planning.

Keywords: Gentrification · Territorial planning · Medium-sized Ecuadorian cities

1 Introduction

From 1960 gentrification phenomenon has been widely studied in global cities in the northern hemisphere. These analyses reveal socio-economic consequences that are generated from the implementation of regeneration, rehabilitation or urban renewal projects. Interventions increase the capital gains of frequently deteriorated neighborhoods are promoted by both the government as well as the real estate sector. On the other hand, some authors identify gentrification as a normal consequence within the development of a city and can be interpreted as positive. In both cases, gentrification results in the displacement of a neighborhood's popular classes by making their stay in the neighborhood economically unsustainable. In Latin American territory the phenomenon is replicated in capital cities and other metropolises but, a degree of mutation of the phenomenon can be noticed in medium-size cities. This research shows that the analysis of the gentrifying phenomenon is considered to be a phenomenon typical of large cities. Thus, its frequent generalization prevents a correct analysis within the Ecuadorian context and specifically in intermediate cities. Medium-sized cities have not fully developed so the gentrifying phenomenon can still be stopped or avoided.

2   Literature Review

Analysis of gentrification began in the sixties with the help of Ruth Glass, renowned geographers, sociologists and urban planners have contributed towards the end of the 20th century and the beginning of the 21st with important qualitative and quantitative data in this regard. phenomenon, you can name for example: David Ley, Peter Mercuse, Neil Smith, Chris Hamnett, Tom Slater, Paul Dutton, Jamie Peck, etc. But it is important to highlight that towards the second decade of the 21st century researchers such as: Jorge Insulza, John Betancur and Michael Janoschka; They already agreed on the lack of empirical evidence to support an in-depth analysis of gentrification in South America. Thus, in the first instance, the academy has tried to contextualize the phenomenon within the Latin American territory, obtaining results that are directed towards the characterization of problems such as: a) the division of the city into areas resulting from the presence of urban poverty and exclusion social, b) condominiums and other new housing trends promoted and even subsidized by national governments and c) global consumers with medium economic power called gentrifiers [1, 2].

This characterization would lead to the immediate assumption that the expansion of the phenomenon beyond an urban boundary may constitute a predominantly Latin American feature. However, before conjecturing this, it should be remembered that David Parsons (1980) had already observed rural gentrification processes in the United Kingdom, attributing the following causes: a) a colonizing approach of the middle class that moves towards a suburban lifestyle - rural, b) changes in the landscape as a result of real estate investment based on capital accumulation due to the application of a post-productivism model, c) changes in residential supply and demand in relation to policies for obtaining housing, and, d) attention in the debate of the classic theories on gentrification directed to the production - consumption. Continuing with this approach: Neil Smith, Martin Phillips and Eliza Darling, come to show that gentrification is not an exclusively urban phenomenon, since after analyzing the differences between urban and rural gentrification they come to determine identical economic and economic conditions. social processes that promote gentrification in both cases. After the beginning of the 21st century, the classic notions of gentrification expand due to a more systematic understanding of the effects caused by other actions. Another action consists of the sale of a postmodern style through advertising oriented to the commercialization of a global architecture and lifestyle, a fact that also leads to a new colonization, especially cultural. In addition to this mutation on the classical notions of the phenomenon, the maturation of the theory also led to determine that not only first world cities suffer the effects of gentrification as explained by Martin Phillips. This statement is essential if one considers that half of the population does not live-in metropolitan cities, since it is unavoidable to carry out an investigation on the effects of gentrification in smaller-scale cities belonging to the same territory [3].

Loris Servillo emphasizes that, within the European Union, small and intermediate cities were largely relegated from government priorities, evidencing the lack of correct policies for housing, education, transportation, etc. Given that the theories and methodologies used in large metropolises were largely adopted, without observing that secondary cities, having a lower degree of complexity than metropolitan ones, found it

easier to respond comprehensively as a community to exogenous agents and thus also understand their own structure in a structured way. local situation summarized by Josselin Tallec. It should be noted that in the 2020 Territorial Agenda, European Commission recognized the fundamental role of small and intermediate cities for spatial and territorial development, motivating urban planners to improve the accessibility of urban centers from rural territories with the aim of to provide services. and employment to the territory [4].

