

**PROCEEDINGS BOOK**

**ICNTAD E-CONFERENCE**

INTERNATIONAL CONFERENCE ON NEW TRENDS IN ARCHITECTURE & INTERIOR DESIGN

**7<sup>th</sup> International E-Conference on New  
Trends in Architecture and Interior Design**

# **ICNTAD** E-CONFERENCE

INTERNATIONAL CONFERENCE ON NEW TRENDS IN ARCHITECTURE & INTERIOR DESIGN

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*Dear Colleagues,*

I am honored to invite and send you this call for papers on behalf of Congress Organization Board of “7th International Conference on New Trends in Architecture and Interior Design (7th ICNTAD’21)”, to be held as based on Online Presentations dates between October 2-3, 2021

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

- Criticism of sustainability/unsustainability
- The architecture of philosophy/architecture without philosophy
- Professional settlement of interior architecture
- Human contact to space with furniture
- Intangible skin of space: lighting design
- Tangible skin of space: material
- Ideology in architecture or architecture of ideology
- Spaces without space: 3D design
- The artistic value of space
- Architecture without architect
- Cultural codes / architecture
- Post-COVID Architecture & Interior Design
- Post-COVID Design Education Models
- Spatial Reflections of Pandemics/Epidemics in History

The 7th International Conference on New Trends in Architecture and Interior Design Conference (7th ICNTAD’21), aims to bring together experts from several institutions such as universities, administrative organizations, architects, engineers and designers, at the framework of conference topics of building, architecture, interior design, product, material, etc. High-level academicians, professionals and design students from around the world will explore the intersection of design, architecture and best practices with leaders from the design professionals. The participation of early-career scholars and postgraduate researchers is also positively encouraged.

We kindly wait for your attendance to our congress to be held on October 2-3, 2021, with a hope to realize a satisfactory congress with its scientific ones and leaving a trace on your memories.

*Regards*

**Prof. Dr. Burçin Cem ARABACIOĞLU**

*Mimar Sinan Fine Arts University – Turkey*

**Conference Chair**



# 02 OCTOBER 2021 SATURDAY

*Online access : with given username and password.*

**10:40 – 11:00**

**Welcome Speech  
Chair**

**: Prof. Dr. Burcin Cem ARABACIOGLU / Conference**

Mimar Sinan Fine Arts University, Turkey

## **SESSION A**

<b>SESSION CHAIR</b>	<b>Assoc. Prof. Dr. Damla Altuncu</b>	
<b>TIME</b>	<b>PAPER TITLE</b>	<b>PRESENTER / CO AUTHOR</b>
<b>11:00 – 11:15</b>	A NEW DESIGN CHALLENGE – OFFICE IN THE 21TH CENTURY	<b>NEGAR AGHAYOUF - GUITA FARIVARSADRI</b>
<b>11:15 – 11:30</b>	DESIGN-BUILD RESEARCH FOR REDUCING THE CARBON FOOTPRINT OF HOME RENOVATIONS	<b>TIBOR ZOLTAN DANYI</b>
<b>11:30 – 11:45</b>	PREFABRICATION AND NEW GENERATION HOUSING DESIGN CRITERIA IN INTERIOR ARCHITECTURE	<b>DIDEM BAS YANARATES - DIDEM KARAGOZLER</b>
<b>11:45 – 12:00</b>	SUSTAINABILITY AND RESILIENCE OF TRADITIONAL TIMBER STRUCTURES IN EARTHQUAKE PRONE REGIONS OF CONTINENTAL CROATIA	<b>MARINA SIMUNIC BURSIC</b>
<b>12:00 – 12:15</b>	CHILDREN AND PLAY IN THE CITIES OF THE 21ST CENTURY: LISBON CITY	<b>BERFU GULEY GOREN SOARES - FRANCISCO SERDOURA</b>

<b>12:15– 13:30</b>	<b>LUNCH BREAK</b>
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## SESSION B

<b>SESSION CHAIR</b>	<b>Asst. Prof. Dr. Didem Tuncel</b>	
<b>TIME</b>	<b>PAPER TITLE</b>	<b>PRESENTER / CO AUTHOR</b>
<b>13:30 – 13:45</b>	SUSTAINABILITY AND ENVIRONMENTAL TRANSITION: PRINCIPLES AND DESIGN GUIDELINES	ROSA MARIA VITRANO
<b>13:45 – 14:00</b>	HEALTH AND BUILT-ENVIRONMENTS IN POST-COVID TIMES: A PROPOSED MODEL FOR STUDYING WORK ENVIRONMENTS	<b>EBRU BAYKAL ULUOZ - GOKSENIN INALHAN</b>
<b>14:00 – 14:15</b>	TOWARDS AN INTEGRATED APPROACH IN ARCHITECTURAL DESIGN STUDIO EDUCATION: DISTANCE EDUCATION DURING COVID-19 PANDEMIC	YEKTA OZGUVEN - <b>KUMSAL SEN BAYRAM</b>

<b>14:15 14:30</b>	<b>B R E A K</b>
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<b>SESSION CHAIR</b>	<b>Assoc. Prof. Dr. Pinar Arabacıoğlu</b>	
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<b>14:30 – 14:45</b>	TOXICOSIS: REBRANDING JANE JACOBS	HUSNU YEGENOGLU - <b>JUSTIN AGYIN</b>
<b>14:45 – 15:00</b>	“TROGLODYTIA”: LEARNING FROM UNDERGROUND COSMOS FOR RESILIENT MORPHOLOGIES	AYSE ZUHAL SARI - FITNAT CIMSIT KOS
<b>15:00 – 15:15</b>	AURA MODELLING AS A TANGIBLE APPROACH IN FIRST YEAR DESIGN EDUCATION	FITNAT CIMSIT KOS - BERKE KARADENIZ - <b>MERVE EFLATUN - SEBEN ASKIN - ECE CINAR</b>
<b>15:15 – 15:30</b>	MOTION-BASED DYNAMIC FORM GENERATION TO CONTRIBUTE TO THE KINETIC DESIGN DIVERSITY	HATICE HILAL TOPUZ

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# A NEW DESIGN CHALLENGE – OFFICE IN THE 21TH CENTURY

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## Abstract

The organization of office spaces is directly related to the technologies used and the workflow dynamics. The vast usage of laptops and internet connection has made a strong impact on the mobility possibilities of the office space users and consequently to the conceptual approaches related to the ways these spaces are designed. Portable devices and wireless internet allow employees to do their work in any place that they want. They can do their work from different places such as home, café or even from another country. Instead of face to face interaction, a new type of collaboration and interaction which is called virtual collaboration or virtual work has appeared. The world's experiences during the Pandemic period showed everyone to what extent the remote office work is possible with these new technologies. So, the nature of work and the meaning of the workplace have fundamentally changed in this era. The traditional meaning of the office is now questioned. Do we need an office as a space anymore? In this new era interior architects are faced with the question of how the new generation offices should be organized and designed, and to be able to answer this question one should have first an insight about how these offices work, and how the approach to the office employees in these offices has changed. There is very little research looking at the current trends regarding work organization and how these influence the design of office interiors, mainly in terms of spatial structure and organization. The main aim of this research is to investigate the latest changes and tendencies in office design in line with the new technologies and approaches to the work organization. In this way, the study aims to prepare a conceptual framework for understanding the underlying factors in the design of the next generation offices and to detect strategies that can be used by interior architects in the design of these offices. This framework has been developed based on an extensive literature review where the new approaches to the office work, emerging concepts in the office and some strategies related to interior design for these new age offices have been determined. Then, some offices of the Google Company (a pioneer in this respect) were examined and the design strategies used in relation to these concepts were identified. In addition, speeches and videos of Google designers, CEOs or ranked employees of the Company were used to understand the approach of the Company to office work and office design.

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*Key Words: New-Age Office; Office Spaces; Interior Spaces; Office Design*

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## 1. Introduction

Early 'office spaces' were small rooms at homes. Until the 18 century, they didn't change a lot. In the late 18th century and through the industrial revolution, radical changes in the layout of offices happened [1]. It was the time that office buildings emerged as a particular building type. Developments in technology caused enormous changes in work patterns. In time, different types of equipment such as mechanical calculator, typewriter and Xerox machine were added to the office to make employees work easier. With the emergence of computers, radical changes happened in office layout and furniture.

The first generation of desktop computers were massive and it was not possible to move them easily. So employees had to work in their offices behind their desks because their computers had to connect to the power outlet with wire, thus they couldn't move to other places, and there was a dependency between employee and office. After a while, new generations of computers emerged. They didn't need too much space and the screen became flat. Employees became accustomed to work with computers over time. Computers made their job easier and faster for example it was easier to keep all the document files in a hard disk rather than in drawers and it was much easier to reach them when needed. The emergence of

computers had a huge impact on the office interior space, basically because there was no need for extra spaces and furniture to keep documents.

Information technology developed and wireless internet and wireless devices such as laptops emerged. They brought mobility and flexibility to the work patterns and gave a chance to the employee to do their work virtually from any place. All these developments in information technology (IT) caused changes in office layouts. Office layouts changed during years according to some factors such as human needs, organizational needs and also technology. The new developments in Information technology such as the advent of the internet and portable computers have an enormous impact on office works. Particularly there are a lot of office tasks that can be done by personal computers and there is no need for a certain space to work. Employees can carry their laptops and work in a café or any other place. So, many tasks may not need a certain physical place called office to be done anymore.

These changes have brought serious discussions about the concept of office, the function of the office and the role of the office in our current time. This study aims to discuss these changes in office work and to find how these new technologies have affected the work and interior design of the offices in this new era.

To do so, first, an extensive literature survey was carried on to determine the new approaches to the office work and office organization. Then, 7 offices of the Google Company (a pioneer in this respect) designed in years 2005-2016 were examined and the design strategies used in relation to these concepts were identified. In addition, more detailed information about Google Company's approach to office work and office design was collected from speeches and videos of Google designers, CEOs or ranked employees of the Company. Important speeches were directly converted to text and important keywords or concepts related to office work and design mentioned in these speeches were noted (recursive abstraction method).

The findings of the study are presented under some main headings: the change in the Office concept, the emerging concepts in relation to these changes and the spatial characteristics developed as a result of these new concepts.

## **2. Change in Office Concept**

Today, the image of working at a classical office or workplace that workers should attend to the work and left it at a special time have been changed totally. In the New-age offices work flow and layout are different than the classical ones. Since using wireless internet and wireless devices such as laptops, tablet or smart mobile phones become popular, the way that people collaborate and work with each other has been changing. The employees can work together virtually and they can see each other with video calls at any time and this makes their job easier and faster. In 2004 William Mitchell asserts that today, since much of an individual's work is carried out through the means of technology such as laptops and cellphones, there's no need to go to work [2]. The technology since then has developed much and the world's experience of remote working in Pandemic situation has proved that most of office works can be done remotely. So, in such a situation, is there any need for office in the new-age?

The utilization of technology in the 21st century has rendered most of the patterns of work such as face-to-face supervision and paper file usage as well as archiving obsolete. In this information technology era of today, office workers frequently engage in virtual communications as collaboration is not only limited to face-to-face communications [3]. Although there is no need for physical interaction and collaboration between employees, still many companies believe that face to face interaction and collaboration is more effective than virtual communication and they try to change their office layout to keep their employee at the office. They believe that face to face talking helps employee to improve their ideas better and also it makes the office environment friendlier.

In the new offices, space design creates opportunities for workers to have chance encounters and facilitate informal interactions between employees working in different parts of the organization in order to enhance interaction. So, in many companies, office spaces are designed with shared kitchen areas and spaces for relaxation [4]. There's strong importance put on employees being present in the office daily because face-to-face communication is considered paramount, regardless of the ability of employees to engage with each other through virtual communication [5]. The chief HR (Human Resource) office at

Yahoo justified their homeworking ban through unleashing a report which stated that in order for their workspace to become absolutely the best space to work in, communication and collaboration are vital, therefore it's essential that they work physically together. Thus, there's an absolute need for their presence in the office [6]. In the new-age offices, the primary function of the office with different routine works and limited levels of interaction has changed radically. Consequently, the spatial quality needed is changed as well. In the light of the new definition of office work a new approach to office space design is needed.

### **3. Emerging Concepts in New Age Offices**

To be able to design a proper office layout and to design a proper environment interior designers should know about the new strategies and concepts emerging in the today's office. There are several concepts that directly affect the way new offices are designed, so, before beginning to write about the design of offices it is necessary to explain about the new concepts emerging in the office.

#### *3.1. Employee Empowerment*

What is changing in today's office is not only technologies used but also the quality of office workers and the thus the way these offices are managed. In this era a new kind of office worker called as knowledge workers, whose main capital is their knowledge has emerged. According to Drucker knowledge workers are high-level workers who apply theoretical and analytical knowledge ... to develop products and services. These knowledge workers are now the most valuable assets of a 21<sup>st</sup>-century organization because of their high level of productivity and creativity [7]. During the 20th and 21<sup>st</sup> century, since the knowledge workers are the actual drivers of the businesses, the industrial organizations focus more on them [8]. The office workers are not seen as employees doing some routine works who need to be controlled and supervised constantly anymore. On contrary, more and more autonomy, more facilities and much better work conditions is offered to these employees to make them feel happier in their works. In this respect office designs become an important issue in retaining these talents. Besides, empowerment of the employees is a new emerging very important concept and a radical change in the management of the offices.

According to Randolph (1995) [9] employee empowerment is a power exchange that is transferred from the employer to the employees. Blanchard et al. (1996) [10] also state that empowerment has a higher level of responsibility and accountability as well as the freedom to act. Therefore, it is obvious that if a management system gives more power to their employees, it will make them more motivated, loyal, and satisfied while assisting the organization in achieving its goals. In this regard, empowerment helps to make employees more independent and allows them to share the responsibility and power in every level. Empowerment also creates the employee self-esteem and boosts the workforce for a better performance. Empowerment increases the employees' degree of confidence and such extra confidence creates not only job satisfaction but also high levels of productivity [8].

#### *3.2. Flat Managerial Organization*

As the office work has changed, the structure of managing and organization of the new-age office has changed too. The traditional hierarchical model of management has been utilized in various offices since the industrial revolution. The way of arranging individuals of an organization in the hierarchical model is based on the power. In other words, the layout of a hierarchical organization is pyramid-shaped. Except one person that is mostly called CEO, each employee in the organization is subordinate to another one. According to Morgan, the layout of a hierarchical organization contains several entities which are descending to the base of staff-level employees sitting at the lowest section of the pyramid [11]. But the traditional system of management is changing in the new-age offices. In new generation of offices, a flat organization system is used instead of hierarchical organization. Traditional organization has a management system that its main focus is on the planning, accounting, organizing, controlling, and ordering processes. Flat organization on the other hand, has a leader that establishes directions and guidelines, arrange people, encourage, motivate, and make change [11]. Therefore, the notion of employee empowerment is supported by such model of organization. Figure 1 graphically demonstrates these two different approaches to management.



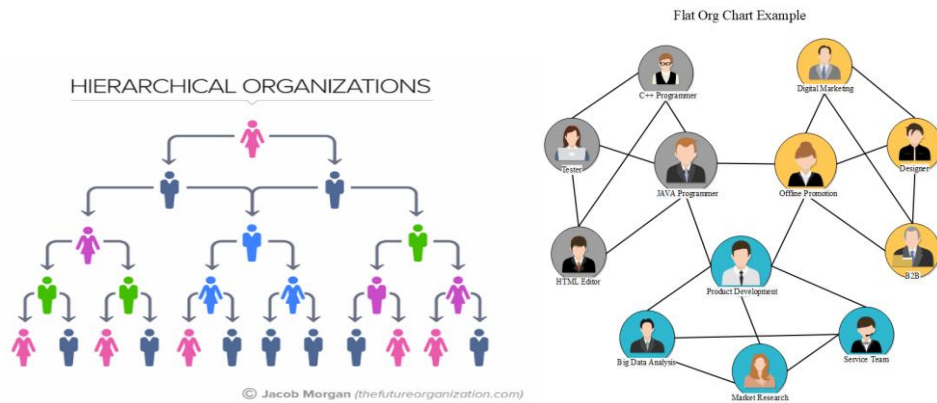


Fig. 1. (a) Hierarchical organization [12]; (b) Flat organization [13].

### 3.3. Flexibility and Mobility

Flexibility and mobility are two concepts that appeared in the workplace after the emergence of computers and wireless devices and internet. The reality of work today is changed by cellphones, laptops, tablets, wireless networks and web meeting tools. Workers are influenced by these technologies as they feel the flexibility to choose where and when they can do their best work [14]. Traditional methods of working are no more suitable for the knowledge workers with changing demands. In new office, workers use flexibility to align their jobs with their personalities, thereby actively shaping their jobs [15]. In many new age offices working hours don't have meaning for the employee because they have flexibility at their time and employees can choose their start and finish times. Some employees work part-time at the office and some of them are coming to the office, for example for 3 days and stay at the office at night and finish their work then the rest of the week they do their own work [16].

Mobility is another concept that has an effect on employee's work. According to Wagner and Watch (2017) [17] while great variation exists on the level of technology found in innovation spaces, technology, on the whole, is influencing office behavior, creating patterns of work that are less obvious or predictable. One clear example of this is how technology has increased the overall mobility of workers, enabling them to work from various locations and still be "plugged in" [17]. Mobility includes external mobility – working from different locations outside the office – and internal mobility – interchanging between individual and collaborative work range settings within the office [18].

### 3.4. Collaboration and Interaction

As Igbaria and Tan (1998) [19] mention, communication is essential in any organization. Due to developments in technology the need for face to face interaction and collaboration has become less and less. But communication and face-to-face interaction within the workplace is crucial to outcomes such as productivity, job satisfaction, and commitment to the organization, so, these kinds of long-distance communications may also result in potential problems [20].

Many researchers believe that having face to face and informal interaction in an organization is very important. When the interaction is informal instead of being formal, information spreads more efficiently and faster [21]. Informal communication takes place within impromptu or unplanned interactions. On the other hand, according to Oseland (2012) [22] The latest technology that facilitates virtual collaboration, through video-conferencing suites of face-to-face simulation, delivers better quality than its predecessors and has become much affordable (especially when having to consider savings in travel cost, time and carbon). The advent of new smaller-scale personal technology such as Skype on laptops and FaceTime on phones assert that elements of virtual communication enabling face-to-face meetings are freely available anywhere, anytime for one-on-one interaction [22].

### 3.5. Care for Employee's Health

Employee's health is another concept that has attracted the attention of companies in recent decades. One of the important issues in human resource management and employer-employee relationship, is health,

safety and welfare of the employee [23]. The importance of the employees' perspective is obvious, but also the employer gains from regarding and supporting employee wellbeing: healthy and productive personnel is one of its most valuable assets. Wellbeing at work (WBW) means healthy and productive work by competent workers who feel their job is meaningful [24].

Hagelstam (2017) [23] states that wellbeing at work affects the competitive advantage of organizations in several ways. It reduces the expenses related to sick leave, occupational accidents, and works disability. This also affects productivity and effectiveness in a positive way. Wellbeing at work automatically increases motivation and improves workplace atmosphere, which leads to betterment in service level as well as quality and customer satisfaction.

### *3.6. The Fit between Person and Environment*

The fit between person and space is a concept that is highly considered today, especially in the new-age office because it is a psychological term that has a relation with employee efficiency. In the realm of organizational psychology, the fit between different personal characteristics and the environment has been of significant interest. The basic foundation of person-environment fit is made up of the alignment of employee characteristics and the work environment, which triggers positive outcomes such as satisfaction, commitment, performance, adjustment, and reduced stress which can become beneficial at the individual level. In disparity, the effectiveness and long-term survival of the organization will be affected by the negative outcomes originating from a poor fit [25].

It is believed that there's a link between higher job satisfaction and productivity which is made up of a better fit between the individual and the organization, between the individual and concentration demands of the job, person and person, and between groups and organizations [26] [27].

Although fit theories are mostly associated with the fit between the work organizational aspects and the person, the office space quality is another dimension that interacts with job type and person and affects his/her health and performance [28]. The basic premise is straightforward. Depending on the spatial design and functionality of the office, the performance and health may differ based on who you are and what do you do. To measure this fit, some aspects pertaining to certain characteristics of the environment need to be taken into consideration, such as noise, lighting conditions, ventilation and the amount of space available per employee. Depending on person-related characteristics, different office types can fit different individuals according to individual differences. Characteristics that are person-related include previous experiences and age, personality, needs that arise from certain disabilities or health problems such as physical and hearing disabilities. For instance, in an open-plan office people with hearing problems might experience a challenge in hindering noise compared to the unimpaired in a cell office [29]. On the other hand, cell offices with many doors, doorsills and narrow corridors may inflict a personal challenge on people with a physical impairment.

## **4. Spatial Characteristics of New-Age Offices**

The new above mentioned emerging concepts have not only changed the type of work and process of working in the office but also the spatial organization, layout and interior design of new age offices.

### *4.1. Flexibility in the Office Spaces*

Parallel to the concept of flexible work and fit between the person and environment, one of the very important issues in interior design of new offices is flexibility. Flexibility allows for multiple diverse work environments that can be altered and reconfigured as needed. Therefore, the office provides multiple rooms that suit each individual's personality, work style, and job position, such as meeting and conference rooms, huddle rooms, lounges, private offices and silent workroom. It is possible to reconfigure the rooms or the furniture in the rooms as the company grows or even when the employees change [30].

In August 2019 Wework Design Company shared a list of spaces that make offices more flexible. In this list they include small private space, café with hot-desking, restaurant-style booths, formal conference rooms, informal conference rooms and quiet nooks for charging workers mind and body and outdoor space [31]. For example, private spaces can be used by an employee who needs a silent place for focused work requiring concentration (think writing or data-crunching). Some examples of such private spaces are demonstrated in figures below. In figure 2 some examples of individual workspaces in Google offices can be seen.



Fig. 2. (a) Google Office in Zurich [32]; (b) Small Private Space at Google Office [33].

Another space that is very popular at new age offices is a restaurant or cafe-style atmosphere with hot desks. Sometimes these spaces are more crowded than formal working spaces (figure3).



Fig. 3. (a) Café in the Google headquarters in Ireland [34]; (b) Google Office in Zurich [35].

Lounges are other popular spaces in a new-age offices. According to Wagner and Watch (2017) [17] lounges have become an important locus for human interaction with various types of seating, a myriad of colour combinations, patterns, textures and light fixtures, which are inspirational. In many of new offices dinner booths style spaces can be seen as these are a good solutions for quick face-to-face collaboration with a colleague instead of virtual communication [31]. In new offices there can be various kinds of meeting spaces. While the formal meeting room with a formal setting is necessary for meetings such as sales meetings, monthly brainstorming or executive strategy sessions, informal meeting spaces, with comfortable sitting, are good spaces for brainstorming or meeting with prospective candidates [31] (figure 4).



Fig. 4. (a) Google Office in Zurich [36]; (b) Direc TV [37].

#### 4.2. Spaces for Collaboration

In order to support collaboration, organizations provide a substantial breadth of open and enclosed space types. Other spaces are offered in line with traditional large, medium, and small meeting areas that remain the most widespread collaborative spaces. Amongst these spaces exist relatively newer concepts such as huddle rooms, videoconference and café spaces, “brainstorming” space and game rooms. Studies of O’Neill show that most of knowledge workers believe that brainstorming is the most important collaborative behaviour for business success, followed by informal interactions [38]. According to him in order to spark creative thinking, these spaces are usually furnished with display technology, whiteboards, chalkboards, writeable or “tackable” walls, lounge furnishings, specialized lighting and other elements which are casual. Certain industries such as high tech companies frequently use also game rooms [31].

According to Wagner and Watch (2017) [17], well-designed kitchens or cafes at new offices are good places for social interaction and asking a question or seek out an opinion. Providing small semi-private spaces at new offices which are good for one or two people for more focusing on their work can support the Converse and Co-create modes of collaboration.

#### 4.3. Strategies related to Employees’ Health

Strategies regarding this issue can comprise of multipurpose activities for healthy lifestyle promotion. It could also comprise providing sports facilities or courses to support physical activity, motivating employees to exercise, supplying healthy diet information and encouraging employees to eat lunch within work premises [39]. So, new age offices such as Google and Facebook add some facilities like gym, yoga and Pilates classes, swimming pool and lots of other activity spaces in their office for employee to avoid sicknesses that appear because of prolonged sitting. And also, they have different types of café and kitchens that serve free and healthy food to the employees. In Google offices, there is a special kitchen called “micro kitchen”. Employees can make their own food and drinks with free provided materials.

In the process of creating happier and healthy places, the effect of poor lighting should not be ignored. Bad lighting can directly affect health conditions in both physical and mental terms. Eye strain, headaches, exhaustion, stress, and anxiety are some results of bad lighting in the high-pressured work environments [40]. On the other hand, daylight is a crucial part of human health due to its positive effects on emotional and mental wellbeing. In terms of human visual comfort, daylight is known as the best light without creating any environmental burden. Therefore, the occupants’ physical and psychological needs are being affected by windows and daylight in working places [41]. According to the World Green Building Council, employees are more engaged and focused on their tasks when they work in natural light. This also increases their collaboration with other team members. The result of this kind of engagement and collaboration is more productivity and success [42].

Sometimes employees need to recharge and refresh their brains, so they need a space for nap or relaxing. According to Radcliffe, Vice President of Google’s Real Estate & Workplace Services: “No workplace is complete without a nap pod” [43]. Also, the spaces with comfortable seating that feel like a living room can be a good place for employees to refresh during their work, especially when they are in the midst of a challenging project. Figure 5 shows some alternative designs used in Google offices for napping and relaxation.



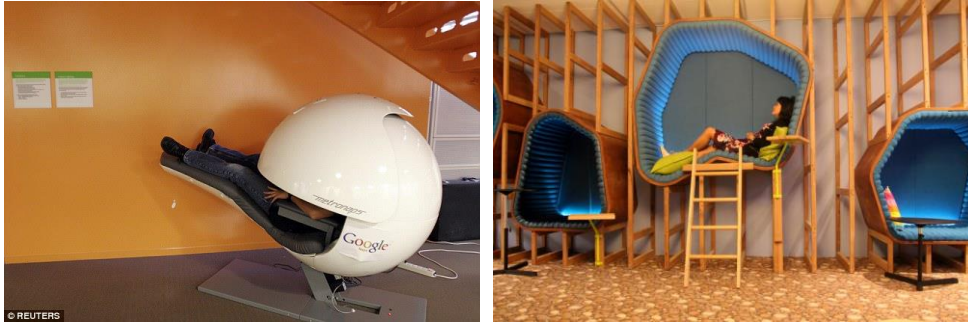


Fig. 5. (a) A futuristic sleep pod at Google's Mountain View HQ [44]; (b) Google Office in Sydney [45]

Outdoor workspace with fresh air, sunlight, and greenery can also contribute to improve employees' health and wellness supporting improved morale and productivity [31].

#### 4.4. Creating Fun and Friendship Culture

According to a traditional perspective of management philosophy, work means work and fun get in the way. But nowadays, a lot of companies try to change this perspective by adding the culture of having fun in the workplace in order to gain a more sustainable success for the organization [46].

According to Fisher (2010) [47] workplace happiness can be defined as a construct that represents pleasant judgments, pleasant experiences, or positive affective workplace experiences [47]. Pryce Jones in her book, "Happiness at work: Maximizing your psychological capital for success", defines workplace happiness as a frame of mind that helps people to maximize their performance and attain their potential and it happens by being aware of the highs and lows when working with other people or alone [48].



Fig. 6. AWeber Communications' Headquarters – Chalfont [49]

According to Kahle (2015) [50], making a workplace more fun is the business leaders' responsibility, while Gostick and Christopher (2008) [51] believe that it is not necessarily the managers' job to initiate fun, but they undoubtedly let fun to happen and encourage it. Furthermore, they also mention that the managers should know the fact that the fun must begin on the employee's first day in order to lighten the stress and tension of joining to a new team and make the environment more enjoyable [50] [51]. Figure 6 shows an example of integration of fun and work in the Aweber Communication Headquarters.

According to Bilginoglu and Yozgat (2018) [46] increasing the motivation of people to work harder, faster and smarter can be done in three ways: threatening them, paying them more money, and making their workplace enjoyable. They also state that in the modern workplace, it is not much effective to threaten people, and it has only short-term success when employees are paid lots of money, but having an enjoyable workplace makes a real positive change. Therefore, it is very important for leadership experts and managers to learn about producing an interesting atmosphere that gives inspiration for creativity. This kind of workplace will be fun and enjoyable not only for employees but also for managers [46].

Workplace friendship is the individuals' friendship with their peers, subordinates, and superiors. It is known that workplace friendship has a positive effect on a company's productivity and improves the workers' attitudes towards their jobs. In other words, a positive friendship between workers, not only affects their happiness but also boost productivity. Friendship groups are more involved in their tasks which leads to increased efficiency. Workers with a meaningful friendship are happier in comparison to the workers who are alone [52]. Wright and Cropanzano (2007) [53] also believe that people who are lonely are less happy. Since good friends are tending to behave nicely to each other, employees with significant friendships may be happier in the working environment. Consequently, it has to be highlighted that happy employees are generally sociable individuals who have more friends [54] [52]. The design of spaces in an office have a profound effect on creating and enhancing friendship culture through creating possibilities for many informal interactions.

#### *4.5. Transparency*

Transparency is another issue that many designers of in new offices pay attention to. According to Piotrowski and Rogers (2010) [55], transparency within the workplace is promoted by the use of glass walls and doors. Better teamwork flourishes when everyone sees what everyone is doing. The feeling of being isolated from the rest of the team is hindered through the use of glass walls and doors. Since glass walls and doors are sound-proof, people can easily concentrate and focus on their work. This directly encourages integrity and honesty within the work environment. There's extensive use of glass in today's most creative office designs.

### **5. Conclusion**

The new technological developments has made it possible to make much of the office works in any kind of space. Despite this fact still many of the companies, particularly those who are employing the knowledge workers try to encourage their employees to use the office spaces as it is believed that face to face interaction and being in the office environment enhances the quality of work. It is only possible by designing spaces that are attractive to the employees and also compatible with the new concepts and emerging office management ideas. In this respect the interior architects now are facing with the challenge of how to design these new offices and they can succeed this only if they can truly understand the new emerging concepts and the new strategies that can be applied in the design of interior spaces to create a proper spaces for this new way of working.

The biggest change happening in the office concept is related to employee empowerment. This new concept has emerged due to a radical change in the office tasks and consequently the characteristics of the office worker. A result of this change is the change in the office organization and management from a hierarchical organization to a flat one where all the employees are involved in the decision making process. This new approach to the employees also brings with itself other new concepts such as flexibility and mobility, employee health, fit to the environment, informal collaboration, and communication.

Concepts of flexibility and mobility in new offices are related to time and usage of space. New age offices have flexible scheduling which means employees come and go to work as they need. To implement flexibility in these offices, private spaces, restaurant or café, spaces for a quick face to face collaboration, formal and informal meeting spaces, relaxing spaces provide employees a wide range of alternatives spaces to work.

Employee's health is another new concept that has emerged in the new age offices as it is believed that healthy employees become more productive. Companies add some health facilities such as gym to their offices and provide employees with healthy diet information to support their health.

Creating a fun culture also makes the employee happy and motivated. Happy employees with good friendship can be more efficient and more engaged at work. There are different suggestions to create fun at work, such as a karaoke room, bar, or music room to play an instrument. Also, by using different colours, materials, and furniture, the workplace can become more friendly and attractive for employees.

In new- age office layouts, different types of space such as private space for employees who need to concentrate on their work are provided. The fit between person to the environment concept is important because new-age offices are designed for people with different personalities.

The mentioned factors are some strategies used in the new offices to make offices attractive spaces

for workers and spaces for communication, discussion, sharing the ideas and working and producing together even in a time that many works can be done remotely.

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# DESIGN-BUILD RESEARCH FOR REDUCING THE CARBON FOOTPRINT OF HOME RENOVATIONS

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## **Abstract**

The aim of this study is to demonstrate how designers' concern for environmental responsibility can be manifest in design and building decisions that ultimately reduce the carbon footprint (CF) associated with construction. Following the philosophy of "Think Globally, Act Locally" the study indicates measures that can be impactful even in the absence of comprehensive European or local regulation. Creative design decisions can be taken towards implementing and disseminating goals of a circular economy (CE) that are most often debated at transnational scales. The case study presents practice-based research solutions and considers possibilities for their wider use in the renewal of vacant and poor conditioned housing stock awaiting renovation. The choice of topic is justified by several facts. On the one hand, 700 million tonnes of construction waste is generated annually in the European Union<sup>1</sup>, and on the other hand, according to statistics, the large amount of unoccupied, unused buildings available. While there is relatively robust literature and public discourse about the harmful environmental impacts of Fast Fashion or the topic of food waste, there are fewer solutions manifest in practice related to the sustainable future of building materials and the construction industry. Considering the dearth of legal and regulatory measures to encourage a new approach to a regenerative economy, the study asserts possibilities for ecological impact based on the combined efforts of designers and builders. The implications of this design experiment for further research suggest that the benefits of rigorously exploring means for reducing the CF of a single apartment renovation can be amplified by examining how they could be iterated and brought to greater scale.

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**Key Words:** (*circular economy, interior design, sustainability, carbon footprint, upcycling*)

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## **1.Introduction**

The climate of our earth is changing, the average temperature is rising year by year. According to data recorded in Hungary, since 1901, this year was the second hottest summer. The link between climate change and CO<sup>2</sup> emissions has been highlighted by a number of studies. It is also a fact that the construction industry and our buildings are liable for 38% of the CF<sup>2</sup>. Responsible organizations are working to address the issue of how to effectively change the current situation. In the present study, I would like to point out that we, the designers, also have a serious responsibility, even when planning small-scale projects such as the home renovation presented in this case study. Designer responsibility cannot be waived. Anyone who is committed to the future of our planet needs to find the sometimes distinctly simple solutions that can contribute to a more livable and safer, long-term sustainable living environment. This is particularly important for us architects and builders, as construction activity is closely linked to all three pillars of sustainability, such as social, economic and environmental sustainability. [1]

On 2 December 2015, the European Commission adopted a package of proposals on the CE. The CE is about keeping materials and resources in use and retaining their value, rather than consuming and disposing of them. [2] However, this approach to economics and production is not a new invention at all. Rural/folk architecture has defined the image of rural settlements for centuries. However, the creative

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<sup>1</sup> [https://ec.europa.eu/environment/system/files/2020-12/2011\\_CDW\\_Report\\_0.pdf](https://ec.europa.eu/environment/system/files/2020-12/2011_CDW_Report_0.pdf)

<sup>2</sup> <https://environmentjournal.online/articles/emissions-from-the-construction-industry-reach-highest-levels/>

power of peasants instinctively built from natural materials no longer exists. [3] Yet many of us can remember the rural way of life of our grandparents, which was naturally accompanied by the (re)utilization of all the materials around us and the rational management of resources. Since then, unfortunately, we have forgotten that by properly orienting buildings, we can gain energy in the winter, so that if we have a thick heat storage mass and no oversized windows, we don't have to cool the building in the summer. We could have forgotten all this, because with mechanical solutions, everything can be corrected. For me, there is no better proof of how perfectly my grandparents' household worked than the fact that there was no waste to dispose of. In the perfect microcosm, everything played a role and all matter was utilized.

In the 50 years since then, however, much has changed radically. We produce a lot of waste, which we can no longer cope with recycling. The construction industry is no exception. The grandparent house mentioned as an example and so dear to me was still really built of local building materials, earth, wood, reeds. Since then, the abandoned house has been left alone and has become part of nature again without human intervention, almost without remnants. Most likely, in a few hundred years, the same will not be true of a family house built today. We use a lot of plastic and composite materials, layered structures, which cannot return to the cycle of nature without human intervention. The circular economy is one of the possible tools in our hands with which we can be able to use construction methods that take into account the limited possibilities of our planet. [4]

Let's see some data from the Central Statistical Office (CSO) that make the examination of the CF of home renovations up to date. According to the latest survey of the CSO, there are 560,000 vacant dwellings in Hungary which is 12.7% of the total housing stock. At the same time only 40% of the residents of inhabited dwellings are fully satisfied with the living conditions. Some of the biggest problems are the inadequacy of thermal insulation, the condition of the windows and outdated heating. According to a survey by the Bureau of Statistics, 140,000 homes are planned to be renovated by residents over the next 3 years<sup>3</sup>. Meanwhile in 2014, the construction industry had the largest CF (522 kilograms of carbon dioxide per capita). The challenge, then, is how to renovate these inadequate dwellings without burdening the planet with unnecessary CO<sup>2</sup> emissions.

Building on this, the case study examines how lessons the renovation of an apartment in a 20-apartment condominium built in 1972 with conventional building construction techniques. This can be instructive because one of the main aspects of the design was to keep as little waste as possible during the renovation, to keep the CF of the renovation as low as possible, while not giving up the comfort expected at the beginning of the 21st century.

## **2.Methodology**

This study aims to augment research on the intersection of ecology and the built environment that emerges as a concern across a wide range of disciplines in the second half of the 20th century. Studies that are the precursors to what is today termed as CE are most often conducted in fields like environmental policy or industrial ecology, with discourse in architecture and the built environment (including design decisions that link to building material choices and construction industry techniques and technologies) less robust than attention given to the manufacturing sector. [5] Of course, the detrimental effects of decades of consumerism on the environment extend to architecture, often through the industrial processes manifest in construction. The European Commission supported studies on construction and demolition waste are focused on collecting quantitative data focused on material waste streams at a scale intended to motivate continent-wide policy changes applicable to the EU's member states.<sup>4</sup>

Thus, the study proposes rehabilitation of a small single unit mid-century Hungarian apartment as a viable lens for experimentation for grappling with issues that are planetary in scale, and most often tackled at transnational scales. The methodology is further motivated by the notion that architectural discourse and pedagogy addressing the social and ecological crises of the contemporary context ought to be informed by

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3 [https://www.ksh.hu/docs/hun/xftp/idoszaki/pdf/miben\\_elunk15.pdf](https://www.ksh.hu/docs/hun/xftp/idoszaki/pdf/miben_elunk15.pdf)

4 [https://ec.europa.eu/environment/system/files/2020-12/2011\\_CDW\\_Report\\_0.pdf](https://ec.europa.eu/environment/system/files/2020-12/2011_CDW_Report_0.pdf) page 7

built experiment (“engaging with building as a form of knowledge production” [6]). Research-based design case studies have been valuable method for exploring local and regional implications of circular economic principles in a European context<sup>5</sup>, defining means relevant for architectural practices to engage critically in new knowledge production. The study shifts focus from macroscopic quantitative and systemic analysis of material flows and construction process, to the scale of a single unit, and at this scale of research-based design process considers issues of disassembly, use of local materials, construction techniques and technology, and aesthetic implications of sustainable approaches that can inform advancement of circular economic design approaches in the field of architecture and interior design.



Fig. 1. Well oriented building with shaded windows

### 3. Case study

According to a recent study by the European Commission, up to 700 million tonnes of construction and demolition waste is generated in the European Union every year<sup>6</sup>. A significant portion of this could be recycled in some form. There are plenty of building materials ready to use that can be re-installed with a little care. Instead of a sustainable economy, we are hearing more and more about the CE or with other words the regenerative economy, which means that, in line with the order of nature, we are placing much more emphasis on the circulation of materials and resources.[5] All the raw materials available to us should be used, re-incorporated over and over again for as long as possible. Think of our immediate surroundings, Pécs, where the municipality alone owns more than 400 uninhabited properties that cannot be renovated economically. But, they have a lot of usable raw materials: bricks, tiles, timber, coverings, cement tiles. We learned from the history of architecture that local building materials were of great importance in every age.

<sup>5</sup> For instance, in the Nordic context: “Circular Economy in Nordic Architecture” Urszula Kozminska Msc.Eng.Arch., PhD 2020 IOP Conf. Ser.: Earth Environ. Sci. 588 042042

<sup>6</sup> [https://ec.europa.eu/environment/system/files/2020-12/2011\\_CDW\\_Report\\_0.pdf](https://ec.europa.eu/environment/system/files/2020-12/2011_CDW_Report_0.pdf)

It shouldn't be any different now. Currently, the only really local building material in Pécs is the recycled building material.

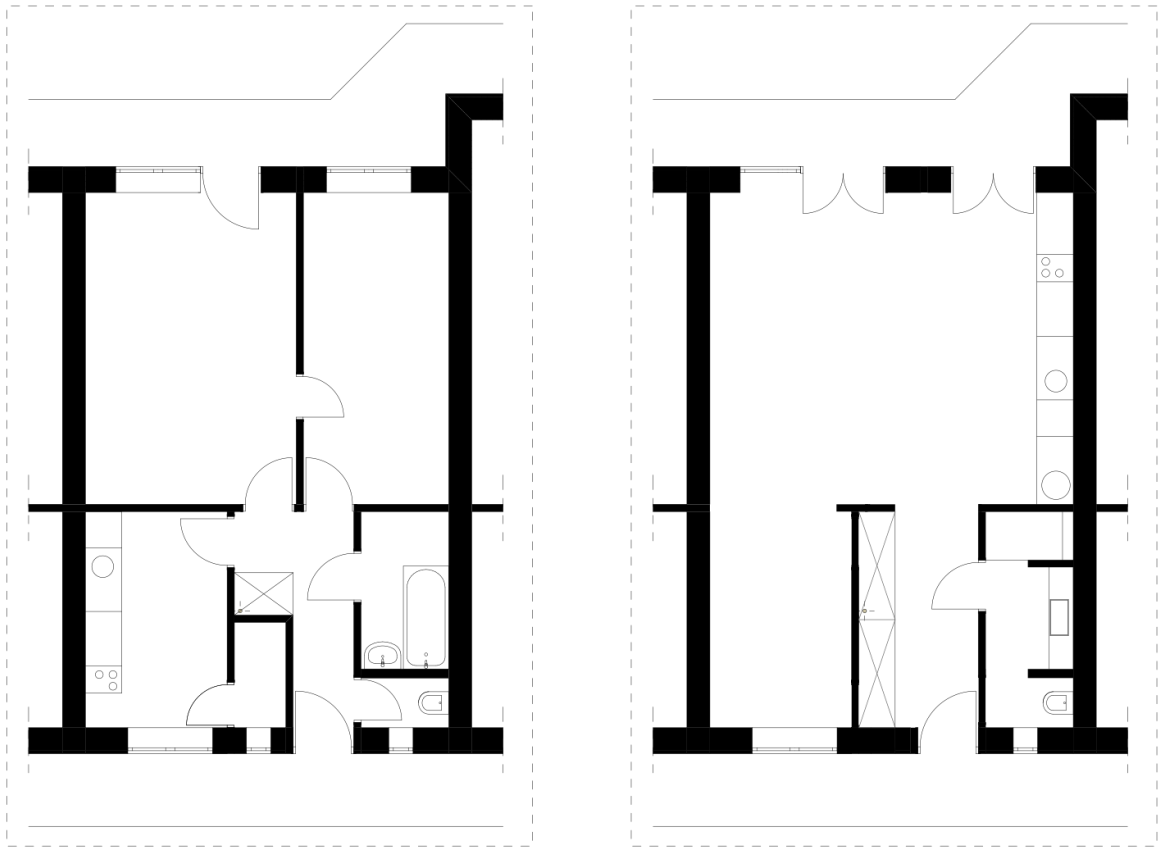


Fig. 2. (a) original floor plan; (b) floor plan after renovation

Let's take a look at the circumstances. It is a five-story, nearly 50-year-old, twenty-apartment condominium made of solid brick walls with a 6-meter span beam slab. External thermal insulation took place 15 years ago. The doors and windows were traditional, not insulated openings. The heating system was designed with parapet convectors, hot water production with instantaneous gas water heaters. The renovation in the interior was comprehensive. The water and electricity network and external windows have been replaced. The apartment has been disconnected from the gas network. The extremely well-positioned, south-facing apartment is bordered on four sides by heated neighbors. Fig.1.

The original 52m<sup>2</sup> 2-room layout was strongly sliced. The new layout has an open floor plan with a single separate room, which is the bathroom. Fig.2. Instead of the previous 7 interior doors, only one remained. The hallway with the wardrobe and the kitchen became much larger. While previously the small room and kitchen were the main venues for the activities, the new floor plan helped to make every square meter of the apartment occupied. The proportion of glazed surface has increased to an ideal size, exactly 1/8 of the floor area, not incidentally on the south façade, which is a source of winter solar gain. The 9 m<sup>2</sup> balcony is also connected to the kitchen, and it is much easier to reach now. It was barely used before, but the new layout made it easily accessible and became a valuable venue for everyday life from early spring to late autumn. A washing machine and hot water production have been installed in the adjoining kitchen instead of the bathroom. The only mechanical element in the bath is the heat recovery ventilation system

located above the false-ceiling. A shower has been placed, which is much more water-saving than the bathtub was.

One of the first steps of the design process was to take stock of the materials in the apartment and decide what to keep, what to recycle, what to keep in a new function, and what to give away. The goal was to get as little material as possible to landfill and keep as much material as possible inside the home, even serving a completely different function than before. Table 1. We used several ways to utilise the materials:

- all floor coverings were refurbished so the old flooring did not have to be picked up and transported to a landfill. The renovation provided work for local contractors.
- gas and water pipes have been given new functions, such as lighting fixtures, bathroom towel dryers and table legs
- the usable wall tiles, toilet bowls and shutters have been donated after cleaning
- the cracked cast iron bathtub was recycled
- the window frames were sawn up and donated as winter firewood to the poor in the area
- the window panes were cut up and used as wall covering over the kitchen counter and in the bathroom
- the handles of the kitchen cabinet were made of the former tin window sills
- part of the demolished brick was used to wall, the rest was sold
- one of the doors remained, it was renovated as a hidden door, the dining table for 8 people was made of the front door, the other doors were sold
- the old radiators will be renovated and used by the neighbour in his weekend house
- the furnitures were partly recycled as raw material, partly renovated

The most important element of the energy modernization is the better use of the building's capacity than before. To increase solar gain, we get rid of the parapet walls under the windows on the south side, thus significantly increasing the proportion of glazed surface. Luckily on the south side there is a balcony running the full width of the condominium, which perfectly shields the windows in summer, protecting the interior from overheating. Fig.3.

Electric radiators were chosen instead of the previous gas convectors. These radiators have a significantly lower cost, they are easy to operate, and can be individually programmed for every day of the week, so you can heat when you need it. Their installation is significantly simpler and faster compared to designing, licensing and constructing a gas heating system. Plans include covering the balcony railings on the south façade of the building and flat roof with solar panels. An approximately 8m<sup>2</sup> pv-panel area would make a significant contribution to the energy supply of the household. In order to reduce heating costs and ensure pollen-free, clean air, a WOLF CWL-F-150 heat recovery ventilation unit has been installed.