The debate and analysis of intermediate cities in Latin America began around the 21st century with the research of Carme Bellet and José Llop that continues to the present day. In recent years, exponents can be cited such as: Francisco Maturana, Jorge Insulza, María Gudiño, Alfredo Otero, among others, who address, among others, the importance of a differentiated planning of secondary cities. In the Ecuadorian context, it is essential to highlight the interest in the planning and implementation of models of eco-cities and intermediate cities as part of the policies that favor the quality of life of human settlements as established in the National Plan for Good Living, which raises as a desired model the formation of a polycentric network, in which intermediate cities contribute to improving demographic imbalances through guidelines focused on: a) controlling the urbanization processes induced by projects of national relevance, b) consolidate human settlements that contribute to reducing the demographic pressure of cities, c) control the expansion of human settlements, d) promote equity, inclusion and social cohesion, through better articulation and, e) control expansion of human settlements, promoting their consolidation and growth vertically to avoid affecting the lands with an agronomic-productive vocation. Note that within this Plan, the gentrification phenomenon is identified as a risk, but only as a consequence of the effects of the urban regeneration of the public-physical space promoted by local governments, and not in all its central public-private dimension - peripheral and urban - rural [5] (Table 1).

Table 1. Gentrification research chronology.

Year	Author	Description
1964	*Ruth Glass*	She coined the term gentrification on the questioning of urban changes by the effects of displacement of the working class generated by the middle class
1980	*Oxford Dictionary*	Gentrification: Movement of middle-class families towards the interior of urban areas causing an increase in property values and causing a secondary effect of displacement to poorer families
1980	*David Ley*	Gentrification is considered to be the spatial manifestation of inhabitants who graft new cultural values to a neighborhood (social diversity, tolerance, permissibility of differences, etc.). Although gentrification produces displacement, it constitutes a process of social emancipation of the city
1980	*Shirley Laska*	Gentrification leads to displacement

(*continued*)

Table 1. (*continued*)

Year	Author	Description
1984	*John Palen*	Gentrification leads to displacement
1984	*Peter Marcuse*	Studies in New York: Theoretical differences between abandonment and gentrification as opposite poles of a simultaneous and inevitable process
1986	*Neil Smith*	Gentrification leads to displacement
1986	*Peter Marcuse*	Gentrification leads to displacement; public policy must minimize this effect
1986	*Robert Beauregart*	Recognize gentrification as a chaotic concept
1988	*Caroline Mills*	Urban-architectural renewal as a gentrifying action
1989	*David Harvey*	Neoliberal Urbanism: Neoliberal policies promote privatization and colonial-mercantile expansion
1991	*Chris Hamnett*	The interest in gentrification is due to: a) it constitutes a new phenomenon in the field of geography and sociology, b) it changes traditional theories about social structure and residential location, c) it represents a problem between regeneration and displacement, d) It is seen as an edge of contemporary restructuring, and, e) is the theoretical and ideological key in the debates within urban geography
1991	*Saskia Sassen*	Broader meaning of gentrification linked to spatial economic and social restructuring processes
1994	*Eric Clark*	Gentrification stresses the local against the global, the modern against the heritage, and the cultural against the economic
1996	*Neil Smith*	Gentrification leads to displacement
1998	*Julie Podmore*	The mass media reproduce the value and meaning of gentrification as a habit of life in apartments such as suites or lofts in New York
2000	*Neil Smith*	Gentrification: The reinvestment of capital in urban centers, which is designed to produce spaces for classes with a lower income than the original occupants. The term coined by Glass in 1964 has been used to describe residential aspects of this process but it is changing, tentrification is evolving
2000	*Ash Amin*	Different types of gentrification: a) rural gentrification, b) gentrification by new construction, and, c) super gentrification
2000	*Rowland Atkinson*	Displacement is extremely difficult to quantify, it is to measure the invisible. It is difficult to find displaced people, particularly if they are poor. They disappear in the censuses, and it may appear that displacement does not exist
2001	*Gary Bridge*	Commercial gentrification, bouticficación or gentrification of retail trade: Refers to the transformation of residential areas into commercial areas

Table 1. (*continued*)