Table 1. List of existing reusable materials

Existing materials	Method of utilisation
parquet	renewal
cement tile	renewal
water/gas pipes	new function: lighting
toilet bowl	donation, further use
wall tile	donation, further use
window frame	donation, fire wood
window glass	new function: wall tile
window sill(tin)	new function: furniture handle
window shutter	donation, further use
brick	reuse/for sale
gas convector	neighbour will reuse
doors	for sale/renewal/new function: dining table
furnitures	reuse/refurbish



Fig. 3. Enlarged glazed surface. (The black area indicates the size of the original windows)

The design task also included the design of furniture and furnishings. With regard to furniture, the main

guiding principle was also with regard to building materials: as little material as possible should end up in landfills and as many materials as possible should extend their life cycle. In the spirit of this principle, armchairs and cabinets of the same age as the apartment have been renovated. The row of cabinet from the eighties became the raw material for the shelves of the new built-in wardrobe and the bathroom furniture. The CO<sup>2</sup> emission from the production of the particle board is about 500g/kg, so using this furniture we saved the earth from 100 kg of CO<sup>2</sup> emissions. Not to mention that there was no need to transport material and no need to landfill the old one. With a view to later recycling, the raw material for the new furnitures has become a uniform plywood, because this material is an extremely durable raw material that can be used in many ways in the future.

The present project was not intended to reduce the cost of renovation, so from this point of view I did not examine in more detail the cost of the various solutions. However, through some examples, it can be seen that environmental awareness does not always mean material benefits. Polishing of old cement tiles cost HUF 10,000 per square meter. Based on the price of ceramic floor coverings available on the market, it can be concluded that the new covering would have cost at least as much. The renovation of the parquet was also HUF 10,000 per square meter. If you had chosen a laminate floor, the renovation could have cost up to half as much. However, it should be noted that the price of solid wood flooring of similar quality can be as much as double the renovation.

## CONCLUSIONS

What can be the lessons of the project, what should we pay more attention to in the future?

Children build a lot, and it was completely self-evident that we used the building blocks over and over again. In contrast, when designing and building architecture, a construction industry system which buys, makes and uses new “building blocks” and materials for each building has become natural. How can this change? I'm convinced that scaling the circular economy begins at home. Some of the 560,000 vacant homes mentioned at the beginning of the study are certainly uninhabitable and cannot be economically renovated. Uninhabitable, but perhaps not useless. It would be good if we became aware that there is something that is more important to all of us than economy, and that is nothing else but the future of the planet EARTH.

There are simple methods that can help to make our future more livable, such as paying much more attention to making better use of our existing resources. For example, instead of sending these buildings to a landfill, we invest energy in saving and recycling its valuable building materials. To achieve this goal, it would be great if local governments not only operated landfills to dispose of demolished building materials, but also supported and encouraged the selective collection of them. These depots could be used by everyone to get rid of their surplus building materials for free and also to get recyclable building materials for free/cheap.

As can be seen from this case study, in the case of housing built of homogeneous building materials with conventional construction techniques, we have the opportunity in many places to consider how to utilise the built-in materials. Fig. 4. Perhaps the easiest option is to keep the raw materials in use for as long as possible. In practice, this means not destroying what we already have, but using it for as long as possible. For example: we don't cover the old cement tile floor with new ceramic tiles just because we don't like the original color anymore. Or, we don't buy new furniture just because it's no longer fashionable.

The situation is a little bit different for buildings built with mass production techniques. In many European countries, a significant number of prefabricated block houses have been built. In Hungary, for example, in 30 years more than 500,000 homes were built with this technology. In connection with the topic of the CE, it would be important to examine how the lifespan of these buildings can be extended. It remains to be seen whether, if these buildings reach the end of their life cycle, it is possible to think of the building materials they contain as raw materials.

We can see that even with very simple tools, the CF of home renovations/constructions can be significantly reduced. Table 2. With reasonable consideration, we can enjoy the 21st century comfort, there is not really a need to invest huge sums in high technology. With a well-chosen heating and ventilation system and properly influenced solar gain, it is possible to design energy-efficient homes at an affordable

priceThe fact that there are 4 flats of similar size and location in the building allows for further research. It would be very useful to perform comparative measurements that could support or even refute the usefulness of the investment.

Table 2. Some examples of preventable CO<sup>2</sup> emissions

2 pcs couches	2x90 kg
1 pcs chair	17 kg
2 pcs armchair	2x43 kg
7 pcs interior door	408 kg
20 m <sup>2</sup> ceramic floor tile	150 kg
30 m <sup>2</sup> laminated floor	120 kg
10 m <sup>2</sup> ceramic wall tile	60 kg
1 bedroom furniture	100kg
SUM	1121 kg

I am convinced that the most significant learning from this project is the design and construction approach, which has kept the CF of home renovation at a significantly lower level than usual. In conclusion, this design experiment suggests areas for further research addressing the role of architecture and design in the CE paradigm shift. At the scale of architectural education, working at the scale of a single apartment unit could be a way to bring students into consideration of architectural issues (and solutions) to the waste problem through studio design-build assignments. Given that the crisis exists at a scale far beyond one single unit, other implications involve design thinking from the scale of a unit, to a whole building, a block, a neighbourhood, a city and region. This would require architects to think of themselves not in isolation but working in solidarity, with groups of related research areas, including ecological activists, economists, businesses in the building materials and waste supply chains, governmental organisations and local municipalities.



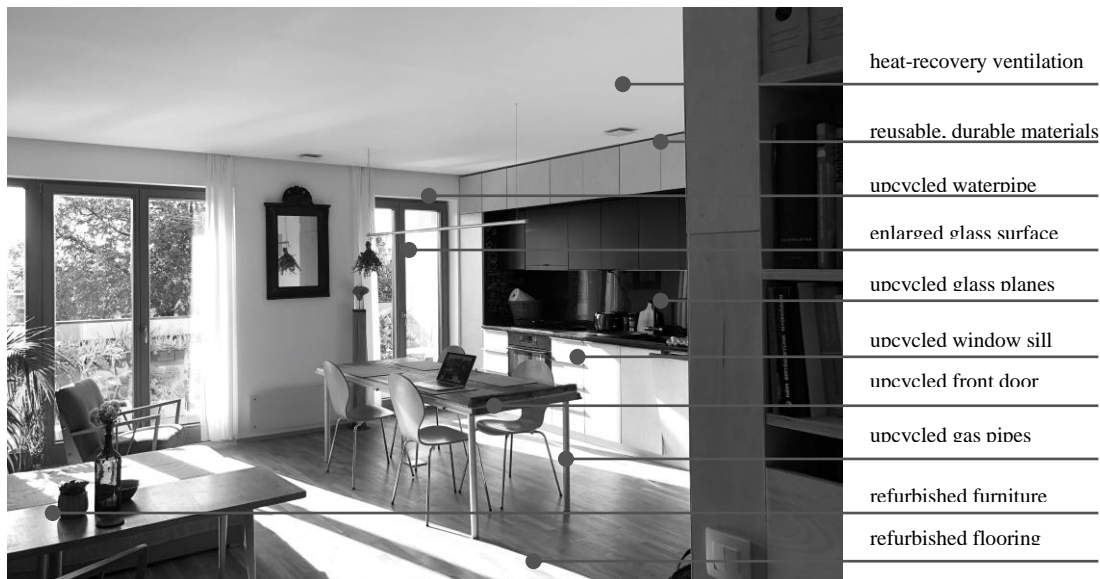


Fig. 4. View from the bedroom to the living room

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# PREFABRICATION AND NEW GENERATION HOUSING DESIGN CRITERIA IN INTERIOR ARCHITECTURE

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## Abstract

Space and human interaction has entered a new era. The interactive global connections of 21st century new media tools and technologies such as virtual reality and augmented reality tools have given birth to a hybrid architecture that combines physical space and virtual space, and this new trend has been immediately embraced by epidemic architecture, which celebrates individual living spaces, with its saviour role. As a result, prefabricated houses that are ready to be installed in the desired place for escape in urban life and that offer an integrated space alternative to working and home life thanks to digital-communication technologies indicate a new generation space design. How should prefabricated construction, which responds to the post-epidemic architecture's tendency to return to nature, be brought together with the new housing understanding that developed especially on the unity of working and living spaces after the epidemic? What will be the approach of interior architecture to prefabricated buildings shaped by the expertise of structural engineering and architecture? It aims to open questions to discussion. First of all, the place of prefabricated construction, which is the main field of expertise of structural engineering and architecture, in interior architecture has been revealed based on the literature research, and then the web sites and blogs specific to the building sector, architecture, interior architecture, and design media have been scanned and a comparative analysis table has been presented. In the epidemic period, the proposed design criteria for new generation space design were determined through common concepts. As a result, it has been underlined that the millennials can meet the new generation housing design criteria in particular, since prefabricated buildings generate less waste, provide more efficient energy planning, and have a dismantlable construction system suitable for integrated life with nature. The importance of being included in the construction process during the design phase of the building element was emphasized.

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**Key Words:** *Prefabrication, Post-Pandemic Housing, Interior Architecture, Design Criteria, Millennials*

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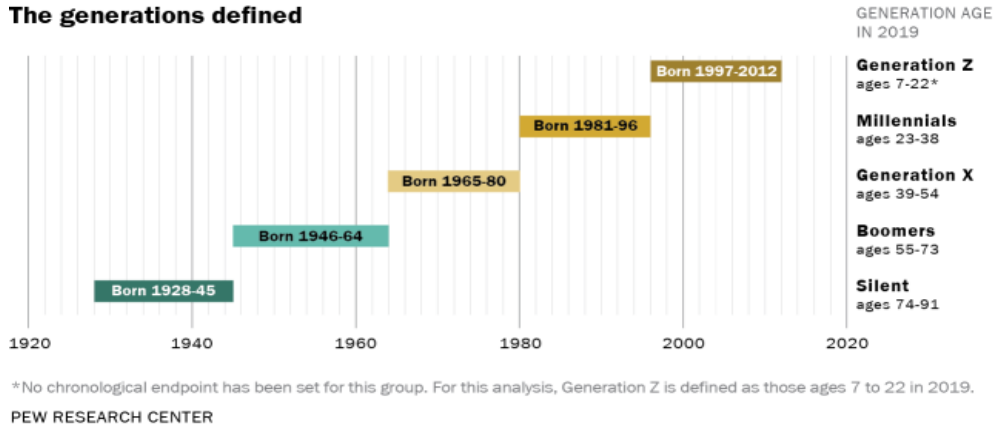
## 1. Introduction

The current Covid-19 Pandemic has changed normal lifestyles. It has necessitated a new lifestyle dependent on digital tools and isolated from normal human interactions. Large-scale physical spaces that make up collective living spaces are replaced by individual spaces. How should prefabricated construction, which responds to the post-epidemic architecture's tendency to return to nature, be brought together with the new housing understanding that developed especially on the unity of working and living spaces after the epidemic? What will be the approach of interior architecture to prefabricated buildings shaped by the expertise of structural engineering and architecture? Before these main questions that need to be answered, the necessity of the interior architect to work with the architect and the engineer, starting from the design stage of the prefabricated building, should be put forward as a hypothesis.

### 1.1. Limitation and Scope

The research was carried out for the Y generation, which covers a large part of the population in general. The Y generation selected as the target audience in the research, published on the official website of the Pew Research Center, which conducts public opinion polls, demographic research, content analysis and other data-based social science research, prepared by Michael Dimock on January 17, 2019, 'Defining generations: Where Millennials end Generation Z begins [1]. It was determined through the Table in the article titled '. Accordingly, the Y generation in Table.1 constitutes the target group between the ages of 23-38.

Table 1. Generations defined with ages [1].



In the research, while determining the Y generation as the target audience, it was assumed that the Y generation is the potential mass that can buy a house by choosing housing after the epidemic. However, it is assumed that the generation Z in the age range of 7-22 will not be able to buy a house yet, constitute the largely unemployed consumer group, while the age groups of the X generation between the ages of 39-54 and before can already be homeowners.

### 1.2. Hypothesis

Most of the time, the prefabrication construction process not only increases the construction speed in the form of mass production, but also provides a high design-implementation unity against the unpredictable design-implementation weakness as a result of changing the designed space in practice due to the technical and technological equipment factor of the construction. This situation minimizes labor losses and the formation of waste in the construction product. However, another benefit is that the interior designer is involved in the construction process even during the production of the building elements, and as a result, by following the design criteria, which are foreseen at the beginning, from the stage of constructing the prefabricated building elements, it allows the realization of guaranteed space designs without unexpected negative consequences.

### 1.3. Research Question and Research Method

This assumption brought with it new sub-research questions: To what extent do the prefabricated approach of interior architecture in space design and the understanding of new generation living space design, which needs after the epidemic, overlap? The determined hypothesis and research question require the construction of a two-stage research in the study:

- Determining the place of prefabricated construction, which is the main field of expertise of building engineering and architecture, in interior architecture and the differing approach.

At this stage, the studies carried out in partnership with the fields of building engineering and architecture and the studies in the field of interior architecture are reviewed and the discipline-specific approach is revealed with a comparative analysis.

- Determining the proposed design criteria for the new generation space design that brings together working and living spaces during the epidemic period.

At this stage, web sites and blogs specific to the building sector, architecture, interior architecture, and design media are scanned during the epidemic period, and common concepts are revealed as agreed design criteria with a comparative analysis table.

## 2. Prefabrication in Engineering and Architecture

Prefabrication is included in D. Hasol's Encyclopedic Dictionary of Architecture (1990) [2] as a word of French origin, which was first defined in 1947 during the founding of the "Union Syndicae de la Préfabrication" in France. Description 'Building with ready-made elements or components; It was built in

the 20th century as a type of 'construction' [2] made by making the site works as factory work as much as possible and assembling the ready-made building elements in the building site. However, it is a very old construction method that dates back to much earlier periods. However, technology, which enables construction to meet industrial production techniques based on the logic of continuity and mass production, has found the opportunity to develop with the industrial revolution. In our country, the first example was given in 1966 as Ereğli Iron and Steel Factory Lodgings. Regardless of the material from which the building component is produced, prefabrication is a technology used in building production and in this sense, it has become an important field of study integrating structural engineering with technology in the 20th century. Since the end of the 20th century, it has been the focus of attention of many academic studies focusing on the intersection of civil engineering and architecture, especially in the field of engineering, as the construction technique of engineering structures such as large-scale industrial buildings.

Prefabricated construction systems have been classified in many ways until today: by material, by size, by weight, etc. As the most general classification, the one according to the degree of prefabrication is accepted. In this classification, the completion level of the building element describes the degree of prefabrication. Classification according to the degree of prefabrication: It is in the form of skeleton systems, panel systems, cell systems and mixed systems in which they are produced in combination with each other in the same structure, and systems can be produced using different building materials (concrete, wood, steel, etc.) [3]. In the literature research, it was seen that the studies on prefabrication were carried out by focusing on certain structural elements groups as concrete and steel in these classifications. The order of broad-framed subject distribution in the studies obtained as a result of the literature research in the department of structural engineering is as follows: 1. Modern Prefabrication Techniques and Applications [4] [5] [6] [7] [8] [9], 2. Prefabricated Building Behaviors [10] [11] [12] [13], 3. Prefabricated Building Connections [14], 4. Prefabricated Buildings in terms of Regulations [15], 5. Economy and Sustainability in Prefabricated Buildings [16] [5].

Among the studies in the field of prefabrication, M. Tapan's doctorate titled "A research on design constraints in multi-storey housing production with reinforced concrete large prefabricated elements", which was made in 1973 [17], was reached as the earliest study. As one of the firsts in this field, the study was used as a source in most of the academic studies carried out in the following years. Y. Ayaydin's (1981) [18] book titled 'Large Span Prefabricated Reinforced Concrete Buildings' is also one of the earliest sources used in the relevant courses of architecture departments.

In the sector, the Turkish Prefabrication Association was established in 1984 with the gathering of 20 organizations experienced in the field of prefabrication. According to the "2005 Prefabrication Sector Report" published by the Union in June 2006 [19], there are a total of 95 establishments producing prefabricated concrete/reinforced concrete elements in Turkey. 25 (26%) of these companies are the member companies of the Turkish Prefabricated Association. All of the 151-25 companies that are members of the Turkish Prefabricated Association are private sector organizations. These companies operate in a total of 33 production facilities and create employment for approximately 3900 people in total, with an average of 118 people per facility. The total annual production capacity of the member companies of the Union is 1.875.000 m<sup>3</sup>. Today, prefabricated reinforced concrete structural elements are used in 85% of industrial buildings in Turkey [19]. However, in housing constructions, which have a 75% share in the construction sector, the rate of use of prefabricated reinforced concrete structural elements is only 4% [10]. According to the official figures of 2006, the share of prefabricated reinforced concrete building elements in the construction sector is 8%, and their share in the total building construction is around 6.8% [19]. These rates remain at very low values compared to Europe and the industrialized world countries, and it has been seen in the literature research that studies focusing on the determination of this problem and its causes have been carried out in the field of architecture. Ayazoglu, I. In his thesis study in 2003 [20], he dealt with Architectural Design Problems in Housing Production with Prefabricated Panel Systems. Ayazoğlu [20] stated that there is a difference in approaches between the design and application processes of traditional construction systems and the design and application processes of industrialized construction systems, and that designing with industrialized systems, unlike traditional systems, takes place in two stages. These stages are: 1. The design of the components that make up the whole of the building, 2. The design of the whole building to be formed by the combination of the components. This differentiation

requires that the design problem be handled with a new approach apart from the conventional design processes [20].

Polat and Damcı [21] stated in their paper titled 'Factors Affecting the Use of Prefabricated Reinforced Concrete Building Elements in the Turkish Construction Sector' in 2007, that although the studies on prefabrication of reinforced concrete structural elements in Turkey started in the 1960s, the sector did not receive sufficient support and the targeted level in the sector was not reached because the first studies did not yield the desired results. they have stated. Although prefabricated reinforced concrete building systems have been widely used for more than half a century in Europe, especially in Northern European countries, prefabricated reinforced concrete building systems are generally used in the construction of industrial buildings and are not preferred in other building types such as residences [21]. Baş and Vural (2019) [3], on the other hand, investigated the 'Usage Opportunities of Prefabricated Concrete Panel Systems in Housing Production' in their article study. Ay, İ (2019) [22] carried out her thesis on 'Determining the Criteria Affecting the Design, Production and Construction Processes of Prefabricated Buildings in the Turkish Construction Sector'. Seitablaiev and Umaroğulları [23] in their review article in 2020 summarized the situation of reinforced concrete prefabrication in the world and in Turkey, and evaluated its use in the context of the development of prefabrication in Turkey. In addition, the effects of economic growth and construction volume on the development of prefabricated construction systems were analyzed in line with the data obtained from the sector reports, and in this context, they underlined the necessity of expanding prefabrication in Turkey, which mostly focuses on infrastructure and industrial structures, but in housing production, which has the largest share in building production.

### **3.Prefabrication in Interior Architecture**

In the literature research conducted in the field of Interior Architecture, it has been seen that very few studies have been carried out compared to the fields of civil engineering and architecture. It is thought that the reason for this is that prefabrication is preferred mostly in engineering structures, especially in industrial buildings, and it is less used in building types that are programmed with the need for more individual space design, such as housing, where interior architects are more active. D. Schneiderman, who has come to the fore in the field of prefabrication in the field of interior architecture in the literature, examines the historical development of prefabrication in the interior with his work titled 'prefabricated interior' in 2011 and emphasizes that this construction method should be adopted as a sustainable and environmentally friendly method, especially by interior architects [24]. The article studies of Schneiderman and Freihofer published in 2013 examine the handling of prefabrication as an application in an interior design studio in interior architecture education [25]. Schneiderman and Freihofer (2013) [25] state that within the scope of this study, the literature is reviewed and the historical importance of prefabrication in interiors dating back thousands of years has been revealed, despite the scarcity of categorical studies focusing on this subject.

The studio started with a research report revealing the lack of current historical evidence linking prefabrication with interior design, followed by a series of theoretical lectures on the subject of 'Prefabricated Interior Design' and introducing sustainable strategies in prefabrication [25]. Finally, the students were tasked with creating and putting together three separate prefabricated design works: a dividing spatial element, a module such as a bathroom-kitchen unit, and an all-encompassing interior. At the end of the education period, a questionnaire was applied to the students about their education, attitudes and professional goals for prefabricated interior design. The results of the survey revealed that the students thought that prefabricated interior design was not "represented" in historical content and professional practice, and also revealed that students' initial awareness of prefabrication in space design was weak, but their attitudes and perceptions towards prefabrication increased with the application of a studio-based course.

Schneiderman and Freihofer stated in their studies that despite all the discourses on sustainability in interior architecture, there was no implementation and that prefabrication construction principles should be adopted and should be considered as a subject in all project groups in interior architecture education, and they emphasized the importance of the subject for built environments with livable space design [25]. In the field of interior architecture, only one thesis study was found during the literature research conducted within the national theses. In this study, it is a master's thesis titled 'Interior Prefabrication and An

Investigation of Contemporary Prefabricated Interior Products' by M.Kurnalı (2015) [26], which refers to the work of Schneiderman and Freihoefer as a source. In the study, first of all, the definition of prefabrication starting from its etymological origin, the prominent features and classifications of prefabricated structures and general information about prefabricated structures in the historical process were given. The history of prefabrication has been examined under 4 titles as its first emergence, pre-modernism, post-modernism and its development in Turkey. Kurnalı (2015) [26] made the definitions of the concepts of modules and units, and analyzed the prefabricated structures or products that were successful in national or international competitions in line with these concepts or that were designed for some special situations.

#### **4. New Generation Housing Approach and Prefabricated Design Criteria**

The thesis, prepared by Brenda Defoe in the Master's Program in Urban and Regional Planning at the University of Florida in 2016, presents a case study of prefabricated and modular construction as an affordable housing solution for millennials of approximately 80 million who are estimated to constitute a quarter of the population in the USA [27]. Defoe states that as millennials begin to enter the housing market, they turn to the types of houses built with energy efficiency, green building and smart home technology preferences [27]. In this study, which was carried out about four years before the epidemic, it is an important indicator that the changing user preferences in the new generation space understanding that emerged after the epidemic started with the millennials.

In the USA, the Y generation is defined as a generation with high social awareness, sensitive to the environment, to which they are exposed to the globalized and changing lifestyle with the information revolution. This generation, which Defoe calls "Digital natives", is the first generation that is increasingly connected and has uninterrupted internet access through social media, a generation that does not have to adapt to new technologies, but develops and shapes it [27]. On the other hand, although they are open to all the innovations of the new media and informatics world, they are considered as a generation that supports the consumption of environmentally friendly products, has awareness of sustainable construction and prefers natural habitats. Defoe explores the role of prefabricated/modular building in creating affordable new generation housing to meet the demands of such a user base [27].

According to Cone Communications' 2013 Cone Communications Social Impact Study: The Next Cause Evolution study report by Cone Porter Novelli Company, which provides social marketing branding service as an international company on serial brand entrepreneurship, Generation Y: They have a very effective power on social networks and have the fingertips of information. They are both users and managers of the digital world from which they are created by their actions [28]. However, they constitute a group of consumers with high social awareness who are sensitive to environmental issues.

According to Barton, Fromm and Egan (2012) [29], the generation that has been taught about recycling since kindergarten wants to be good for the planet and believes that collective action will make a difference. However, millennials think that work is an integral part of life. Instead of making one-off cash or charitable donations, they tend to integrate their cause into daily life by participating in large movements aimed at solving societal problems by purchasing products that support sustainable agriculture or "fair trade" principles.

As a result, millennials are constantly looking for ways to make their homes and lifestyles greener as their actions are environmentally responsible. On the other hand, prefabrication and modular space design positively affect the construction processes in the name of sustainability, while providing less energy use, more efficient resource management, and significantly reducing the destruction of construction with demountable construction systems and environmentally friendly building products.

Thus, prefabricated houses offer the user the option to rebuild their house wherever they want and become attractive in the housing construction sector, which tends to return to nature after the epidemic. On the other hand, the existing building stocks should be renewed with the name of urban transformation at the beginning of the efforts to take improvement measures against natural disasters, especially earthquakes, and this situation brings new environmental problems due to the increase of rubble as non-recyclable waste. In this regard, Smith (2010) [30] states that disaster shelters produced in the factory and distributed quickly offer durable and temporary housing solutions. However, prefabrication undoubtedly contributes to the reduction of post-demolition waste of buildings that complete their life cycle and undergo urban

transformation, and can also contribute to the development of adaptable housing with multi-use-flexible space designs.

#### 4.1. Proposed design criteria for next-generation space design during the epidemic period

In the second stage of the research, web sites and blogs specific to the field, which constitute the construction industry, architecture, interior architecture and design media, published between 2020-2021, covering the epidemic period, were scanned. During the epidemic, the views put forward about the changing living conditions and new generation living spaces were brought together. The keywords used in the research were *epidemic architecture*, *new living spaces*, *post-epidemic space design*, *new housing approaches*, *epidemic and interior design*, *future trends in interior architecture*. As a result, the release date, web/Blog address, 50 articles, articles and author names are listed in Table2.

Table 2. Web Pages and Blogs Examined Within the Scope of Literature Review.

	Release date	Web Page/Blog Address	Article and Author
1	19.June2020	share-architects.com - (W)	Architecture matters. Towards antifragility in the Post Pandemic Era/Andreea Robu-Movilă
2	02.June2020	<a href="https://gngindia.com/blogs/">https://gngindia.com/blogs/</a> - (B)	ENVISIONING POST- PANDEMIC ARCHITECTURE PRACTISE/ANKUR GAUTAM
3	28.July2020	archdaily.com - (W)	RIBA Announces Winners of Post-Pandemic Design Competition/Eric Baldwin
4	19.Oct.2020	<a href="https://www.dwell.com">https://www.dwell.com</a> - (W)	How the Pandemic Is Reshaping Interior Design So Far/Anna Squier
5	03.April2020	<a href="https://www.italianbark.com/">https://www.italianbark.com/</a> - (B)	8 Future Interior Trends for the homes driven by the Corona virus/Elisabetta Rizzato
6	18.August2020	<a href="https://pursuit.unimelb.edu.au">https://pursuit.unimelb.edu.au</a> - (W)	Architecture and Design in a Post-Pandemic World/Professor Alan Pert and Dr Stephanie Liddicoat
7	03.Jan.2021	archdaily.com - (W)	Makes a Home and How Do We Plan for its Future?/Kaley Overstreet
8	15.June2020	<a href="https://bobbyberk.com/">https://bobbyberk.com/</a> (W)	Life After Covid-19: How Interior Design Will Change/Bobby Berk
9	07.Jan2021	<a href="https://www.elledecor.com/">https://www.elledecor.com/</a> (W)	NOW WHAT? HOW HOME DESIGN AND ARCHITECTURE SHOULD ADAPT TO A POST-COVID WORLD/Charles Curkin
10	20.July2020	bimsmith.com (W)	Four Considerations as We Design Post-Pandemic Spaces/Kanye Winston
11	23.April2020	gensler.com (W)	How Should Office Buildings Change in a Post-Pandemic World?/Ben Tranel
12	04.May2020	gensler.com (W)	An Architecture of Optimism for Post-Pandemic Society/Jordan Goldstein
13	30.Sept.2020	www.forbes.com (W)	Five Ways the Pandemic has Influenced Interior Design 2020/ Amanda Lauren
14	08.April2021	idesignawards.com (W)	Safe Shed/ SARAH GOLDBLATT
15	07.Jan.2021	bionniccity.com (W)	Covid-19 Design Innovation Grant/ Melissa Sterry
16	14.Sept.2020	bathbospoke.co.uk (B)	Post-Pandemic Architecture/ Jess Spoke
17	07.Oct.2020	www.goodhousekeepin g.com (W)	A Top Designers Take on How Homes Might Look Post Covid-19/Monique Valeris
18	13.August2020	www.theurbaneditions.com (B)	Inter-Pandemic Architecture/ Devon Passivhaus, McLean Quinlan
19	12.Feb.2021	www.vsj.com (W)	13 Interior Design Trends Shaped by Pandemic/ Kathryn O'Shea Evans
20	04.May2020	architecturaldigest.com (W)	8 Ways COVID-19 Will Impact the Future of Interior Design /Tiffany Jow
21	24.April2021	architecturaldigest.com (W)	Designing for Kids to Get a Lot More Play Post-COVID
22	30.Sept.2020	re-thinkingthefuture.com (W)	10 Innovative Conceptual Public Space Designs Post-Pandemic
23	15.June2020	ibigroup.com (W)	Senior Living and Long-Term Care in a Post-Pandemic World: Part 2

2 4	12.Feb.20 21	www.arup.com (W)	A new approach to urban space in a post-pandemic Middle East
2 5	29.May20 21	www.multihousingnews.com (W)	Senior Housing Design Trends Post-COVID-19
2 6	08.Nov..2 020	www.frameweb.com (W)	POST-PANDEMIC SCHOOLING: SEEING THE PLAYGROUND AS AN EXTENSION OF THE CLASSROOM
2 7	14.July20 20	www.bloomberg.com (W)	How to Design a Post-Pandemic City
2 8	13.May20 20	seniorhousingnews.com (W)	Senior Living Industry Rethinks Building Designs, Improvises Solutions During Covid-19
2 9	16.Oct.20 20	www.homeaccenttoday.com (W)	Design Intelligence: The changing face of post-pandemic design
3 0	18.June20 .21	www.scmp.com (W)	This is what public spaces will be like for you post-pandemic: touchless buttons, natural air, flexible layouts – and more QR codes
3 1	05.Oct.20 20	blog.nic.org(B)	Designing for the Pandemic: A Look at Seniors Housing Design Principles
3 2	23.July20 21	adp-architecture.com (W)	Improving Children’s Lives Through Design
3 3	Feb.2021	gestalten.com(B)	Henning Larsen: Will The Pandemic Change Architecture?
3 4	18.June20 .21	timesofindia.indiatimes.com(W)	Smart post-pandemic office interior changes
3 5	27.Oct.20 20	www.apa.org(W)	Building a safe space in the pandemic
3 6	09.Oct.20 20	jgu.edu.in(B)	THE PANDEMIC IS CHANGING THE FUTURE OF ARCHITECTURE—NOW IS A GOOD TIME TO STUDY INTERIOR DESIGN
3 7	13.July.2 020	www.washingtonpost.com (W)	Designing to Survive
3 8	08.July.2 020	archdaily.com -(W)	Healthy Design: The Latest Architecture and News Materiality in a Post-COVID-19 World
3 9	17.June.2 020	www.newyorker.com (W)	How the Coronavirus Will Reshape Architecture
4 0	10.Sept.2 020	www.canadianarchitect.com (W)	How will the design of commercial and multi-unit residential buildings change, post-pandemic?
4 1	31.May20 21	sightlinesmag.org (W)	Pandemic Places: Notes from Afield
4 2	17.March 2021	www.linkedin.com (W)	Post-Pandemic, What’s Next For Senior Housing?
4 3	20.July20 20	frameweb.com (W)	POST-PANDEMIC URBANISM: WHY IT’S VITAL THAT WE RECLAIM THE SIDEWALK
4 4	21.June20 21	www.sasaki.com (W)	Post-Pandemic Workplace Design Will Not Be the Same for All
4 5	24.June20 21	www.smithgroup.com (W)	HOW DESIGN OF SENIOR LIVING COMMUNITIES MUST CHANGE AFTER COVID-19
4 6	20.July20 20	naaee.org (W)	The impact of COVID-19 on public space: An early review of the emerging questions - design, perceptions and inequities
4 7	26.July20 20	www.hindustantimes.com (W)	Urban Design in times of Covid-19: Imagining a post-pandemic city
4 8	11.March 2021	theconversation.com (W)	Rewild your kids: why playing outside should be a post-pandemic priority
4 9	28.May20 20	www.mixinteriors.com (W)	Realising the post-pandemic workplace
5 0	11.June20 21	www.domusweb.it (W)	The post-pandemic challenge: can indoor spaces be safe again?

According to Table 2, forty web pages and ten blogs related to the subject constitute the sample universe of the paper. The sample universe created in Table 2 has been analyzed in terms of new housing design preferences of the Y generation and 20 case studies that stand out as architecture, interior architecture and design media have been determined. When the articles in the determined web/blogs were analyzed with their conceptual frameworks, the subject focuses of Prefab Housing, Flexibility/Permeability, Home Office Working, Nature Integrated Living, Individuality, Smart Systems were determined Table3.

Sixteen web and four blog pages selected for the case study were narrowed down within the limitations of the paper and listed in a table by relating to the interior design criteria. The sequenced case-studies rows are matched to the design criteria Prefab Housing, Flexibility/Permeability, Home Office Working, Nature Integrated Living, Individuality, Smart Systems, which are created as table columns.



Table 3. Analysis Study on Web Pages and Blogs Examined within the Scope of Literature Review

	Release date	Web Page/Blog Address	Article and Author	Design Criteria					
				Prefab Housing	Flexibility/Permeability	Home Office Working	Nature Integrated Living	Individuality	Smart Home System
1	19.June 2020	share-architects.com - (W)	Architecture matters. Towards antifragility in the Post Pandemic Era/Andreea Robu-Movilă		+	+		+	+
2	02.June2020	<a href="https://gngindia.com/blogs/- (B)">https://gngindia.com/blogs/- (B)</a>	ENVISIONING POST- PANDEMIC ARCHITECTURE PRACTISE/ANKUR GAUTAM		+	+		+	+
3	28.July2020	archdaily.com -(W)	RIBA Announces Winners of Post-Pandemic Design Competition/Eric Baldwin		+		+		
4	19.Oct 2020	<a href="https://www.dwell.com -(W)">https://www.dwell.com -(W)</a>	How the Pandemic Is Reshaping Interior Design So Far/Anna Squier	+	+		+	+	
5	03.April2020	<a href="https://www.italianbark.com/- (B)">https://www.italianbark.com/- (B)</a>	8 Future Interior Trends for the homes driven by the Corona virus/Elisabetta Rizzato	+	+		+	+	+
6	18.August2020	<a href="https://pursuit.unimelb.edu.au -(W)">https://pursuit.unimelb.edu.au -(W)</a>	Architecture and Design in a Post-Pandemic World/Professor Alan Pert and Dr Stephanie Liddicoat			+			+
7	03.Jan2021	archdaily.com -(W)	Makes a Home and How Do We Plan for its Future?/Kaley Overstreet	+	+	+	+		
8	15.June2020	<a href="https://bobbyberk.com/(W)">https://bobbyberk.com/(W)</a>	Life After Covid-19: How Interior Design Will Change/Bobby Berk		+	+	+	+	
9	07.Jan 2021	<a href="https://www.elledecor.com/(W)">https://www.elledecor.com/(W)</a>	NOW WHAT? HOW HOME DESIGN AND ARCHITECTURE SHOULD ADAPT TO A POST-COVID WORLD/Charles Curkin		+	+	+	+	
10	20.July2020	bimsmith.com (W)	Four Considerations as We Design Post-Pandemic Spaces/Kanye Winston		+		+	+	
11	23.April2020	gensler.com (W)	How Should Office Buildings Change in a Post-Pandemic World?/Ben Tranel	+	+		+	+	+
12	04.May2020	gensler.com (W)	An Architecture of Optimism for Post-Pandemic Society/Jordan Goldstein						+
13	30.Sept 2020	www.forbes.com (W)	Five Ways the Pandemic has Influenced Interior Design 2020/ Amanda Lauren	+	+	+			+
14	08.April2021	idesignawards.com (W)	Safe Shed/ SARAH GOLDBLATT	+			+		
15	07.June2021	bionniccity.com (W)	Covid-19 Design Innovation Grant/ Melissa Sterry		+			+	
16	14.Sept.2020	bathbespoke.co.uk (B)	Post-Pandemic Architecture/ Jess Spoke	+			+	+	+
17	07.Sept2020	www.goodhousekeeping.com (W)	A Top Designers Take on How Homes Might Look Post Covid-19/Monique Valeris		+		+		
18	13.August2020	www.theurbaneditions.com (B)	Inter-Pandemic Architecture/ Devon Passivhaus, McLean Quinlan	+			+		+
19	12.Feb2021	www.vsj.com (W)	13 Interior Design Trends Shaped by Pandemic/ Kathryn O'Shea Evans		+			+	+
20	04.May2020	architecturaldigest.com (W)	8 Ways COVID-19 Will Impact the Future of Interior Design /Tiffany Jow						+

## 5. Conclusion

The assumption put forward in the study is that the interior architect should be involved in the project together with the architect and engineer from the design stage in the production of prefabricated building and building elements, and thus, by following the design criteria originally envisaged by the interior architect from the stage of constructing the prefabricated building elements, the construction of a house that is not preferred by the user can be prevented.

Based on this assumption, in the study, 'How much does the prefabricated approach of interior architecture in space design and the understanding of new generation living space design that needs after the epidemic overlap?' was determined as the research question. The study was carried out with a two-stage research. In the first stage, the place of prefabricated construction, which constitutes the specialization field of structural engineering and architecture, in interior architecture and the differentiating approach were determined by literature review. In the second stage, the determination of the proposed design criteria for the new generation housing design that brings together working and living spaces during the epidemic period: It was carried out by reviewing the site-specific websites and blogs that constitute the building sector, architecture, interior architecture, design media. The target user group focused in the study was determined as the Y generation between the ages of 23-38.

As a result of the first phase of the research, it was seen that prefabrication in the field of Interior Architecture was handled in a much narrower field than structural engineering and architecture in the literature. In the studies on prefabrication in the fields of Structural Engineering and Architecture, no study has been found that deals with the subject in terms of interior architecture and interior design criteria. However, it has been seen in the literature review that all professions in the construction industry are in common opinion that prefabrication provides an environment-friendly, sustainable construction opportunity, provides efficient energy use in construction, and saves the high cost of faulty workmanship practices.

In the second stage of the research, web sites and blogs specific to the field that make up the building sector, architecture, interior architecture and design media published between 2020-2021, covering the epidemic period, were reviewed. Changes in living conditions and new generation living spaces during the epidemic were brought together and listed in a table. The table was analyzed in terms of the new housing design preferences of the Y generation and 20 case studies were determined as architecture, interior architecture and design media. When the articles in the determined web/blogs were analyzed with their conceptual frameworks, the subject focuses of Prefab Housing, Flexibility/Permeability, Home Office Working, Nature Integrated Living, Individuality, Smart Systems were determined.

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# Sustainability and resilience of traditional timber structures in earthquake prone regions of continental Croatia

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## Abstract

Nowadays, when experts consider sustainability, they are mainly concerned with global factors that endanger our civilization and even our survival as well as survival of other species. Climate change is an example of such a menace. In the past, when threats were caused by local factors, such as local floods and earthquakes, the sustainability of structures can be defined as the quality of structures to resist adverse events without endangering human lives and thus to provide safety to individuals and societies. In this context, the buildings from the past that came to us as still existing structures testify to their sustainability. The ones that resisted severe earthquakes without serious damage are worth studying, because they can offer valuable insight into their seismic behavior and thus reveal the “secrets” of their resilience. The understanding of what makes certain historical structures earthquake-resistant is precious for modern engineers, in order to design sustainable, seismic resistant buildings. In fact, even nowadays, with our advanced knowledge in mechanics and our computational and experimental methods, it is hard to reliably model structural behavior of a real building submitted to earthquake vibrations. Thus, the study and analysis of earthquake-resistant structures from the past is a precious source of knowledge that should be applied for future sustainable building. As a contribution to this knowledge, traditional timber structures in continental Croatia have been analyzed. In the recent earthquakes in Zagreb and Banovina regions, traditional timber houses proved to be earthquake resistant: no damage of these traditional timber houses of the region was recorded, while newer masonry structures and even some reinforced concrete structures suffered considerable damage. The analysis of these structures showed that the proven seismic resistance of traditional timber houses in this region is due to the specific way of construction. The walls of traditional timber structures in these regions have been constructed of horizontal logs or planks connected with dovetail joints, which require high 3D precision and mastery of builders. This type of joints enables micro-displacements and thus dissipation of seismic energy. Of special interest is a detail used in the past for connecting lower part of traditional timber houses (their foundations) with their upper parts (walls), This detail enables relative displacements of the upper structure with respect to its lower part, providing a seismic isolation of the structure. The principle of seismic isolation has been only recently applied by modern engineers to assure seismic resistance of important new buildings. Even though the theory of mechanics was not known in the past, the principle of seismic isolation was applied by traditional master-builders to create resilient earthquake-resistant structures. This testifies that empiric knowledge of generations of master-builders is worth studying even today.

**Key Words:** *sustainable building; earthquake resistance; traditional timber houses; continental Croatia; seismic isolation*

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## 1. Introduction

### 1.1. Definition of sustainability in different contexts

Sustainability is defined as the ability to be maintained at a certain rate or level. Today, we often refer to the sustainable progress, or to the sustainable activities, which would not endanger our planet.

In this sense, sustainability is connected to the efforts to maintain the ecological balance of our planet. Scientists are mainly concerned about the climate change which causes global warming of our planet that results in melting of polar ice, rising of sea level and catastrophic events like huge floods.

The efforts of architects, civil engineers and other professionals and scientists to reduce the carbon footprint of our global civilization, should be highly praised. Due to their discoveries, humanity gets conscious of the repercussions of our deeds and starts actively caring of our planet; due to their innovations we can use alternative energy sources and reduce carbon footprint by making better insulation.

Nonetheless, if we turn back to the definition of sustainability as the ability to be maintained at a certain rate or level, we can apply this term to the quality of structures. In this meaning, sustainable structures could be defined as high-quality structures which demand lower quantity of maintenance to provide the same level of quality than other, not so sustainable structures.

This aspect of sustainability is especially important when we consider catastrophic events that could not only damage structures but also endanger people's lives. In this sense, the humanistic aspect of sustainability and resilience is important: to save lives. In the past the planet Earth was not endangered, but smaller societies could have been endangered by local catastrophic events - even to the level of extinction.

The buildings from the past that came to us as still existing structures (though perhaps damaged at a lower or higher degree, but still standing) testify to their sustainability. In this context, sustainability is defined as the quality of structures to resist adverse events (such as earthquakes, floods etc) without endangering human lives and to be functional at least for basic actions necessary for a human being and for a community to survive such natural disasters and to recover from them. Evidently, this definition applies to the past catastrophic events, which were limited to smaller regions. The menaces we face today threaten the whole planet.

### *1.2. Earthquakes and sustainability*

Earthquakes are catastrophic events that in the past caused collapse of several civilizations (e.g. some scholars link the downfall of the high ancient civilization of Crete with the earthquake caused by a huge eruption of the volcano in the island of Thera – nowadays Santorini). Even now, strong earthquakes cause destruction, huge material damage and painful loss of lives. The consequences of strong earthquakes are not easy to be healed and eliminated even in our technically progressive global civilization, when water, food, technical aid can be provided promptly, from many local communities, often distant, which were not hit by the earthquake.

In the past, of course, the aid from distant communities could not be provided, due to the lack of modern communications and slow means of transport. The community hit by earthquake had to cure its wounds alone, and to remove the consequences of a disaster alone, without help of other communities.

Thus, the earthquake resistance of buildings was essential for the survival of persons, their communities and their economies – in a word, for their sustainability.

## **2. Lessons learned from the recent earthquakes in continental Croatia**

Two strong earthquakes which hit continental Croatia in 2020 made us aware of how important is to build resilient, earthquake-resistant structures.

### *2.1. Earthquakes in continental Croatia in the year 2020*

On March 22, 2020, Zagreb, the capital of Croatia, was hit by the earthquake of magnitude 5.3  $M_w$  according to the moment magnitude scale (MMS). [1]

Nine months later, on December 29, 2020 the earthquake of magnitude 6.4  $M_w$  hit the region of Banovina, in central Croatia, approx. 3 km west-southwest of the town of Petrinja. some 50 km south-east of Zagreb. [2]

The Banovina earthquake caused much damage in nearby towns of Petrinja, Sisak and Glina. The maximum intensity was estimated at VIII (*heavily damaging*) to IX (*destructive*) on the EMS (European macroseismic scale). [2] Seven persons lost their lives that day, and several persons in the aftershocks.

The Zagreb earthquake, though featuring a lesser magnitude, also caused much damage, and one girl lost her life. It was damaging because its epicenter was within the area of the city, ca. 7 km north of the city centre. [1]

### *2.2. Behaviour of structures in the recent earthquakes in continental Croatia*

The observation and study of the damage caused by the 2020 earthquakes in Croatia evidenced a notorious, but often ignored fact: that for a good behavior of structures under seismic load a good earthquake-resistant overall concept is of essential importance. In fact, the concept of a building is much more important for its seismic resistance than large, sometimes excessive quantity of building material used for construction.

In particular, it was noticed that traditional timber houses in the Banovina and Turopolje regions, as well as still existing traditional timber houses at the outskirts of Zagreb, did not suffer any damage – although they are old, and most of them had not been properly maintained.

At the same time, masonry structures, and even concrete structures from the 20<sup>th</sup> century, were damaged to a greater or lesser degree.

### 2.3. Resilience of historical structures in earthquake prone regions

In earthquake prone regions, resilient, earthquake resistant structures have always been of essential importance. Nowadays we make considerable efforts to design earthquake resistant structures, using our knowledge of mechanics for intricate dynamic calculations, and making use of computational programs for defining stresses under seismic loads; we use shaking table experiments to deepen our knowledge and to improve the overall earthquake behavior of our structures.

In the past, builders were not equipped with such elaborate tools. Nevertheless, they constructed resilient buildings that resisted a number of earthquakes. The lessons that we have to learn (or repeat) on building in earthquake-prone regions - be it the traditional timber constructions in continental Croatia or other buildings around the world that withstood strong earthquakes - deserve our consideration and analysis.

## 3. Traditional way of constructing timber houses in continental Croatia

### 3.1. Natural resources

Among traditional houses in continental Croatia, traditional timber houses in the Sava-Kupa alluvial plain, to the south of the city of Zagreb, have always attracted special interest of art-historians. [3]

On the north the plain is bounded by the Medvednica mountain (known also as the mountain of Zagreb) and to the south by the hills and mountain of Zrinska gora and other mountains. In the past, the plain was often flooded by the river Sava, which flows near the city of Zagreb (the capital of Croatia) and through the town of Sisak (once the capital of the Roman region of Pannonia). Because of the adverse circumstances, the inhabitants used to construct pile dwellings (stilt houses). [4]

Although nowadays in this region there are no pile houses any more, their existence is proven in historical written sources and drawings. [5]

For constructing pile houses, the inhabitants used high-quality oak wood, abundant in nearby forests of pedunculate oak (Latin: *quercus robur*). Due to the specific social organization of the sub-region of Turopolje (a region within the Sava-Kupa plain), a large forested area known as *Turopoljski lug* ("The forest of Turopolje") was owned by inhabitants of Turopolje as a collective feudal master.

Due to this organization, the inhabitants of Turopolje decided collectively how the large *Forest of Turopolje* would be exploited, i.e. how much timber one family was allowed to cut within a certain period. Thus, the *Forest of Turopolje* was indeed managed carefully, without excessive felling of trees. In a word: this precious common good, the *Forest of Turopolje*, was managed in a sustainable way.

### 3.2. Elements and features of traditional timber houses

In Turopolje, because of frequent floods of the river Sava, people used to live in pile houses. For constructing their dwelling raised on stilts, the inhabitants of Turopolje used oak timber from the nearby *Forest of Turopolje*. Local master-builders used it for construction of walls and roof structures, for covering (shingles), for doors and windows, and even for stilts. Stilts (piles) were exposed to changing water level – which is a very aggressive factor for all materials – but due to the very high quality of local oak timber, the pile houses were nevertheless durable.