Year	Author	Description
2001	*Neil Smith*	Fourth wave or Pro-gentrification: The effects of State intervention by drastically changing economic policies aimed at financing housing combined with polarized urban strategies
2002	*Carlos de Matos*	Globalization originates a process of metamorphosis in Latin American urbanism through a process of capitalist modernization
2002	*Tom Slater*	The study of gentrification cannot be separated from the geographical context
2002	*Neil Smith*	Mutations derived from gentrification. Identify displacement due to class oppression Gentrification is a global urban strategy that regulates the market. Gentrification occurs in different geographical contexts under global strategies and can spread in different ways and patterns
2002	*John Betancur*	Gentrification is a process of accumulation, abandonment, speculation, displacement and abuse
2002	*Darren Smith*	Studentification: It refers to the changes in social, environmental and economic processes carried out by considerable groups of university students that invade specific areas of cities
2002	*Peter Byrne*	Gentrification is a positive process. In the case study carried out in 1990 in New York, it is found that the displaced represent only 5.47%
2003	*Paul Dutton*	The risk associated with gentrification is probably higher in small towns, small town policies adopt gentrifying policies of grater cities in their plans
2004	*American Heritage Dictionary*	Gentrification: The restoration and improvement of dilapidated urban property by the middle classes leading to the displacement of low-income classes
2004	*Elvyn Wyly*	Gentrification leads to displacement
2005	*David Harvey*	New imperialism: recomposition to the theory of original accumulation proposed by Karl Marx. Territorial expulsion based on force exerted by the State when facilitating by omission the privatization of public property and the dispossession of the right to the city
2005	*Nicole Gelinas*	Hurricane Katrina was related to the fourth wave of gentrification in the US. Post-Katrina politics
2005	*Rowland Atkinson*	In the context of contemporary gentrification, a new urban colonialism is implicit, mercantile expansion has been exported from the North American metropolises to western Europe and new territories
2005	*Lance Freeman*	Gentrification cannot be considered an isolated phenomenon, different processes in different places have in common the flow of capital, real estate speculation, professionalization of gentrification

Table 1. (*continued*)

Year	Author	Description
2005	*Eric Clark*	Gentrification is a broad and diffuse effect rooted in the commercialization of space polarized by power relations. The term requires elasticity to incorporate characteristics of new processes that may emerge in the future
2005	*Anna Badyna*	Central Gentrification in Moscow: Market forces led the government to actively facilitate gentrification. The polarized socio-spatial growth undermined the achievements of the Soviet system and denotes the triumph of neoliberal urbanism. Neocolonialism - Europeanization
2005	*Kevin Gotham*	Tourist gentrification (touristification): To define socio-spatial transformations of neighborhoods based on the proliferation of tourist corporations
2005	*Mark Davidson*	The publicity of the programs that subsidized the remodeling of residences with objectives of social mixing did not achieve their purpose
2006	*Loretta Lees*	Super gentrification (financing): It is the highest level of gentrification. Occurring in some neighborhoods of global metropolises, investment is directed towards a typology of ultra-gentrification that goes beyond the limits of a country. It constitutes the third generation of gentrifiers
2006	*Jamie Peck*	The mobilization of power across different geographical scales requires many planning strategies that lead to see gentrification as positive under a healthy approach to real estate power understood as a solution and not as a problem
2010	*Marc Davidson*	Gentrification for the construction of new luxury condominiums. Gentrification due to social exclusion
2010	*Peter Nelson*	Rural Gentrification: An investigation is carried out based on the 1990 and 2000 censuses in the United States. A methodology is developed to determine areas of gentrification
2012	*Jorge Insulza*	Latino - Gentrification: physical and socio-economic patterns specific to the Latin American territory
2013	*Fernando Pauta*	It formulates a way of application of the Territorial Planning in Ecuador
2013	*José Llop*	The right to the city in the context of the Urban Agenda for Intermediate Cities in Ecuador. It specifies the responsibilities of local and national governments, civil society and international organizations to guarantee that all people live with dignity in urban areas. The right to the city must begin with the right to the plan, the right for the population to understand the plan because only then can they participate in its improvement, in its management

(*continued*)

Table 1. (*continued*)

Year	Author	Description
2014	*John Betancur*	Critical analysis and gentrification in Latin America in global cities
2015	*Kate Shaw*	Gentrification by exclusion. Construction of luxury condominiums generate gentrification without displacement
2015	*María Gudiño*	It analyzes the planning processes in Latin America, declares an option to take the Territorial Order to a State policy based on the Mendoza case study
2016	*Hamdouch*	Planning and local development in small and intermediate cities in Europe
2016	*Michael Janoschka Surname*	Logic of displacement: a) as a material process related to the expulsion promoted by the real estate market, b) as a political process based on the political-administrative force of the State, c) as a symbolic process linked to the coloniality of knowledge, and, d) as a psychological process referred to any action that affects the identity of the subject
2018	*Andrej Holm*	Proposal of a method to measure gentrification considering its spatially diverse mutation processes
2019	*Jean Bolay*	Analysis of intermediate cities
2019	*Loretta Lees*	They propose a contemporary methodology to measure and map the displacement caused by gentrification
2019	*Mahasin Mujahid*	Based on 3 methods: a) Freeman, b) Landis, c) Urban Displacement Project, a methodology appropriate to a specific context is achieved to measure gentrification

3 Medium-Sized Ecuadorian Cities and Territorial Planning

Large metropolitan cities have undergone a deep urban, geographic, social and economic analysis, obviously derived from the high degree of tension they exert on the surrounding territory, as well as the problems that are generated in them require interventions dissimilar to those that are can use. in intermediate cities that, unlike metropolises, constitute balancing nodes of the territory, as mentioned by Llop. In these lower-ranking cities, solutions are more feasible due to the characteristics of their size and the way in which they weave networks among themselves, thus showing greater possibilities of positively impacting a territory. The main objective of the intervention against gentrifying effects in medium-sized cities is: to prevent the expansion of urban limits, to stop any path that leads to metropolisation, to avoid social degradation and its imbalances, to eradicate the carelessness of governments in this matter, reduce their degree of vulnerability with respect to density changes and strengthen the urban-rural relationship [6].

In the same sense, and due to the fact that gentrification for Territorial Management purposes in intermediate cities of Ecuador has not yet been studied in depth, it is considered necessary to incorporate its analysis in the diagnoses prior to the

formulation of Plans in the perspective that these instruments They include objectives, policies and strategies, as well as regulatory and investment measures designed to protect and compensate for the processes of forced population displacement within cities. In support of what was mentioned by Gómez: the difficulty of prospecting, in forecasting is one of the most critical points of Territorial Planning. The plans are in themselves a hypothesis, a bet on the scenarios and is conditioned to the precision of their conditions and variables. Prospective analysis using various scientific techniques should be incorporated into the diagnosis and development of the plan [7, 8].

Thus, the creation of a technological tool that allows locating the gentrifying phenomenon in a multitemporal way under census parameters, will allow the generation of alerts, will reinforce the perspective of Territorial Planning that provides elements of judgment to decision makers so that they can formulate and manage policies public that do not turn their backs on the phenomenon of gentrification. It is important that policy makers discern on how to mitigate the territorial imbalances produced by the desire for development and growth typical of intermediate cities, especially the State, which has been incorporating government policies that allow projects that favor real estate capital causing the displacement and exclusion of original and low-income inhabitants, ultimately hiding the practice of displacement and making the use of physical and symbolic violence invisible [9].

4   Conclusion

According to Betancur Latin American cities may be very different from each other, but they share a common experience in the urban renaissance based on new public transport networks, restoration of historic neighborhoods, and improvement programs that involve local residents. Betancur himself indicates that at least 20 cities in the Latin American region have advanced with high-profile urban improvement projects in recent years, including Ecuadorian intermediate cities. Currently, in several of these cities there is a factor of housing displacement related to social changes, these have their origin in the reform of the Constitution of Ecuador due to the transformation of the relational policies between capital and society, as mentioned by Janoshcka. Another important aspect falls on the declaration as Cultural Heritage. In this way, it is palpable that society is directly affected by social and cultural policies, the same that affect capital gains, the market and the cost of housing in areas with important colonial history, tourist potential and economic relevance [10].

On the other hand, Atkinson mentions that displacement is an effect of gentrification, a term coined by Ruth Glass in 1964 as a result of the observation of the indirect expulsion of the working class from central London due to media income. and upper-class homes - nobility. This change is the action referred to by the term gentrification, or the process of becoming a place for the nobility or gentry and causing a change within the city. This phenomenon has been studied for many years and over time it has been modifying its scope and scope, also including local governments, thus calling gentrification as the proliferation of public policies that have the objective of displacing the popular classes of the central areas accompanied by a massive real estate investment that materializes the reconquest of urban centers for the well-off classes, as shown by

Janoschka and Sequera. Local governments are a type of institution that, despite their colonial history, seem more functional to the current global order that contribute to accelerating the gentrification process. This phenomenon also includes the increase in the price of land through the transformation of specific spaces, locating artifacts such as museums, universities or research centers and feeding the expectations of the owners [11].

Likewise, it is visible that it appears as an activator of gentrification, a local public authority interested in the regeneration of the area, influences its reconversion by promoting the installation of certain infrastructures or developing certain urban strategies aimed at modifying certain spaces and looking for private investors to the area, which not only makes this planning operational, but also seeks investment channels for private capital. That public operator, in complicity with the local political power and, therefore, with the same ideological strategies on the future of the urban territory that it manages and governs, will develop a concrete planning of the area to be gentrified and for this it will use or place some elements such as dynamizes of it. Ultimately, planning is passed to the design of a specific and determined artifact, using urban criteria far from all sustainability. As Mark Davidson and Loretta Lees point out: the State deliberately avoids the use of the term gentrification in any planning project that involves the reinvestment of capital, improvements aimed at privileged social environments, modernization of the landscape or even direct or indirect displacement of the low-income groups.

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