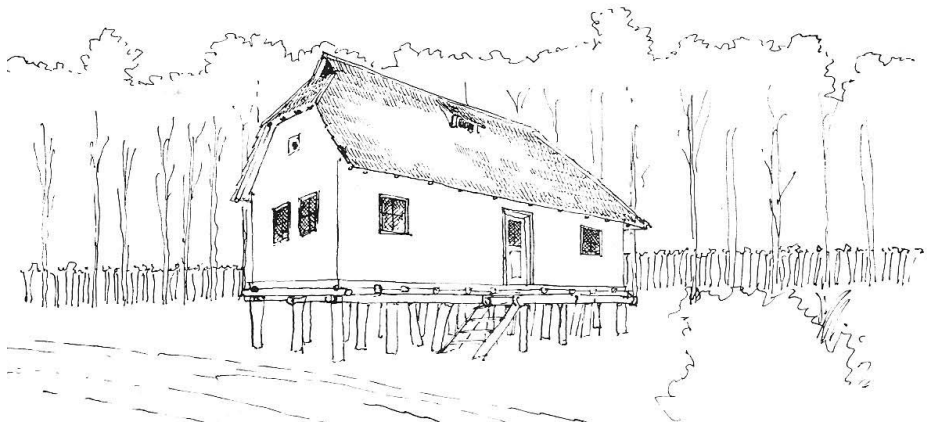


Fig. 1. Traditional timber house raised on stilts, village Mlaka near the Sava river, Croatia.  
Drawing by A. Freudenreich, 1979 [5]

The houses were originally pile dwellings, with a free, open ground level – the open space on this level was intended for livestock and for storage. In times of flood people would flee in the upper floor, and cattle would be transferred to the hills.



Fig. 2. Čardak - traditional timber house in Mračin, Turopolje region.  
Although relatively small, the so-called *Načelnikov čardak* has a ground floor and an upper floor  
(Photo by the author)

Only in later times, when rivers in the region were ameliorated, and the terrain was freed of floods, the ground level of the pile dwellings was enclosed with perimetral timber walls, and the ground level was used also for human activities, such as cooking. Even now the main rooms of the houses – all sleeping rooms – are on the upper floor.

Nowadays pile dwellings are not preserved, but they are documented in documentary drawings and descriptions of ethnologists.

The tradition of pile dwellings is echoed even now in the type of houses: the majority of traditional houses in Turopolje still have been conceived as two-floor houses, with a ground floor and an upper floor, although they were constructed in scarcely populated region, in the villages where there was plenty of free ground for buildings. It should be mentioned that in other regions of continental Croatia traditional houses usually had only ground floor.

It is interesting that the traditional houses in Turopolje featuring an upper floor are still now called *čardak*, while houses without the upper floor (which are in minority in this region) have never been called *čardak*. *Čardak* is etimologically linked to the Turkish word *çardak*, which, according to dictionaries that I have consulted, in Turkish means structure that is free in the lower level, like pergolas, trellis etc.

#### **4. Construction technique**

##### *4.1. Carpentry joints of timber walls*

The timber houses of Turopolje are all built in the same way – they are constructed of horizontal logs (in the later period of planks), connected at the angles with carpentry joints.

The orthogonal connection of logs or planks at the angles were achieved by dovetail joints. For constructing massive timber walls, only this type of joints was used; for timber roof structures, of course, also other types of joinery were used.

Dovetail joints at the angles of timber walls, although they may seem simple, requested high skill and 3D visualization of master-builders because of the intricate geometry with oblique surfaces in various planes of the joints. As joints are relatively small elements, so also the utmost precision was necessary.

The joints were made without nails and screws; in fact, without any metal connecting element and without added wooden wedges or dowels. Dovetail joints have been designed to restrict the freedom of motion in two orthogonal directions, restricting displacements caused by compressive and tensile stresses. Hence they were formed by surfaces oblique in various direction, which results in intricate 3D geometry of the joints. Therefore, the masters specialized in construction of traditional timber houses have always been highly respected.

##### *4.2. Traditional variants of dovetail joints*

In the whole region of the continental part of Croatia, the joints of traditional timber houses were made in the same way; the ethnologists differ so-called *Croatian angle* joint from the so-called *German angle* joint.

Technically, it is the same type of joint: the only difference consists in the fact that the ends of logs (or planks) were cut off in the German joints, while in the Croatian joints they protrude from the angles of the building. Thus, in the *Croatian angle* the actual connection detail is concealed, while in *German angle* joints the geometry of the connection is visible, but only partially. *Croatian angle* is an older form, reflecting the belief of constructors that the protruding ends would make the angle joint more resistant.

The terms *Croatian angle* and *German angle* point to their different origin: German joint is an imported form, as can be understood from the term itself. In Croatia, the use of *German angle* joint begun later than the one of the *Croatian angle* joint.





Fig. 3. Croatian angle joint

Source: Živković Z. *Hrvatsko tradicijsko graditeljstvo* [3]



Fig. 4. German angle joint

(Photo by the author)

#### 4.3. Gables

Both *Croatian angle* and *German angle* were used at the intersection of walls, but this type of joint was impossible to be applied at the level of a roof structure, because here there are no intersecting walls. The gables were constructed in a different way, with less massive timber elements.

The problem of gables, which cannot be fixed and fastened to other structural elements by dovetail joints, emerged as one of the biggest problems in the earthquakes of Zagreb and Banovina, but not within traditional timber structures, but in masonry buildings. Gables of historical masonry structures resulted to be the most threatening parts of buildings with pitched roofs, because they are not connected with the other parts of masonry structures.



Fig. 5. Traditional timber house in Mraclin: *Jerbekov čardak*  
 Massive timber walls are constructed with dovetail joints while gable has a lighter structure  
 (Photo by Ratko Cvetnić)

#### 4.4. Foundations

The timber walls of traditional houses were constructed on horizontal timber frames made of stronger horizontal elements which were placed on foundations. Foundations were not continuous, but punctual elements. They were constructed of stones, spaced apart between them, and placed under connections of walls. Another way of constructing foundations was by using wooden stilts driven into the ground at discrete points under the intersection points of horizontal elements.

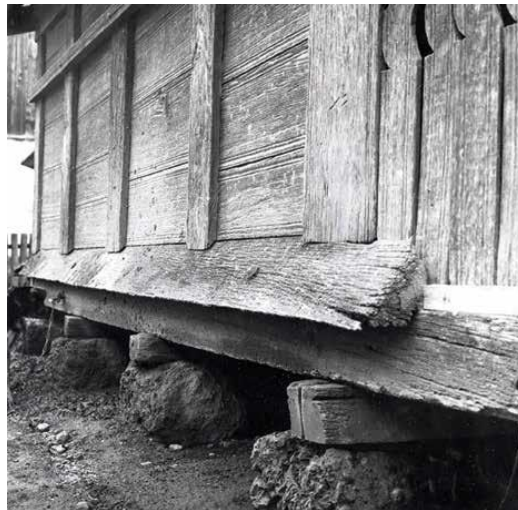


Fig. 6. Detail of foundation – timber frame is raised from the soil  
 Source: Živković Z. *Hrvatsko tradicijsko graditeljstvo* [3]

This detail provided a simple and efficient insulation of the upper structure from a wet marshy soil. Similar solutions were developed also in other regions of the world (e.g. Japan). [6]

Another – and very important - aspect of this traditional detail of separation of foundation from the upper structure (timber walls) is the seismic isolation.

The displacements of the soil and of the foundation stones are transferred to the upper structure only in reduced quantity. The upper structure acts as a 3D box, subjected to a much lesser extent to displacements and vibrations caused by earthquakes.

In fact, the traditional timber houses were not reported to suffer any damage in the 2020 earthquakes in continental Croatia. The inhabitants of the village of Mraclin in Turopolje who were in their traditional timber houses during the earthquake of magnitude 6.4  $M_w$  on December 29, 2020, in Banovina, testify that they felt strong vibrations of the timber houses, but no damage occurred.

## 5. Conclusion

### 5.1. Ductility and seismic isolation of traditional timber structures in continental Croatia

The joints of the walls of traditional timber houses in continental Croatia create a resistant 3D structure but enable micro displacements within the joints themselves. Due to these tiny displacements, during the earthquake a dissipation of energy occurs. In this way, the seismic energy which “attacks” the structure is dissipated and reduced. Ductility of timber structures is a well-known fact: in traditional Croatian timber houses it is even improved by specific joints, made without metal elements (screws, nails) which could cause concentration of stresses.

This precious characteristic of ductility of joints of the timber walls is even improved by another special feature: the specific method and details of construction of foundations. The superstructure of traditional timber houses, their walls, were constructed on rigid frame made of strong massive timber elements. This frame was laid on stones or on wooden stilts, so that the upper structure can actually be displaced in relation to the substructure.



Fig. 6. The so-called “Odd čardak” in Mraclin, Turopolje region,  
Its street façade looks like a rear façade, because it was “rolled” across the main street  
(Photo by the author)

There are testimonies that occasionally timber houses were transferred from one place to another. This action, known locally as “*prevlačenje*” (what can be translated as traction over or drawing over) meant the transport of the house as a whole. Supposedly, it was done by rolling the house on a series of trunks. Although I have not testified to such an operation, some older people of Mraclin (a village in Turopolje)



witnessed to the “*prevlačenje*” in the not so far past. Moreover, the memory of local inhabitants is testified by one still existing “*čardak*” in Mraclin, which was said to have been “drawn” from its original plot to the plot across the street.

The oral tradition is corroborated by the unusual characteristics of this peculiar “*čardak*” in the main street of Mraclin which was “rolled over” the street. This “*čardak*” is odd, because its street façade does not look like the street façades of other “*čardaks*” in Turopolje. In fact, its street façade displays the form of the “rear façade”.

The substructure (foundation made of stilts or stones set on distance from one another, not connected to form a continuous foundation), connects the upper structure with the ground only in discrete points, which results in the insulation of the upper structure (walls and roof) from the soil.

This solution was probably developed because it provides the insulation from moisture, i.e. from rising damp. Similar details are known from historical architecture, e.g. stones which formed foundations of timber columns of Japanese traditional structures, which primarily insulated wooden columns of the upper structure from a wet soil. [6]

Another, very important function of this type of foundation was probably discovered only later: the described detail of connection between base frame and the superstructure provides also a seismic isolation. The vibrations of soil are transferred to the superstructure only in reduced quantity: the displacements of foundations and of the superstructure can be described as relatively independent.

The superstructure, in its turn, behaves as a 3D structure, as a box. The displacements of this “box”, relatively independent of the displacements of the soil, dissipate an important amount of energy.

Due to the concept and details of the structure of traditional timber houses, seismic energy is efficiently dissipated, and structure is earthquake resistant.

The earthquake resistance of traditional timber houses, with their carpentry joints that allow dissipation of seismic energy, and with the specific solution of foundations that provide a seismic isolation, was proven in the recent earthquakes in central Croatia.



Fig. 7. Main street of Mraclin, Turopolje:

*Jankečinov čardak* (in front) and *Jovačev čardak* (behind)

*Jankečinov čardak*, the largest traditional timber house in Mraclin, although not maintained for a long time, resisted the 2020 earthquakes, while the masonry church (left) was damaged.

(Photo by the author)

There were no reports on demolished or even damaged traditional timber houses. And it should be mentioned that these traditional buildings are old; some of them were constructed two or three centuries ago. Though the evidence on the time period in which they were built is rarely known with precision, and though they cannot be precisely dated on the base of their formal elements, the *terminus ante quem* i.e. the period before which they had already existed, can be relatively accurately established.

### 5.2. Example of seismic isolation of historical buildings in other regions of the world

It is known that principle of earthquake isolation was successfully applied also in other historical structures, in other cultures.

The example of Guanying hall of the Dule-si temple in the Jizhou District of Tianjin, China, testifies to the excellent seismic resistance of the important historical building made of wood. The constructional system of Guanying hall differs from Croatian traditional timber buildings – it is a characteristic Chinese timber-framed structure.

According to the presentation of Prof. Chen Zhi-hua at the International Course on Preventive Measures for the Protection of Cultural Property in Earthquake Prone Regions, IZIIS-ICCROM, Skopje. 1985 (unpublished), it was observed that Guanying hall was not damaged in one of the strong 20<sup>th</sup> century earthquakes, while numerous modern concrete buildings in the vicinity were severely damaged, and even destroyed. It was noticed that in this earthquake the Guanying hall was displaced for a noticeable distance. [7]

The investigation of historical documents revealed that in the past Guanying hall was shifted for even bigger distances. Obviously, the hall was constructed in the way that enables movement of the structure as a whole, which resulted in an exceptionally good earthquake resistance of the building.

It is worth mentioning that “*prevlačenje*” of traditional timber structures indicates that they probably possess similar seismic isolation.

### 5.3. Principle of seismic isolation applied to modern buildings

The principle of seismic isolation was ignored for a long period. The application of the principle of seismic isolation is being rediscovered and applied relatively recently.

This is probably due to the fact that for a long period masonry was predominantly used for construction of most buildings. Masonry is not suitable for seismic isolation - in fact, masonry is not at all suitable for construction in earthquake prone regions.

Recently, seismic isolation systems are being developed. They are applied to new large buildings of vital interest, e.g. to new modern hospitals in earthquake prone countries. The reason why seismic isolation systems cannot be applied to common buildings is their high cost. In the future, however, I believe that they will be applied to a broader range of buildings, as human lives should be considered precious.

### 5.4. Learning from master-builders of the past

Sustainability and resilience of structures are of vital importance: structural solutions that enabled buildings to resist earthquakes and other adverse impacts have *ipso facto* proven their resilience and therefore have been accepted - and also developed and improved - throughout the history of architecture. The analysis of traditional timber structures in the 2020 earthquakes in continental Croatia showed that their earthquake resistance is due to ductility provided by structural solutions and details: the dovetail joints of timber walls dissipate seismic energy, while the specific foundations act as seismic isolation. Nowadays, seismic isolation is considered of great importance for construction in seismic prone regions, in fact it is considered that the application of the principle of seismic isolation could considerably improve seismic behavior and resilience of structures.

Traditional structures which have proven their seismic resistance through a long period in which they were subjected to earthquakes and other adverse impacts are a source of precious knowledge. Modern studies are based on complex dynamic analyses, computational modeling and experiments on models. In the past, master-builders did not have theoretical knowledge nor our sophisticated research tools. Their knowledge was based on observing the behavior of existing structures. As in pre-industrial societies the methods of constructing, the concept of buildings and their size changed slowly, constructors were able to analyze the existing buildings and to apply the solutions that they considered good to the structures that they were constructing.

This method of acquiring and broadening knowledge and understanding of behavior of structures was successful even for complex dynamic actions like earthquakes.

After an earthquake occurred, constructors were able to analyze the damage on buildings and would imitate the overall concept and solutions of the buildings that proved to be earthquake resistant. As the tradition of building was strong, and the buildings of a “next” generation were similar in concept and details to the older buildings, the constructors were able to apply good solutions to their buildings.

Empirical knowledge of past generation, based on centuries-long experience, yielded sustainable earthquake-resistant structures.

Therefore, architects and civil engineers can learn a lot from the earthquake-resistant structures of the past.

### **Acknowledgements**

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# CHILDREN AND PLAY IN THE CITIES OF THE 21ST CENTURY: LISBON CITY

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## **Abstract**

In this research, the relationship between children and urban space is examined through the analysis of one of playground in Benfica parish of the city of Lisbon. In the next steps of the research, other parts of Lisbon and Istanbul will be included into the analysis. In this paper, the researcher's observations on the biggest playground of Benfica have discussed. In the next phases of the study, new obstacles and needs emerging in the lives of children with the Covid-19 pandemic, will be determined by in-depth interviews and surveys. Besides, the behavioral mappings, movement lines, tracking tools will be prepared and used; Space Syntax modeling will be done; the matrix, that to calculate the convenience and accessibility of the areas for the children, will be developed by Analytic Hierarchy Process (AHP) method to complete the analysis for the playgrounds in Lisbon and Istanbul. Thus, the areas will be evaluated quantitatively for their accessibility and convenience for the children development and freedom. At the end of the study, design principles guide of the open public spaces will be created according to children's needs, demands and their mental-physical development by the children's own voices.

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**Key Words:** *child friendly spaces, integration, play, playground, public space.*

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## **1. Introduction**

Globally, the number of people living in cities is increasing and at the same time getting younger. Today, about 55% of the world's population lives in cities. By 2025, 60% of the world's children will live in cities. By 2030, 60% of the world's total urban population will be under the age of 18 [1] [2]. Globally, 81% of 11-17 years old population are not physically active enough [3].

The majority of the world's population is in urban areas. Urbanization has many positive or negative consequences. Children live in more built environments, under the threat of traffic, pollution and lack of open spaces in cities. Due to the urban density and environmental conditions, children are mostly indoor. If they are outside of the home, it is just possible under parental control.

In many 21st century cities, the impact of consuming culture by globalization is felt in every piece of the city. It cannot be denied that the reason why this effect is visible that the interaction between urban space and social structure. Commodified urban spaces have been separated at different levels by different socio-economic groups. The meeting places of the city, which should bring together citizens in accordance with its purpose of formation, have become places that separate the citizens from each other. The residents of the same city, who cannot come together, experience the same city in completely different ways, unaware of each other. Therefore, it is the same for children. The child who cannot live the world other than her/his environment will unfortunately continue this in her/his future life by developing an idea that other children also have experiences similar to their own conditions. The perception that areas outside of her/his environment are unsafe will occur consciously or unconsciously. This means that the child will move away from other facts.

The children represent a group that is considerably higher in the population living in a city. However, the children are one of the groups whose existence is considered the least while urban arrangements are made. This situation can be clearly read from the fact that open spaces such as squares, parks and streets are not designed for child activities in cities with an increasingly large population and so that the child mobility in these places are dramatically decreasing. The most important reason why today's cities cannot be child-friendly are the dominance of increasing traffic surfaces in cities that are growing in terms of

population and area. There are many studies on children and urban environment relations to analyze how child-friendly indoor and outdoor spaces, playgrounds should be designed and the values that child-friendly space adds to the future development of the child.

21st century children cannot develop their perception of human scale due to the scales, which they experience. Children, who find limited place in public spaces, are locked up in their home, and often complete their physical and mental development at home with only parents. However, to become physically and mentally healthy individual of the future, they must interact with their peers and others. At this point, the importance of public spaces should not be forgotten. The public sphere for the child that is meant is not the shopping centers and playgrounds that have been normalized by the 21st century.

The Child Friendly Cities Initiative (CFCI) was initiated in 1996 to make it easier to realize children's rights in a world where urbanization is rapidly accelerating. The initiative brings together local stakeholders to create cities and communities that are safe, inclusive and sensitive to children [4]. Child friendly cities create a safe and clean environment, provide basic health and education services, and create opportunities for children to play. Thus, it ensures that children's rights are protected and used in cities [5].

Sustainable cities and sustainable societies are possible with equal opportunities for all. Every human-being has same rights, regardless of gender, abilities and age. Following the United Nation 2030 Agenda for Sustainable Development adopted in 2015, that aims to create sustainable cities and communities and guide societies and cities; to provide universal access to safe, inclusive and accessible, urban environments, in particular for women and children, people with disabilities and older persons. UNICEF has created Strategic Plan for 2018-2021. In the plan, five target areas that can be effective on the Sustainable Development Goals are defined. The fourth and the fifth goals “*every child lives in a safe and clean environment*” and “*every child has an equitable chance in life*” are at the center of the study [1].

Churchman (2003) states that the children who constitute a social group that does not have the right to vote do not have political power and therefore the lack of opportunities to express their wishes and expectations about the city in the public sphere also causes the cities to not be designed with children in mind. Whereas, the city should be a place where children can physically enjoy and feel safe, and in a symbolic sense, they can convey the message that they are an equal part of the society with other members of the society through urban design, planning [6].

Article 12 of the Convention on the Rights of the Child recognizes participation as a fundamental human right; Article 31 recognizes the right of the child to rest and recreation, to participate in play and recreational activities appropriate to the child's age, and to participate freely in cultural life and arts. Participation is about being informed, involved and influencing decisions and issues that affect a person's life, in private and public spheres [5][6]. In this direction, have a say in their own living spaces and play freely in these spaces are the rights of the children. The right of children to make decisions about the area where they live and to use these spaces freely are significant links in the chain that creates a sustainable society.

Table 1. Population of Children

	Total Children	% of Children in Total	Total Population
European Union (EU)	81.527.787	%18,1	446.461.494
Portugal	1.729.675	%16,8	10.276.617
Lisbon City	106.697	%21,0	507.220

## 2. Child in the Literature

All children, without any discrimination, have the right to full enjoyment and protection of human rights. Convention on the Right of the Child (CRC) is the most important international human rights instrument created to protect the rights of children [7]. Convention on the Right of the Child indicates on the Article 31: “*States Parties recognize the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts; States Parties shall respect and promote the right of the child to participate fully in cultural and*



*artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity.”*

International standards define the child friendly space (CFS), which supports the resilience and well-being of children [8]. Child friendly spaces are the crucial keys to mobilize communities around well-being of children [8] [9]. CFSs or safe spaces/ child centered spaces should adhere to the UN Convention on the Right of the Child; respond to children’s rights to psychosocial well-being; to be highly inclusive and non-discriminatory; to support resilience, safety, and security in the environment; to mobilize communities around the protection and well-being of all children; to provide opportunities for children to play and activities for parents; to make the environments supportive and participatory [9].

### *2.1. Importance of the play for children*

Children are inherent to play and play wherever they are free. Play has been an activity played with peers outside the home from past to present. Anthropologists state that children play and explore freely every day, from dawn to dusk, and by doing this they acquire the skills and attitudes necessary for successful adulthood [10] [11]. For a healthy manner, children need to play on a regular basis [9]. There are evidences about the importance of regular physical activity to children’s health, but in the 21st century, many children are physically inactive [12].

Gray stated that playing helps children develop their intrinsic interests and competencies; teaches decision-making, solving problems, self-control, following rules, regulating emotions, making friends and getting along with other peers and providing an opportunity to have joy. He claims that children, who grow up without play, fail to acquire the social and emotional skills necessary for healthy psychological development. He emphasizes that free play is valuable for the psychological development of the child. Free play is an activity that depends on the free choice of the child participating in the play and is not followed consciously and does not offer grades, praise, trophy. The social play which allows to the children get along with others as equals thus to create narcissist children will be prevented [13][14] uses the term as unstructured play, which has the same meaning as free play [3].

According to Jean Piaget children do not receive information passively [15]. They want to be active in their environment, choose and interpret what they hear and feel. Piaget examines the development of children in four stages. The third stage, which corresponds to 7-11 years of age, is the concrete process stage. Children tend to master abstract and logical concepts at this stage. Schools and peer groups are the socialization forces of children [16].

According to Mead (1913), the stage in which the child learns the generalized other, which is an important stage in the development of the child and corresponds to the age of 8-9, that is, the child's understanding of the general values and moral rules in the culture in which (s)he lives is provided by organized games (games with equal participation) [16] [17].

Schools and peer groups are the socialization forces of children [16]. Barrie Thorne observed 4th and 5th grade students at two schools in Michigan and California for two years. In this study, Thorne states that children learn the meanings of gender through games in the classroom and schoolyard [18].

The perception captured by the actor's body in its interaction with the socio-physical environment is the relational psychological characteristics between the perceiving actor and the perceived element [19] [20]. For example, a bench in the garden invites an adult to sit, while the same bench can invite a child to use as a spaceship; a green space invites adults to sit, talk and / or feel as a resting place, while the same space can invite children to feel excited and energetic [21].

### *2.2. To be a child in cities of the 21<sup>st</sup> century*

From the industrial revolution until the middle of the twentieth century, children lived their lives into long hours of work. After the 1950s, the elimination of long hour work conditions and the increased emotions on childhood created positive attitude towards the development of parks and other playgrounds to encourage children's free play [13]. But this attitude in the early stages of modernization has been transformed in today's modernity, and children are more at home than outside.

Increasing population density, increasing inequalities, changing dietary habits and the development of technologies affect social lifestyles and the use of natural and urban resources, sustainable development [22]. By neo-liberalism, materialism, and individualism children's interests have been sidelined [23]. In the context of the social change, in order to determine how the city is perceived by the child as an actor-user-thinker, children's relations with the city should be examined. In line with the United Nations Sustainable Development Goals, the quality of life and social welfare should be increased with sustainable cities and societies. Stanley, Richardson and Prior (2005) [24] indicates that a sustainable society is possible if the children's place is at the center of the city.

In recent years, there is a rapidly growing public debate about the welfare of children. There are international, interdisciplinary and different dimension discussions on the child health and well-being. It is recognized that children's mental and physical health is influenced by factors of the everyday environment. Built environments are the keys to shape the well-being of children [23]. In the lively areas of the city, the child's autonomy of movement is greatly reduced due to the decrease in opportunities for children to play freely [13].

Children are living more sedentary life because of environmental and social effects. They spend their leisure time with more inactive activities instead of play, that they do not have time for themselves, that time is scattered between home, school and organized activities, that children cannot socialize in appropriate environments, that computer games replace friends and that health problems such as obesity occur due to lack of physical activity [25] [26] [27] [28]. Child and play are integral parts of each other. Play is exercising the child does to get used to the real world. Real play should be free, unstructured, free of adult control, performed outdoors not indoors. In the words of Palmer, the children are becoming as coach potatoes [29].

Obesity in children should be seen as a health problem related to urban planning [1]. There are strong links between childhood obesity and new forms of urban development which causes sedentary lives for children [23]. Children who were not physically active as children face other health problems later in life [1] [30]. According to Cadzow (2004) [26] because of residential design which provide limited recreation and self-expression, and parental control the children have become bubble wrap generation and/or pampered prisoners [31] [23]. The study of O'Brien and Smith (2002) [32] shows that %70 of the mothers, who participated the survey, stated that they played outside every day when they were children. This rate was 31% for their children. In the study conducted by Hofferth and Sandberg (2001) [33] to examine the activity changes of children between 1981-1997: It was found that the time spent for play (outdoor & indoor) by children between the ages of 6-8 decreased by 25%; the time spent at school increased by %18, time for homework of school at home increased by %145 and time spent shopping with parents increased by %168. The decrease in children playing in open spaces is associated with technology. In Clements's (2004) research, 85% of the mothers stated that watching television and 81% of them prevented their children from playing the computer game, while 82% stated that they had security concerns about outside and therefore restricted their children from playing outside [34]. In many parts of the world, the grandparents of today's children, two generations ago, enjoyed a high degree of freedom from an early age to play and move around their neighborhoods [1] [35]. The reasons of this change are complex [1]. Car-centric neighborhood planning, traffic growth, air and noise pollution decline the childhood freedoms, children's mental and physical health [1] [36]. Studies show that environmental attributes such as green and open spaces have a direct impact on children's mental health [1] [37] [38].

In the modern world, the reflections of the stress and pressure experienced by children due to the increasing speed of life, the overwhelming effects of information technologies, insufficient training, excessive consumption of sugary foods and family life can emerge as Attention-Deficit Hyperactivity Disorder (ADHD) [16].

### **3. Case Study: Playground in Parque Silva Porto (Silva Porto Park) /Benfica-Lisbon**

The playgrounds must include highly vulnerable children without stigmatizing them; must meet the needs of different age and gender groups, ethnicities, living conditions; must provide clean water and toilet;

must be removed from the physical dangers as broken glass, electrical wires etc. The spaces should encourage the participation of the children; provide diverse activities such as drama, dance, drawing, play, storytelling, reading, sports. When these activities have planned in the playground, the cultural appropriateness of the toys and activities should be considered [9].

Lima (1989) shows how school spaces, parks and playgrounds are produced to maintain and consolidate the adult's dominance and power over the child [42] [43]. Children share a certain number of characteristics (for example being enrolled at school, or being materially dependent on adults), they are not just children. Their situation must be understood in relation to other characteristics such as gender and social background, which they share with adults. Studying children means considering the many specificities of this population without essentializing childhood as a *separate* object, with specific research questions, theories, and methods. Interviewing or surveying children is often seen as a methodologically suspicious practice [44].

Portugal was ranked 14th, while Finland ranked top in a survey of 16 countries on child mobility independence levels [39] [21]. The freedom / autonomous mobility / mobility independence of children in Portugal to act autonomously in the public sphere without adult control is very limited, especially in urban centers [40] [41]. To analyze the current situation of the playgrounds in Lisbon this research has been started. In the study, the relationship between Parque Silva Porto, that is the biggest playground of Benfica parish, and the child, which is located in the northwest of Benfica within the borders of Benfica parish, which attracts users from different parts of the city and is located in the northwest of Lisbon, is examined. In the park, which is 4,11 hectares in total, suitable areas for different activities of different age groups have been arranged. Children playground, climbing walls-trees, which are used extensively by the child population; for the adults there are paddle courts, resting areas, picnic areas, walking-jogging paths and a dog park.

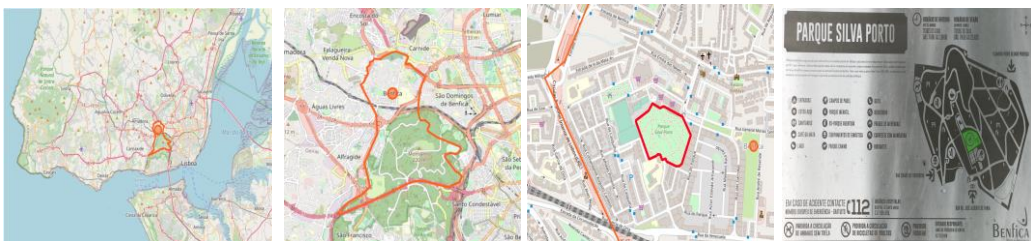


Fig. 1. a) Lisbon;(b) parish of Benfica in Lisbon;(c) borders of Parque Silva Porto (Source: OpenStreetMap); (d) borders of playground

A playground analysis can be done in the afternoon. There is a big difference on use of the space between weekdays and weekends, but on holidays and if the weather conditions get worse this pattern changes [45]. In this direction, the analysis studies of this research are carried out in the afternoon on weekdays and weekends, and under good weather conditions in the season. Daily and hourly planned observations are evaluated in the study.

This study is going to be carried out with the public space tools that Gehl and Svarre determined in eight steps as counting, mapping, tracing, tracking, looking for traces, photographing, keeping a diary and test walks [45].

In the later stages of the study, a child-centered ethnographic study will be carried out. Visual techniques such as interviews with children, child-led walks, storytelling, map drawings by children [46] [47] will be used. In this way, children's right to speak on their own spaces will be considered, and child-centered design strategies will be produced together.

Pictograms that children had to circle after each question had been read and the meaning of the different pictures had been explained [48]. Therefore, the pictogram will be included into the survey to evaluate the children's opinions on the playgrounds of their neighborhood.

Among researchers who conduct interviews with children it is widely recognized that survey techniques must be specifically adapted. Interviews are often conducted at home, sometimes in the children's

bedroom, and participants are often interviewed several times [49] [50] [44]. Moreover, a wide range of techniques is used to avoid “head-on” discussion: interviewers asked children to draw, react to an anecdote, video, or image [49] [51]. One of the other solutions to make the children feel comfortable, used by Lignier and Pagis (2017) [52] was interviewing the children in pairs [44]. Therefore, the surveys and in-depth interviews will be done with the children and caregivers in the playgrounds or other urban spaces where the children and caregivers feel themselves safe and comfortable.

In this study, the first phase of the playgrounds of Lisbon research, Parque Silva Porto, which is one of the biggest playgrounds in Benfica, has been observed on accessibility and usability issues without survey and in-depth interviews. The design and accessibility elements have been analyzed. The entrances, the levels, the materials, quantity of the urban furniture, children and adult behaviors, weekend-weekdays differences has been examined and counted. The counting will be done in other seasons and different hours. Then the behavioral mappings, movement lines, tracking tools will be used and Space Syntax modeling will be done to complete the research in the area.



Fig. 3. (a) Main entrance; (b) (c) south entrance; (d) (e) northwest entrance ;(f) north entrance

Portuguese paving stones in the main entrance (Fig.3. a) do not create a suitable walking surface for individuals, who use wheelchairs or assistive devices in their mobility especially in rainy weather. The children's playground has three entrances in the south, north and northwest directions. The south entrance of the park (Fig. 3. b; c), that is the closest to the main entrance, is the most used by the users despite it does not comply accessibility criterion width (90 cm), slope (without landing), material (not in proper condition), physical barriers (lightning element) in front and pedestrian way narrows as enter the playground. For the wayfinding on the south entrance there is wooden information (Fig.4a) which is not perceptible and the height is not legible.

The entrance in the northwest (NW) (Fig. 3. d; e) is connected to the pedestrian road by stairs and its width is 80 cm. The northwest entrance is associated with the stairs, which does not meet with the accessibility criteria because of inappropriate surface material maintenance, lack of handrails, lack of landings and ramp. Thus, a wheelchair or stroller user cannot enter to the area from this entrance. The entrance to the north (Fig. 3.f) is accessed from the main entrance gate by inclined pedestrian roads and its width is 200 cm. Although the northern entrance is seen as the most suitable entrance, north entrance's remote location relationship with the main entrance of the park is a factor that reduces the level of accessibility and usage. The main obstacle to the accessibility of the playground is to be arranged at two different levels in 1,5 meters (Fig.4.b). In the observations, it is seen that the children frequently move between two playgrounds. This situation prevents the monitoring of the parent/person who takes care of the child by sitting in the sitting areas. The areas on two separate levels are connected to each other by an 80 cm width, 9-step ladders in 8 cm riser (with 2 steps and landing rhythm) stairs (Fig.4.c) and a ramp (Fig.4.d) with less than 6% slope, which are mostly accessible, but without any railings, which is not accessible. Besides, it is observed that the children are not using ramp or stairs. They walk and run on the soil inclined ground (Fig.8.b).



Fig. 4 (a) wayfinding in the entrance of the playground; (b) view from top-level playing area to down; (c) stairs in the area; (d) ramp; (e) wooden rubbish bin; (f) (g) wooden bench.



Fig. 5. (a) wooden swings on the top level; (b) toilet on the top level; (c) wooden playhouse and climbing on the top level; (d) metallic turntable on the top level; (e) wooden seesaw on the top level.

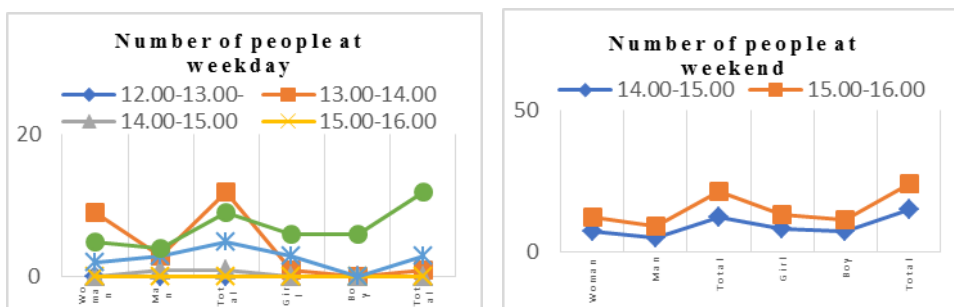
There are 4 swings (Fig.5. a; 6. c), 1 seesaw (Fig.5. e), 2 slides (Fig.5. c; 6. a), 2 climbing areas (Fig.5. c; 6. a), 3 spring rider toys (Fig.6. e), 1 playhouse (Fig.5. c), 2 turntable toys (Fig.5. d), 7 sitting benches (Fig.4. f; g), 4 rubbish bins (Fig.4. e), 11 lightning elements, 1 toilet in the area (Fig.5. b). While the 1-4 age group usually plays on swings (Fig.5. a; 6.c), playhouse (Fig. 5. c), and spring rider toys, 5–10-year-old children mostly play with climbing, slides (Fig. 5. c; 6. a; 6. b) and seesaw (Fig.5. e). But there are not any toys which is accessible for the children with disabilities.



Fig. 6. (a) (b) wooden climbing and slide on the down level; (c) wooden swings on the down level; (d) wooden turntable on the down; (e) spring toy on the top level.

To have toilet in the area seems as an advantage for children, it also causes the use of the area by adults only to come to the toilet (Fig.5. b).

The material of the playing surface is rubber (Fig. 5; 6), walking surface is shingle. The surface is suitable to walk or move with a wheel-chair, an assistive device to walk and a stroller. The material of the urban furniture's, playing tools are wood, metallics and plastic. Thus, children's safety the materials on the playing area and tools are suitable to avoid the injures. There are ten lightning elements on the area which is enough for security, safety and the usability of the area and a whole raft of trees to create shadow in sunny days.



According to the counts made at various times on weekdays and weekends, the number of users is very low until 13.00 on weekdays. It is observed that the number of adults and children increased significantly between 17.00-18.00. Individuals who entered the playground until 15:00 on weekdays used the



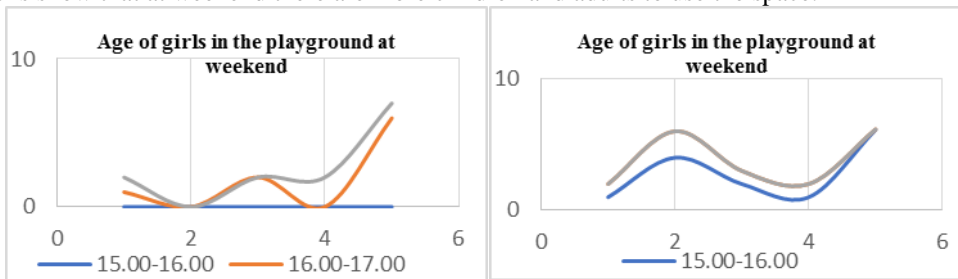
playground only as a transition area; %90 the movements of women and men are from north to south (Fig 8. a). It is seen that the number of users of the playground to play increases after 15.00 at the weekend.

The average age of women who transit only until 16.00 on weekdays is 44. It is seen that the women in the area with the children who come for the play after 16 pm is close to 50 ages. At the weekends, it is seen that the age range of the women who are together with the child in the playground is 30-40 ages. Accordingly, it can be interpreted that coming to the playground with grandmother during the week, with parents at the weekend.

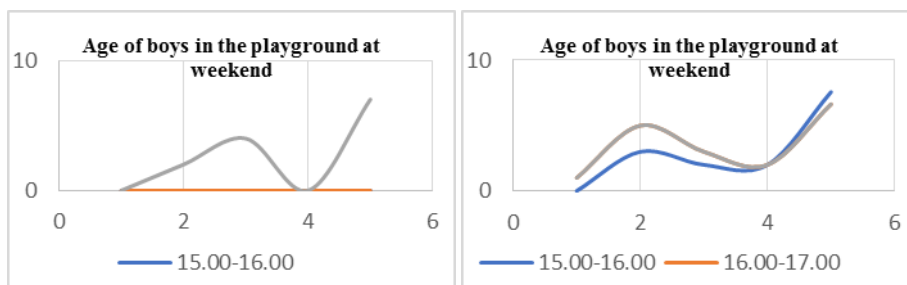


Fig. 7. (a) Playground plan; (b) hand-drawing playground cross-section

The average age of men who come to the playground with their children on weekdays is 55. At the weekend, this number is 38. A similar interpretation may apply to men as well as to women. The observations show that at weekend there are more children and adults to use the space.



It is seen that the average age of girls playing in the playground during the week is similar to the weekend and is 6-7 years old.



It is seen that the average age of boys playing in the playground during the week is similar to the weekend and is 6-7 years old.

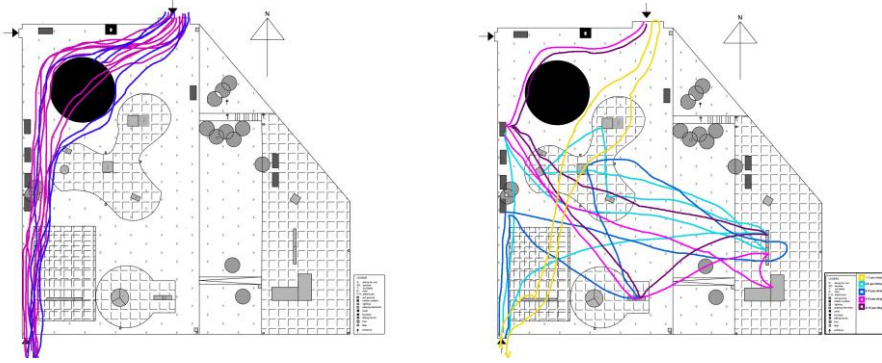


Fig. 8. (a) transit pass lines, weekday between 12.00-16.00 by women (pink) & men (blue); (b) movement lines of the children

From the mobility lines created by observing the movements of the children, it has been observed that children in different age groups between the ages of 1-10 use swings mostly. It has been observed that the group under the age of 8 spends time in the playhouse, and the girls in the age group of 8-10 play card games by sitting on a bench, while it is observed that the boys are more active, running around and moving among the playing elements.

Of the three entrances, it is observed that the south entrance is used extensively, and the northwest entrance is rarely used. The connection of the playground with other areas such as climbing and walking areas is related to the entrance in the northwest. However, the fact that this entrance is associated with the stairs greatly restricts the use. In addition, it has been observed that parents with children over the age of 6 observe their children by sitting on the benches. However, in two separate children's playgrounds with a height difference of 1.5 meters, children are in very fast motion and it is not possible to sit down and observe the child at the lower level. Therefore, it will be possible to strengthen this connection by rearranging the seating elements. From the mobility traces of the children, it is observed that the children, whose existing stairs and ramp are not used, moved in two areas with a level difference over the soil on the sloping land. Although children do not seem to use the stairs and ramps much, these connections will be of great importance when a child with a disability arrives. Therefore, the existing stairs and ramp will need to be arranged with handrails in accordance with the width, height and slope standards. The entrances of the children's playground should be rearranged and the connection between the two areas with the level difference should be strengthened. For bad weather, playgrounds and sitting areas should be arranged with suitable covers to protect them from climatic conditions. The connection between the children's playground and other areas of the park should be strengthened.

#### 4. Conclusion

In the study, the current and new situations of the child in the 21st century city are examined by children literature that examined the relation between the child and the city. Then, the study focuses on the children's playground located in the Silva Porto Park area, which is heavily used by the local people in the city of Lisbon. The observations on the relation between the area and child, that is the first stage of the research, have been done. The number of users, users' profiles and activities of the area at different hours, including weekdays and weekends, are monitored and the usage density, activity and mobility traces of the area are determined. The accessibility of the design elements that complete the children's playground are evaluated.

The level difference, which creates two different playgrounds within the park area, should be designed more organically and turned into a holistic design for the playground. Seating areas should be repositioned so that children can be observed comfortably. The entrance doors to the park should be widened; landings of appropriate sizes should be left at the beginning and end of the ramps and stairs at the entrance; the wayfinding should contain information visual, aural and tactile in eye-level position; playing tools should be revised for use by children with disabilities; the ramp and stairs, which are located between two

different levels of the playground, should be rearranged with handrails (60-80 cm) of appropriate size (width 120 cm; riser 12-15 cm; in every 10 steps 1 landing); in the beginning and the end of the stairs and ramp, the landings should be placed and maximum slope of the ramp should be %6 as currently to increase the accessibility of the playground.

In this research, there are the observations on the relation between the area and child, that is the first stage of the research. In the next steps, the analyzes will be deepened and extended to other neighborhoods of Lisbon and Istanbul. The research will be widened **and continued** with other playgrounds observations and the evaluation of the areas by accessibility, usability and child-friendliness matrix, which will be prepared with the children in the next phases by Analytic Hierarchy Process method. In this direction, in-depth interviews and surveys will be done with children and their caregivers. The fieldwork analysis and public space design studies with children will be extended to other neighborhoods of Lisbon and Istanbul.

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# SUSTAINABILITY AND ENVIRONMENTAL TRANSITION: PRINCIPLES AND DESIGN GUIDELINES

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## **Abstract**

In these times of constant precariousness and insecurity, debates on the need for environmental sustainability are on the increase. There is a need to regenerate urban areas both by transforming the existing heritage while respecting historical memory, and by proposing "renewed" neighbourhoods with smartness, according to the use of renewable energy sources, eco-building, intelligent mobility, with a view to ecological transition. Immediate responses are needed to resource depletion on the one hand and the need to protect the quality of natural and environmental capital on the other. To achieve these goals, cities are called upon to play the role of drivers of sustainable development. By enhancing ecological quality, sustainability and resilience, cities will make a decisive contribution to the well-being of their citizens and the growth of local development. The design reference is the "green city", which focuses on the quality of the urban environment, the circularity of resources, mitigation of the causes of climate change and green growth and redevelopment, with a multi-sector methodological approach integrated with planning and based on the BPCI method "Bioclimatic Park City Immersive" (this means immerse the city into a bioclimatic park). This green approach already appears in the international policy documents Global Green New Deal by UNEP in 2008 and Towards Green Growth by OECD in 2010. [1] The key factors and methodologies of intervention are based on the interaction between Green Economy, Green City and Adaptive and Resilient Design, whose proposals can support the overcoming of urban/environmental degradation in terms of physical recovery, environmental rehabilitation and energy improvement, integrated with the enhancement of the existing heritage.

**Key Words:** *regeneration, transition, sustainability, resilience, co-design*

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## **1. Introduction**

Sustainability is now a priority on a global level, and the climate neutrality objectives set by Brussels inevitably require a new green and sustainable design for cities and a complete overhaul of human behaviour in relation to nature. From this point of view, today "we are witnessing the transition from the sustainable city to the regenerated city with smart approaches supporting local development". [2] The regeneration project interacting with the evolving actions and tools of strategic planning and social inclusion, must also contribute to the strengthening of resilience, in close connection with the identity signs that distinguish a community and the sense of belonging to places. Citizen participation as "the involvement of community members in formal organisations (...)" thus becomes an essential tool for the success of the project.[3]

In Italy, the revival of the country's sustainable development is the only and unavoidable road to take, seizing all the opportunities for a balanced transition. Our future and the future of our cities depend on adapting to the great changes taking place and on the ability to react and reconvert. Providing responses corresponding to new prospects for rebirth and ecological transition is an unavoidable objective.

In the last fifteen years, the approach to possible environmental regeneration has mainly focused on the criteria and tools of sustainability and resilience. Sustainability is part of the broader issue of the relationship between technological culture and environmental culture, and in particular of the central question of optimising resources, both natural and artificial, and the problems arising from the fracture between the built environment and the physical-climatic context.

In recent years, we have learned how necessary urban and environmental regeneration is for meeting housing needs and the sustainable development of the built environment, and we have also understood, also at European level, how essential it is to implement conditions of safety, inclusiveness, subsidiarity and social equity. We have also realised, at European level too, how essential it is to implement safety,

inclusiveness, subsidiarity and social equity. Thinking today about new forms of sustainable regeneration means first and foremost focusing on strategies that put the health of the inhabitants at the forefront, and if this was previously an achievable goal, today it is the primary aim to cope with current and future pandemic effects.

Sustainable regeneration will have to primarily control human behaviour, as it is the actions of citizens on the environment that must be educated and regenerated. Only after this education of individuals will it be possible to actually achieve urban regeneration that can also be defined as environmental and social.

As noted by Jannack (2015) [4], the real challenge for the future is to allow massive communication between citizens and experienced professionals, especially for projects of public interest. The experience and ingenuity of communities, i.e. that collective intelligence, which is itself a project asset, must be enhanced. [5] In this direction, it is also important to optimise the use of digital platforms [6] in order to disseminate and involve on the strategies of reconversion, valorisation and fruition all the stakeholders of the community.

## **2. Sustainability and unsustainability of the environmental issue**

Now more than ever it is necessary to ask ourselves what process and design innovations we need to focus on in order to re-generate the existing building stock and mitigate its environmental impacts, in the light of new changes and new complexities in living.

Urban problems: from building decay to urban squatting, to the unacceptable conditions of entire degraded settlements, are all part of a complex environmental issue that has persisted for several decades, and which must certainly be tackled step by step and in sections, always with a global vision of environmental rebalancing. But we need a substantial turnaround to be launched quickly to tackle the emergency and create scenarios for the future.

Among the measures envisaged and to be implemented: the use of green technologies for energy saving and the use of techniques for greening buildings will make it possible to convert obsolete and polluting building systems or urban areas. This will allow us to integrate the existing with the new with simple natural-action measures: the use of renewable energies, the use of eco-friendly materials and techniques for building insulation and improving thermal comfort will create the ideal conditions for comfortable, attractive and sustainable living.

"It is time to become aware and aware of what is happening, and it is from moments of crisis that the ability to improve is measured. The art of knowing how to build has already been demonstrated, history is full of monuments and marvellous architecture, but now is the time to evolve, the new century requires a greater effort, there is an urgent need to plan cities and buildings that breathe without consuming, that are able to live with the environment. We need to look at the world with new eyes, we need far-sighted planners who will make us forget the short-sightedness MIOPIA of the last century". [7]

Since it is unthinkable to make credible forecasts today, in the age of pandemics, without falling into dangerous simplifications, we need to move towards a logic of possible scenarios. The methods and measures taken by the government in recent months will be decisive.

## **3. Sustainability and Health in All Policies**

Considering that the link between the morphological and functional characteristics of urban contexts is given by the relationship between the quality of the environment and the use of healthy lifestyles, the impact on public health deserves even greater attention.

The "Health in All Policies" strategy indicated by the World Health Organization (WHO) highlights in particular that the health of inhabitants derives not only from the presence and management of health environments/services, but also from the quality of living and working environments. [8] The current health emergency has made policies and actions of a necessarily interdisciplinary nature urgent, both in terms of technical training (architects, engineers, town planners) and medical/health training (hygienists, epidemiologists, public health experts, molecular biologists, pharmacologists, etc.). [9] We are therefore once again experiencing how health is not individualistic but a collective condition strongly influenced by

the environmental context. Today, providing answers corresponding to the new prospects of rebirth and ecological transition with salutogenic design strategies becomes an objective that can no longer be postponed, and technological design is among the disciplines called upon to provide increasingly targeted and concrete answers. Urban nature-actions can offer cities new metabolisms, oriented towards wellbeing and health (Agenda 2030) as important analytical parameters for measuring the results and impacts of design actions.

#### **4. Resilience, participation and sustainable design**

The concept of resilience does not have an unambiguous representation in literature, as it is used in different disciplines: ecology, social sciences, economics, architecture and engineering with different meanings, values and developments. The root of the term can be traced back to the Latin "resilio" which textually means "to jump back". [10]

The concept of resilience was originally established in the field of ecology by Holling, who asserts that for ecological systems resilience is "a measure of the persistence of systems and their ability to absorb change and disturbance and maintain the same relationships among populations or state variables. Stability represents the ability of a system to return to a state of equilibrium after a temporary disturbance; the faster it returns to equilibrium and the less it fluctuates, the more stable it is". [11]

The environmental context, understood as physical - material, but also social and cultural reality, after an unexpected and/or extreme transformation must be analysed in all its forms in order to organise the new equilibria of resilient regeneration.

Recent literature suggests that in environmental regeneration, an approach involving residents and starting from local issues is necessary. [12] [13] Pronk states that proper outreach requires intensive cooperation between stakeholders, adapting communication with residents to the circumstances. [14]

A participatory process aimed at involving users also on energy regeneration issues needs a good relationship with residents so that they know both the importance of these systems in relation to environmental sustainability and how to use them (ventilation/heating). [15] Reflecting on comfort and well-being helps to create the new environment, helps to understand what you want or what you would like to change, each creating their own comfort. [16] Current participatory processes in relation to resilience [17], [18] tend to focus on being heard. Joint exploration and discovery with residents can help develop dialogues about what we would like to change and how that change can be integrated with the environmental issues of everyday life. As Aureli and Mastrigli argue: "If politics is about shaping the space for coexistence between people, architectural design is inevitably - whether we like it or not - a conscious political act. Architecture is as such a representation: it gives shape to an idea of inhabitable space, and is therefore the representation of a political idea of the city. (...) In order to achieve this, architecture must free itself from its reduction to a "profession" or a media container for its own sake, and return to being representation, that is to say, the embodiment of a political project that is alternative to the imagery of the market metropolis. This means understanding architectural thought not only as a place of cultural development but above all as a concrete instrument of political action. This is the task that motivates us to take up the arms of theory". [19]

It is necessary to experiment with sustainable regeneration interventions that can act on social life, social inclusion and resilience at all scales, redeveloping buildings and at the same time, where possible, operating an environmental reconversion that puts the inhabitant and his health at the centre of its interests, also with bottom-up procedures by means of self-organised and participatory paths and through the figure of the social entrepreneur [20] "While studies on resilience to disasters (natural catastrophes) have been undertaken for quite some time [21], aspects of social inclusion concern theories and practices for new developments in resilience research. Communities around the world are increasingly discussing ways to improve their resilience" (...) in this direction, research can be considered as part of the total "design effort" that aims to develop technologies and actions that will enable each structure and/or community to regain its function in the shortest possible time. In the long term, this research effort will allow the development of software tools for decision support to improve the resilience of territories and communities. [22]

## **5. Sustainable design tools: PNRR, nature-actions and ecological transition**

The Council of Ministers of 7 December 2020 gave the go-ahead for the examination of the National Recovery and Resilience Plan (PNRR), which will have to implement, in our country, the Next Generation EU programme, launched by the European Union to supplement the Multiannual Financial Framework (MFF) 2021-2027 in light of the economic and social consequences of the COVID-19 pandemic.

The Italian PNRR is built around four strategic lines:

Country modernisation; Ecological transition; Social and territorial inclusion; Gender equality.

Ecological transition must be the basis of the new economic and social model of development on a global scale. To initiate it, it will be necessary to:

-dramatically reduce climate-altering gas emissions in line with the objectives of the European Green Deal;

-improve the energy efficiency of supply chains, civil settlements and public buildings, and the air quality in urban centres and inland and marine waters.

Investing in the 'beauty' of the country, also in order to consolidate the capacity to attract tourists and the potential of its enormous historical, cultural and natural heritage, starting with effective management of urban green areas, including in terms of a greater spread of such areas in urban and peri-urban areas, and substantial reforestation.

Ecological reconversion can and must also represent a field of new competitiveness for a large part of our production system, including through investments in sustainable agriculture, starting in the South, making it possible to achieve greater harmony with nature, even in the context of a society with a strong industrial vocation. To this end, a green revolution also plays a strategic role for the building system, i.e. for the built heritage, which, with greening and landscaping systems, could be able to absorb a large proportion of harmful gas emissions, as already partly highlighted by the European Green Deal.

The process of greening/nature-actions of buildings already boasts a large amount of design interventions in Europe. Indeed, many contemporary architects are also experimenting with the use of roof gardens, green walls and other green systems for the conversion of existing buildings.

In the six missions of the PNRR, which represent structural "thematic" areas of intervention, that on the green revolution and ecological transition is focused on four lines of action:

- Green enterprise and circular economy
- Energy transition and sustainable local mobility
- Energy efficiency and building renovation
- Protection and enhancement of land and water resources

The first component, "Green enterprise and circular economy", has as its priority objectives the promotion of environmental sustainability in the agricultural sector, "but can be extended to the urban and peri-urban system of many cities whose conformation lends itself to urban park-actions (parkification) where there are urban voids bordering on rural lots or extensible urban parks".

The second component "Energy transition and sustainable local mobility" intervenes on energy production and distribution, favouring the use of renewable sources and providing the necessary infrastructure for their integration into the national electricity system and the infrastructure to power electric vehicles and exploit liquid hydrogen.

The third component, 'Energy efficiency and upgrading of buildings', envisages the reduction of energy consumption in buildings, which generate more than one third of total consumption in Italy, as well as their anti-seismic upgrading. In fact, most of the 14.5 million buildings in the country were built before the current energy efficiency regulations were in force; moreover, Italy is particularly exposed to risks related to seismic risk, which require widespread prevention measures.

The European Union has responded to the pandemic crisis with a planning and financial instrument named Next Generation EU (NGEU), defining the path started in 2020 and aiming more strongly at an ecological transition plan.

The fundamentals of the ecological transition, already outlined by the European Green Deal at the end of 2019, aimed to achieve climate neutrality by 2050 and to reduce climate-distorting emissions by 55% by 2030 compared to the scenarios of the 1990s. The studies carried out by the IPCC - Intergovernmental Panel on Climate Change show how necessary it is to implement measures to combat and prevent climate change in accordance with the 17 goals of the 2030 Agenda, launched in 2015 by the United Nations. We must therefore focus on increasing environmental sustainability and urban resilience by addressing the vulnerabilities of the environmental system itself.

## 6. Case studies and nature/action strategy applied to the degraded Brancaccio district

The environmental regeneration projects taken as sample case studies [23], are some of the most interesting responses to the European and in particular French dimension of concrete application of the policies envisaged on the use of regenerative and salutogenic urban design strategies.

### 1. City of Pré-Saint-Gervais -2019 - Project manager: OGIC

For the redevelopment of this part of the city of Pré-Saint-Gervais (France), a strongly vegetated public space is planned: the urban forest, which is often mentioned in the wishes of associations and collectives involved in the future of the site. But more than an urban forest, the Busso forest is conceived as an edible and nutritious forest. It develops in the form of a border and a linear afforestation between rue Danton and rue Gabriel Péri. It is also a place of fruit and vegetable production. Harvest periods can be the subject of festive events organised by city and neighbourhood associations.

The town is therefore immersed in the forest, which is over 150 metres long and 25 metres wide, and whose paths are treated as forest trails equipped with furniture for relaxation and meeting. (Figure 1)



Fig.1. City of Pré-Saint-Gervais -2019



Fig.2 Eco-centre Notre-Dame-de-Gravenchon - 2015

2.Eco-centre Notre-Dame-de-Gravenchon - 2015- Project management: SHEMA, La Compagnie du Paysage, Richez\_Associés, InfraService (BET VRD), Architecture and Development (HQE ) - Area: 19 hectares. The town of Notre-Dame-de-Gravenchon is located in the heart of the Seine valley and has many advantages in terms of living environment and landscape. The green metamorphosis of the town centre is organised around several points: improvement of the image of the town centre; urban densification and restructuring; reorganisation of the commercial centre around a thoroughfare; reorganisation and increase in parking spaces; enhancement of existing buildings. Faced with the heterogeneity and discontinuity of current public spaces, the project affirms public spaces that are legible on the scale of the city centre. The 'Cours' is the space for pedestrian mobility. Reinforced by an exceptionally gentle topography, this large and comfortable public space offers a pleasant urban walk to all citizens, including people with reduced mobility. The Cours brings together three large public spaces that contrast and complement each other in their functions: the urban square; the garden; and the Telhuet Nature Park. (Figure 2)



Fig.3 District of the Madeleine -2007/08



Fig.4 The Nature/action strategy applied to the degraded Brancaccio district – 2020/21

3. District of the Madeleine -2007/08 - residential-Project manager: Chartres Habitat-Project manager: JF.Gay, La Compagnie du Paysage, Soderef (BET) Area: 23 hectares

13 years after its completion, this regeneration project embodies all the concepts of sustainability linked to respect for the environment and public health.

For the redevelopment project of the Madeleine suburb and the central park, solutions were adopted which could combine the requirements linked to the concept (aesthetics, environment) with the functional requirements defined by the inhabitants and the municipality. This urban recomposition project is exemplary in terms of balance, functioning and diversity of uses. Specific studies have been carried out (orography, climatology, hydrology, building analysis, etc.) in order to identify a landscape approach that respects the ecology of the site within a high environmental quality approach.

Here, too, the city is immersed in the park, which aims to reconcile and renew the dialogue between: suburbs, commercial activities and activities dedicated to leisure and the health of the inhabitants.

The overall composition is organised around the 'large lawn' and the 'intimate gardens' arranged in a comb-like pattern at the centre of a new development of 400 housing units. Their identity is aimed at awakening the senses, such as the garden of materials, the garden of scents or the garden of movements, taste buds and whispers. The treatment of rainwater in the park is treated independently. The system allows rainwater from roofs and walkways to be reused to supply a linear body of water and to irrigate the park's plantations. The study showed that the neighbourhood has everything it needs to succeed in its gradual transformation towards the concept of an 'inhabited park'.

Large but poorly qualified, the avenues were the first degraded urban parts of the neighbourhood. The redevelopment of these axes plays a decisive role in the metamorphosis of the neighbourhood into an "inhabited park", a landscaped coastline is created with the construction of a large mixed pavement favourable to mobility and urban conviviality. The project integrates a herringbone car park regularly interrupted by wide valleys planted with woodland gardens. (Figure 3)

In the three projects analysed, it stands out as a structuring force of sustainable regeneration, a hinge of continuity between the pre-existing environment, its identity memory and the innovated environment that respects each single characteristic and at the same time transforms and improves it.

A three-goal strategy has been developed for all three of these projects: improving wellbeing by enhancing nature in the city; revitalising public space in order to increase its commercial and tourist appeal; and extending the reclamation policy by pedestrianizing public space. The projects concretise the protection of biodiversity, the regulation of private and public electric transport systems, the articulation of bicycle and pedestrian routes, the management of solid urban waste, renewable energy, accessibility and design for all, eco-design for the management of indoor and outdoor living spaces (green deal, home farming, urban agriculture), all expedients that activate forms of circular economy in the direction of the necessary ecological transition. These are examples representing sustainable design, increasingly oriented towards health and safety, in the decisive overcoming of dissipative anthropocentric models with a high exploitation of resources and in favour of a different way of living in harmony with nature.







and hanging gardens and green ways will be created all around the Maredolce Castle (an imposing fortified structure of Arab origin). All the buildings and palaces in the project area (about 10 hectares) are being surveyed and renovated as a matter of priority. For each type of building, the redevelopment interventions aimed at transforming the neighbourhood into a park inhabited by "intelligent" buildings, i.e. equipped with solar energy systems (use of micro wind turbines positioned in the park and photovoltaic panels both in the canopies and parking areas of the green areas and on the roofs of the redeveloped buildings) are indicated with the elaboration of guidelines. These installations will make the whole neighbourhood carbon neutral. (Figures 4,5)

Design strategies at the neighbourhood scale: the framework below summarises the BPCI 'Bioclimatic Park City Immersive' method, whose research developed in 2020-21 (still ongoing) within the broader Energy, Environment and Sustainable Development programme, represents a significant example of how it is possible to intervene on the existing heritage in an integrated way, from the settlement scale to the building scale. Design strategies at the building scale: a list of design strategies for existing buildings that will be upgraded with the aim of reducing consumption by 50% through the overall renovation of the building is given, "the minimum performances that the components of the building system must possess at the end of the renovation intervention are established: as regards opaque and transparent walls (walls, window frames, glazed parts, etc.) the transmittance limit value (U) is defined by the regulations in force. For the plant engineering part, energy efficiency must be sought not only in production efficiency (which must be the maximum possible for the chosen type of heat generator), but also in the efficiency of heat regulation and distribution." These are indications of minimum thresholds to reduce wastage, such as bringing buildings from energy-consuming classes to higher performing ones like B and A, in the operational phase of the implementation plans and then in the executive design phase these thresholds can reach more important and significant objectives, such as energy self-sufficiency.

The whole area will be transformed into a pedestrian island, a large green lung which will be added to the already present historical gardens, but which will also have a new bioclimatic concept of context.

The green spaces and the grafting of vertical green surfaces in most of the buildings allow to remove the polluting emissions present in the area and contribute to the adaptation to heat island phenomena and to heat wave phenomena ensuring natural cooling by evapotranspiration. Their interaction with natural ventilation is strategic, as it is adequately studied by diversifying the intake at different points in the urban area; the renewed morphological structure created by the inclusion of the new species improves resilience.

Equally strategic is the relationship with solar radiation using evergreen and deciduous species that can create a context capable of shielding from sunlight in the summer or the thermal action of radiation in the winter. The central axis of the experimentation is the passive technological apparatus determined by the "bioclimatic square". Through the construction of energy hubs (photovoltaic structures with a circular planin) in the park's Maredolce, the buildings that are overlook and the related living environments to modulate the effects of temperature variations between outside and inside thanks to the thermal inertia to the advantage of the adjacent environments both from the thermal point of view and energy consumption. In winter these rooms accumulate heat thanks to the activation of internal air masses, while in summer they allow natural ventilation, passive cooling of the rooms at night and air changes by opening the glass windows. A similar thermal/energy behaviour is achieved with the use of solar loggias for each apartment facing onto the park; the same apartment openings will be equipped with shading elements to provide shade in summer and to take advantage of solar exposure in winter. In the renewed urban layout, the creation of vertical gardens differentiated in relation to the type of building and adaptability, for most of the buildings overlooking the park, is decisive

Results – In order to define the entire modelling and simulation process carried out thanks to the methodological approach adopted and the strategic lines followed by the experimentation, it is possible to evaluate the conditions existing before the design intervention and the conditions after the same to determine the impact in terms of environmental bioclimatic performance. The verified parameters record the desired effects and prove the adequacy of the technical-design solutions adopted with respect to the set objectives of bioclimatic regeneration, aimed at enhancing the area and improving the environmental and

ecosystem quality. These minimum thresholds indications reduce wastage, such as bringing buildings from energy-consuming classes to higher performing ones like B and A, in the operational phase of the implementation plans and then in the executive design phase these thresholds can reach more important and significant objectives, such as energy self-sufficiency. The whole area will be transformed into a pedestrian island, a large green lung which will also have a new bioclimatic concept of context.

The green spaces and the grafting of vertical green surfaces in most of the buildings will allow to remove the polluting emissions present in the area and will contribute to the adaptation to heat island phenomena and to heat wave phenomena ensuring natural cooling by evapotranspiration. Their interaction with natural ventilation is strategic, as it is adequately studied by diversifying the intake at different points in the urban area; the renewed morphological structure created by the inclusion of the new species improves resilience.

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The verified parameters record the desired effects and prove the adequacy of the technical-design solutions adopted with respect to the set objectives of bioclimatic regeneration, aimed at enhancing the area and improving the environmental and ecosystem quality of the quarter of Brancaccio in the area of Maredolce park.

## **10. Sustainable development - Conclusions**

The design of a sustainable regeneration intervention stems from an analytical, cognitive, perceptive process of cultural peculiarities, whose social awareness has an essential role in the management of the transformation of the built environment. Within the actions that build the regeneration project the sustainable approach has to identify ways to manage transformation, not as a result of an imbalance but as a manifestation of a "dynamic project" that modifies the built environment respecting all its characteristics of adaptation and innovation. In the perspective of sustainable design, mitigation, adaptation and resilience measures should not be seen as a simple "technical response" to environmental criticalities on different scales, but must be the result of an integrated and shared process between serious and "appropriate" planning and an inclusive design based on effective technologies aimed on the one hand to protect and on the other to grow a healthy urban environment.

Another idea concerns the concept of sustainable development. In the context of a profoundly unsustainable contemporary reality, ecological literacy offers a more comprehensive critique of the abused concepts of 'sustainability' and 'sustainable development'. Sustainability has been associated with development since the 1987 report of the UN Brundtland Commission. Our Common Future, means 'ecological care' and 'development' but in some cases the term is described as conflicting. Critics claim that the concept guarantees the "conservation of development, not the conservation of nature". [24] This contradiction has been there from the beginning. With sustainable development there are no limits to

growth. Greens and environmentalists who still use this concept today show a certain ecological illiteracy. There is in fact a contradiction between the finiteness of the Earth, with natural self-regulating systems operating within limits on the one hand, and the expansive nature of industrial capitalist society on the other. The language of sustainable development sometimes helps to mask this fundamental contradiction, so that industrial expansion on a global scale can continue undisturbed. [25] The concept of sustainable development related to environmental regeneration intervention must instead overcome this contradiction, activating rehabilitation processes in perfect balance with environmental dynamics, corresponding to new perspectives of rebirth and ecological transition with salutogenic design strategies. Urban nature-action can offer cities new metabolisms, oriented towards wellbeing and health (Agenda 2030) as important analytical parameters for measuring the results and effects of design actions. Using the BPCI "Bioclimatic Park City Immersive" method means creating a system of ecological literacy for cities, the results of which are already visible in the overcoming of the concept of sustainability understood as unlimited sustainable development (which too often has favoured the indiscriminate development of models that exclusively favour industry).

The results of the research have shown that the only way forward is through "nature-action" strategy, which is essentially based on ecological and bioclimatic principles. Cities in bioclimatic parks will offer the planet new horizons for recovery by integrating the needs of the inhabitants with the needs of nature and seeking new ways of communion. Urban nature-action interventions are not intended to imitate nature but rather to coexist with it, creating spaces of real and harmonious coexistence. Not artificial landscapes but inhabited parks. By subjecting architecture with nature, we will find a habitat where our health and that of the environment will come first and can guarantee us a better future.

These research postulates are developed progressively after careful analysis of projects whose founding principles are precisely the use of green and natural systems that can guarantee us a better life on this planet. What we intend to propose is a new vision of living in which man realises that he is part of a complex and fragile ecosystem that must be helped to recover its natural dynamics. For the degraded district of Brancaccio in Palermo, in the Mareddolce park, the results of the research consist in the design of guidelines based on the BPCI method through a strategic nature-action intervention. Here too the primary design direction is to reconvert the neighbourhood and by addition of neighbourhoods reconvert the whole city into an inhabited park.

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# HEALTH AND BUILT-ENVIRONMENTS IN POST-COVID TIMES: A PROPOSED MODEL FOR STUDYING WORK ENVIRONMENTS

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## **Abstract**

Due to the pandemic, health is at the center of human concern more than ever. Architecture and interior design can make a decisive contribution to the prevention of diseases and to the improvement of health, wellness and well-being conditions, especially in highly frequented environments such as workplaces. Therefore, based on the discussion of previous theories, mainly the salutogenic approach, the theory of supportive design and psychosocial supportive design, this article proposes an analysis matrix that takes into account selected factors and properties of the built environment and their corresponding positive health outcomes. The purpose of this matrix is to show the most relevant elements that need to be examined in real work environments through a specific architectural methodology such as post occupancy evaluation (POE). Thus, this work provides the theoretical, analytical and methodological basis to enter the field research of an ongoing doctoral research aimed at deepening knowledge in the field of interior design and its contribution to human health.

*Key Words: Workspace design; Built-environment; Health promotion; Health outcome analysis; Post Occupancy Evaluation*

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## **1. Introduction**

Due to the outbreak of the pandemic, the importance of the relationship between the built environment and humans has come back to the fore, and in this equation the concepts of health, wellness and wellbeing and the importance of the built environment have been re-discussed beyond aesthetic concerns in all areas of life. Therefore, this article aims to discuss the main theoretical elements of an ongoing doctoral thesis analyzing how the design of work environments affects health outcomes.

Health, wellness and well-being are, without a doubt, key concepts in relation to humans. There are currently international organizations that specialize in promoting these key concepts around the world and educating the public and private sectors about healthcare and wellness, such as the World Health Organization (WHO) and the Global Wellness Institute. The WHO defines health as a state of complete physical, mental and social wellbeing and not just the absence of illness or ailment. The Global Wellness Institute defines wellness as the activities, choices and lifestyles that lead to a holistic state of health, and wellbeing is defined as the state of being comfortable, healthy and happy.

Scientists around the world have also explored these concepts over the past century and today they are relatively new approaches and theories that focus on factors that support health and wellbeing, as well as the positive effects of environmental design on human health. One of these theories is the Salutogenic Approach, introduced by Antonovsky in 1996[1]. The salutogenic approach is health-oriented and focuses on the origins of health rather than the origins of disease. Salutogenesis states that the factors that create health, Often in this perspective, “the sense of coherence” helps people deal with stressors, depending on how understandable, manageable and meaningful their understanding of life is [2]. Meaningfulness (be motivated to cope), comprehensibility (believing that the challenge is understood) and manageability (to believe that resources to cope are available) has been demonstrated to be a resource for health promotion. The salutogenic perspective has been adopted by studies conducted on the health and wellbeing supportive qualities of the built-environment. This approach, which was initially used in the design of health facilities, has recently started to be adopted in the research of work environments.

Most studies of workplaces have so far focused on mitigating the negative impact of the physical work environment on staff and overlooked the potential of the work environment to promote health. So instead of promoting health through workplace design, previous research only tends to reduce the negative impact of the physical work environment. However, more recent studies have begun to consider health-promoting effects. In this context, Roskams and Haynes (2019) [3] identified environmental resources that would strengthen the three components comprehensibility, manageability and meaningfulness of Antonovsky's concept of coherence in work environments. However, there does not appear to be any extensive research on the relationship of the attributes of the physical work environment and related health outcomes.

## **2. Background**

For hundreds of years there has been a direct relationship between changing economic and social conditions and work environments. The first industrial revolution in the early 19th century resulted in a shift from working in agriculture to working in factories. With the second revolution at the end of the 19th century, cars, electricity, oil, and communication and entertainment devices also changed living and working conditions. Advances in transportation and the invention of automobiles made the proximity of living and working spaces obsolete.

Likewise, the rapidly developing and changing communication technology at the end of the 20th century and the use of the Internet made it easier to work remotely. Nowadays it is possible to work from a main office, from home or from shared workplaces, with full or partial remote working being accepted as a norm.

More recently, with the onset of a pandemic in late 2019, there have been renewed changes in the way business is done and the place where work is done. With the advent of the pandemic, people mostly worked from home to prevent the transmission of the virus. Later, with some provisional design and operational changes, the work areas were reused. How work environments will contribute to the physiological and psychological health and wellbeing of their users is now the focus of discussion in the workforce.

Under these circumstances, the design of workspaces has begun to adopt and evolve again due to the changing work conditions. Post-pandemic surveys and studies already show that various spatial characteristics of workplaces (such as access to nature, fresh air, ventilation) will have greater impact on user preferences than before [4-5]. All this shows that in the future work, health and design equation will continue to matter after this pandemic.

## **3. Built Environment and Supportive Environment**

Previous research in environmental psychology analyzed the effects of indoor comfort on physical, mental, and social health. Various studies also show that the negative qualities of the built-environment (inappropriate indoor lighting, thermal comfort, natural light, ergonomic comfort, etc.) trigger stress, depression and anxiety problems and influence mood, performance and productivity [6-7-8-9]. The effects of these indoor conditions, especially in open work areas, as well as the strong correlation of these conditions with the satisfaction of the occupants were examined [10-11-12]. Many researchers have taken the view that access to nature, the color of the environment, daylight and the view into nature influence the emotions, behavior and performance of users and reduce mental fatigue [13-14-15].

At the same time, research on the built environment and humans has not only focused on the negative effects of health, but also on creating environments that support health and wellbeing with a salutogenic approach. With this understanding, the evaluation of built-environment qualities was primarily carried out in healthcare buildings [16-17-18] and in recent years, health promotion has also been examined in workplaces and other built-environments [3-19-20].

Studies have also stated that built-environment should support people psychologically and psychosocially [21]. The term “psychosocial” defines the relation of social factors and their effects on the mind and behavior of the individual. The environment that supports the psychosocial health of the

individual is defined as “the supportive environment”. The supportive environment and its components-also defined as therapeutic environments, and the benefits of these environments on the users have been the subject of many studies and created well-known theories such as Kaplan’s Attention Restoration Theory [22].

The idea of built environments that support health and wellbeing has also been explored by some organizations around the world. The International WELL Building Institute (IWBI), founded in 2008, is taking a comprehensive and interdisciplinary approach. WELL, carries out practical research and develops standards for natural and artificial lighting, room ventilation, surface materials, biophilia mainly among others.

#### **4. Theoretical Main Strands**

This research deviates from the umbrella theory of the salutogenic perspective developed by Antonovsky (1996), which focuses on the processes that support health. This paradigm discusses the physical, psychological and social needs of the users of the built-environment for health and wellbeing, paying attention to factors that support people's health and wellbeing rather than factors that cause disease. In addition, two contemporary theories are presented here; Supportive Design Theory (SDT), developed by Roger Ulrich (1991) and Psychosocial Supportive Design (PSD), introduced by Alan Dilani (2001), both deal with variables that measure physical and social factors of the built environment.

##### *4.1. Salutogenic Approach*

The salutogenic approach and the concept of the “sense of coherence” has proven to be a valid paradigm, particularly for the development of research and practice in health promotion.

Antonovsky did not simply define health as the absence of risk factors but argued that health should be promoted environmentally. Antonovsky justified his work with the question of how health can be created. This approach, as mentioned above, which is mostly used in the design of healthcare facilities has recently been taken into consideration for the design of workspaces in order to determine the qualities that support a sense of coherence. Later, Dilani drew attention to the gap between salutogenic theory and its application and attempted to translate this theory and the concept of the sense of coherence into environmental design factors (2001) [21].

##### *4.2. Supportive Design Theory*

Supportive Design Theory devised by Roger Ulrich (1991), explores ways in which a designer can use the built-environment to reduce stress through understanding the physical needs of users (e.g., outdoor connections, control of the indoor environment, appropriate light levels, etc.). It argues that a design which provides environmental control, access to social support and positive distractions in the physical environment can help reduce stress.

Ulrich focused on the concept of stress, revealing that the three supportive design components that should promote the built environment and design are the sense of control, social support, and positive distractions in the physical environment (2004) [16]. These components will be discussed next as environmental factors in the analysis matrix proposed in this paper.

##### *4.3. Psychosocial Supportive design (PSD)*

Psychosocial supportive design is a theory developed by Alan Dilani (2001) that is based on the salutogenic perspective and supports the built-environment through a sense of coherence. According to Dilani, there is a growing awareness of the need to create human-centered as well as functionally efficient environments that aim to improve and initiate health processes (2004) [2].

For Dilani, the focus of his theory is not the treatment of health risks and preventive factors, but the revitalization of the mind and body. The design of an environment should encourage a complex process that produces pleasure, stimulation, creativity, satisfaction, enjoyment and admiration (2009) [18]. He

argues that “wellness factors”, which are aspects of the physical environment that can positively affect emotions, experiences and behaviors, should be used in the design of healthcare facilities as well as in the design of other built-environments such as workplaces. According to this researcher, these wellness factors are access to nature, art, colors, music, nature, lighting, use of culture, familiarity, creating landmarks and references in buildings, aesthetics, the use of harmonious and cheerful color, social interaction, spatial composition and articulation as well as the provision of inviting spaces for social support [21].

### 5. Factors and Attributes of Healthy Built-Environments

Physical and social environmental factors are elements of a space which affect large groups of people who share a common living or working space. Environmental factors can also be determinants of health, and spatial variations can lead to different health outcomes. In this regard, access to social interaction and access to recreation are categorized as social factors, while indoor comfort is a physical factor, which in turn consists of environmental properties such as appropriate acoustic, thermal and air-related properties of an environment. These spatial properties are referred to as attributes in this work.

Under the light of the broad examination of the literature on “work, health and design” and related theories, factors influencing the design of healthy workspaces and physical characteristics of these environments (attributes) were defined. This categorization has been thought to be useful in the analysis of this subject and later it has been used to develop the analysis matrix.

Therefore, the five factors that were defined are

1. *Comfort* or the ambient conditions which are proven to have effects on productivity, performance and satisfaction or their positive effects on health,
2. *Social support* understood as access to positive human interaction and/or recreation,
3. *Stimulating design* refers to natural aesthetical environmental characteristics proven to be effective on mood and moral,
4. *Complexity and coherence* are elements derived from health and design theories known to affect stress level and other related physiological outcomes,
5. *Sense of safety* refers to qualities derived from studies on airborne pathogens and their prevention of transmission in built-environments which create a sense of safety regarding the environment.

The physical attributes related to the five factors above are shown in Figure 1. They are discussed in more detail below, along with attributes associated with health outcomes. Later research will evaluate user perceptions of these five factors and their associated physical characteristics in work environments that promote health and wellbeing.

Health and wellbeing supportive work environments					
Factors	Comfort	Stimulating design	Complexity and coherence	Social support	Sense of safety/(pandemic)
Attributes	Indoor climate/ Air quality Acoustic comfort/Noise/Music Access to daylight Appropriate indoor lighting Provision of ergonomic support	Usage of art/Aesthetics Use of color Access to view/View of nature Usage of biophilic elements Access to nature	Spatial organization/ configuration Facilitation of wayfinding Access to privacy Provision of environmental control	Access to social support/interaction Use of culture Access to relaxation/restoration	Controlled density/Crowding Hygiene/Promotion of hand washing Use of appropriate surface materials Use of proper filtration/HEPA filters Provision of ventilation Physical separation/distancing

Figure 1. A conceptual model of work environments that support health and wellbeing, with five factors that are derived from the theories and environmental qualities that gained importance after the pandemic (Source: Author’s own elaboration)



## 6. Matrix of Analysis

The elaboration of theories dealing with health and the environment and the operationalization of some other concepts and elements resulted in the need to link these results to the health outcomes that are of great importance for the design of healthy workplaces. As part of the study, a thorough literature review was performed to relate the physical environmental qualities of the workplace and related health outcomes. The resulting analysis matrix, which shows the relationship between the design features and the physiological and psychological health outcomes, is intended to contribute to the salutogenic design of work spaces and the investigation of healthy work environments.

Factors (as design strategies)	Comfort				Stimulating design				Complexity and Coherence			Social Support		Sense of safety(Covid measures)											
	Acoustic comfort/ Noise/ Music	Appropriate indoor lighting	Access to daylight	Thermal comfort/Air quality	Provision of ergonomic support	Access to nature	Access to view/View of nature	Usage of biophilic elements	Usage of art/ Aesthetic experiences	Use of color	Provision of physical activity	Spatial organisation/configuration	Facilitation of wayfinding	Access to privacy	Provision of environment control	Use of culture	Access to social support/ interaction	Access to relaxation/restoration	Physical separation /distancing	Balanced density/ crowding	Hygien/ Promotion of hand washing	Appropriate surface materials	Usage of masks	Use of proper air filtration (HEPA filters)	Ventilation
Attributes																									
Health and wellbeing outcomes																									
Less stress	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Less spatial disorientation											*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved quality of sleep		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Increased performance and productivity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Less mental exhaustion/ restoration			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Less physiological changes (cortisol levels, heart beat and breathing frequencies,etc.)					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Increased mental health							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Higher general satisfaction	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Increased sense of belonging											*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Increased morale /Mood			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Healthcare needs/ physiological health				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Decrease in the number of sick days				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved social support										*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Higher sense of safety																	*	*	*	*	*	*	*	*	*
Less rate of infections/ transmission (covid)											*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Lesser depression/ Anxiety			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Increased sense of coherence							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Attention/Concentration	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Figure 2. Matrix of analysis: The relationship between health outcomes and the qualities of the physical work environment that affect these outcomes (Source: Author's own elaboration)

### Attributes of “comfort”

As mentioned earlier, the effects of environmental conditions and indoor comfort in work environments such as thermal comfort, lighting, noise and air quality on the mental and physiological health of users have been known since the 1980s. Researchers developed building assessment methods to determine the relationships between these conditions and user satisfaction, performance and productivity. Some studies also made direct links between these circumstances and health outcomes that are believed to affect user perception and behavior. Inadequate lighting, thermal conditions and acoustics, for example, trigger stress, anxiety and depression, which also cause physiological changes in cortisol levels, heartbeat and breathing rate and impair the quality of sleep [7-12-16]. Access to daylight in an environment can affect regulating circadian rhythms and thus better the quality of sleep. Research also shows that the provision of ergonomic support in work environments such as ergonomic furniture reduces the number of sick days due to the prevention of physical discomfort.

### *Attributes of “Stimulating design”*

Mental exhaustion is a common health problem among working people. The literature shows the strong connection between mental health and nature. According to studies, recovery from this state is possible through access to nature, the view of nature and the use of natural elements in the environment. There is research on the aesthetics and ambience of the built environment that associate these properties as positive for mood and behavior [14-23]. In this context, these studies show the importance of color, furnishing elements (e.g. artifacts, works of art)) the perceived satisfaction and the mood and behavior of the users.

### *Attributes of “complexity and coherence”*

“Complexity and coherence” as a single factor are enhanced by elements such as spatial organization and configuration (the way the layout and allocation of the space is done), facilitation of wayfinding (e.g., usage of land marks, signage that facilitate orientation), access to privacy (to prevent unwanted encounters and facilitate concentration) and the provision of environmental control (e.g. being able to control blinds to provide shade, indoor lighting, thermal conditions). Their absence is known to cause stress and anxiety among residents[2-24].

### *Attributes of “social support”*

Workplaces are not only places where people work, but also physical spaces in which a social environment is created. The literature contains studies that analyze the relationship between environmental social support and physical and mental health. Researchers have shown that personal interaction in workspaces with peers and colleagues provides social support that has positive physiological and psychological consequences for user behavior [1-6-24-25-3-16-18]. Also, facilitating the use of culture in the workplace (i.e. sharing corporate visions and values through interior design qualities) and providing access to recreational spaces such as indoor gardens and informal meeting places are also influential in creating social support.

### *Attributes of “sense of safety”*

In addition, the recent pandemic has put disease transmission in the built environment, as well as the physiological health and safety of its users, on the agenda of design decisions. Previous research on the effects of the physical environment on airborne infections in healthcare facilities and further research after the Covid-19 outbreak is being revised to redesign all communal environments such as workplaces, theaters, cafes and restaurants. These shared areas mediate the transmission of infectious diseases in the environment. In addition, a strong correlation between contamination rates and some spatial properties was found. Understanding the operational elements of buildings, human behavior and the spatial characteristics that potentially increase or decrease this transmission is found to be of great importance [4-26-27-28-29-16-17]. Some qualities of work environments have been found to be effective in fighting the epidemic. These additional attributes are partitioning (suitable partitions between workstations), windows that can be opened for ventilation, use of suitable air filters, promotion of hand washing, reduced density and use of easy-to-clean surface materials. These attributes, which help combat transmission, are considered, according to the latest surveys, to be a feeling of security for the users of these community environments.

Taking into account all elements of the analysis matrix in a single study poses the challenge of designing a specific methodology. This methodology is discussed below.

## **6. Proposed Methodology of the Research and Discussion**

The theoretical and conceptual revision formed the basis to create an analysis matrix with all the elements to help develop new design strategies that take into account factors, attributes and health outcomes. However, the challenge remains to observe, measure, quantify and qualify all of these elements in real work environments. This requires building a comprehensive methodology. Post Occupancy Evaluation (POE) was therefore selected to investigate the extent to which the spatial properties of workplaces affect the mental and physical health and well-being of users.

Post-occupancy evaluation is used as a knowledge-gathering tool and has been a method of assessing built environments after they have been occupied for some time. For over 60 years researchers have been using this method to study physical environmental conditions such as privacy, lighting, thermal comfort, especially in work environments, and the effects of the quality of the built environment on employee productivity [30-31-32-33]. POE has been widely used range of environmental problems applied, from the indoor quality of the built environment, the design of parks and open spaces, to crime prevention in mass housing developments [34-35]. This method is also used in the analysis of health and wellbeing enhancing properties healthcare facilities.

POE uses tools such as interviews, questionnaires, observational walk-troughs, focus groups to observe and measure all of these elements and the related user perceptions in real world. The combination of these tools applied to specific elements of analysis appears to be a suitable method for this research.

Later, the knowledge gathered from this POE can be used in the evidence-based design of work environments. Evidence-Based Design (EBD) evolved from evidence-based medicine (i.e., relying diagnostic and treatment decisions on published research results) and its application is done by relying design decisions on systematic research and accumulated data on occupants needs.

Future field work on this PhD will use this methodology in coworking spaces, which are shared, activity-based work environments. The importance of coworking spaces has not only increased with the changing work concept in the last ten years due to technological advances, but also with the increasing number of teleworkers due to the pandemic, who are expected to use these working environments more in the future.

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# TOWARDS AN INTEGRATED APPROACH IN ARCHITECTURAL DESIGN STUDIO EDUCATION: DISTANCE EDUCATION DURING COVID-19 PANDEMIC\*

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## Abstract

All educational practices, including architectural education, are carried out generally as face-to-face formal education with their structured and organized programs by the institutions. However, the physical closure of schools and the disappearance of this conventional environment during the COVID-19 pandemic has necessitated a different model as distance education. And many schools had to adapt to distance education in the spring semester of 2019-2020 worldwide. But the different and specific structure of internet-based distance education caused the methodology and content of teaching and learning in face-to-face education to lose their validity; moreover, brought the search for new education methodologies in all levels. In higher education, the most affected disciplines by the transformation of the educational environment and model were the applied ones, and especially architectural education as one of the main applied disciplines that includes practical courses as well as theoretical courses. The unique nature of architectural design studios based on experiencing and trial-and-error method and also that distance education has never been experienced by institutions, educators and students, caused some difficulties in this adaptation process and required new methodologies in architectural teaching and learning. Therefore, the education model transformed to a more comprehensive and complicated model of “an integrated environment of formal, informal and non-formal education” on distance education. While the structured objectives, method and content of the design studios in face-to-face formal education were removed forcedly, it also changed the role of actors in the education such as leading teachers to become learners as well as students and the students to become more interactive learners. But these new methodologies on distance education have provided a more complex and inclusive understanding for the achievement of lifelong architectural learning. In this context, this study aims to share the experiences on internet-based distance education of architectural design studios, conceptually based on the methodology of informal learning and non-formal education in the spring semester of 2019-2020 and the academic year of 2020-2021 at Maltepe University, Faculty of Architecture and Design. It is extremely essential to present and discuss these short-term experiences of distance education during the COVID-19 pandemic that will determine the direction of contemporary education and the trends of the “new normal” in the near future.

*Key Words: Learning and teaching; Architectural education; Architectural Design Studios; Distance education.*

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## 1. The Formal Teaching and Learning in Face-to-face Architectural Education

Education is basically a methodological system that enables individuals to acquire the knowledge, skills and understanding necessary for participating in social life, and that enables future generations to be developed, improved and shaped in certain areas. Therefore, educational practices are carried out as formal education with their structured programs as well as conventional environments. These formal learning and teaching facilities are constituted of an organized and systematic model with a rigid content and aims defined by a curriculum. Hence, formal education necessitates fundamentally the institution, the teachers and students as well as a strict set of laws, regulations and norms administratively, physically and curricularly [1]. While such formal education is provided institutionally in schools and universities at all different levels -from kindergarten to higher education-, it is usually based on face-to-face teaching and learning.

However, the COVID-19 pandemic, which unexpectedly penetrated the whole world, radically changed these conventional education models. With the physical closure of schools in Turkey due to the quarantine period in March 2020, education and teaching practices at all levels started to be provided on distance education, which is considered as a “new” education model. Thus, the face-to-face formal education system, which had been widely practiced by both institutions, educators and students, was abruptly removed; furthermore, replaced with a quite different education system. While the essential and specific structure of internet-based distance education caused the methodology and content of teaching and learning in face-to-face education to lose their validity; at the same time various searches arose on new education models. Especially, in the field of higher education, the most affected disciplines by the transformation of the educational environment and model were the applied ones. As one of the main applied disciplines that includes practical courses in addition to theoretical courses, architectural education was also faced with a really serious crisis at the beginning of the pandemic in 2020.

In Turkey, the formal face-to-face architectural education in the spring semester of 2019-2020 could only be enabled for 5 weeks, and then replaced by internet-based distance education till the end of the semester. But the different dynamics of distance education from face-to-face education, which have not been experienced before by either educators or students at any level of education, required a new teaching and learning methodology. And both institutions, educators and students have been compelled to learn the new methodologies of how to teach the knowledge in distance education, rather than the professional architectural knowledge itself. This has resulted in both institutions and educators becoming learners just like students. But the prevalent contents and objectives of the courses structured according to face-to-face education brought up many discussions on how to maintain practical courses in architectural education, especially in the architectural design studios. These discussions were mainly guided by the view that education is what one does for himself and is always at the center of individual improvement [2]. In this regard, for the future of societies and the cultural transformation in a healthy manner, the idea that the education could not be limited only in the strictly defined classrooms but also could be in non-formal and informal forms in the diverse locations of everyday life has gained widespread practice, even in architectural education.

In this context, while many architecture schools in Turkey rapidly switched to distance education, some of them decided to continue only theoretical courses in the digital environment, with the concerns that practical courses -especially the design studios- could not be handled by internet-based education due to their essence based on learning by doing. However, since the long duration of the pandemic for 2 years, all architecture schools have searched -even if unwillingly- for adaptation to the internet-based distance education, including all practical courses. On the other hand, the decision to continue higher education in the 2020-2021 fall and spring semesters completely on internet-based distance education has left these short-term adaptation searches into comprehensive discussions on how the interactive character of architectural design studios can be re-constructed in the digital environment. And it has resulted in a new education methodology, a more complex and hybrid education including other education models such as informal learning and non-formal education which has already been used worldwide mostly for theoretical disciplines as well as formal education. Besides, in terms of learning of a lifetime and contemporary education policies, these new models have been supported by various international organizations, especially by UNESCO, EU Parliament and architecturally by UIA.

In the 2019-20 spring semester, with the disappearance of the formerly planned and organized structure of the courses according to face-to-face education and the transformation of educators and institutions into learning actors of the process, and experiencing distance education for the first time caused a new education model as informal learning spontaneously and enforcedly. In the fall and spring semesters of 2020-2021, with the former experiences of informal learning practices in the previous spring semester, and also with the re-construction of objectives and contents of the courses in accordance with the dynamics of distance education, the informal learning in the distance education got closer to the non-formal education.

The common point of these informal learning and non-formal education models is that they are parallel to the contemporary understanding of education in which the student is transformed into an "active actor"

in teaching practices, instead of the "passive participant" role assumed in the traditional education model. Moreover, they have largely common aspects with the distance education methodology, which is based on "individualized" and "collaborative" learning for students, and in which the knowledge transfer between the educator and the learner provided through different medium, and also teaching and learning could be possible without being physically at the same place and at the same time. Especially during the COVID-19 pandemic, these models have gained a much broader sense that enables education to reach the masses quickly and easily, as the ways of producing, sharing and reaching information have evolved into a technology-based form recently. Therefore, with the physical closure of universities in the spring semester of 2019-2020, this comprehensive nature of the different education models led to maintaining higher education in all disciplines -either applied or theoretical- including architecture, despite the physical "distance" of students and educators.

Distance education has become the norm for all education models today along with the advances in computer-based technologies. Although the number and scope of learning facilities provided on online platforms are increasing day by day, formal education is not fully integrated into this process yet. One of the applied disciplines that benefits effectively from computer-based technologies, but the most hesitant to use these technologies as an educational model is architecture. In particular, applied disciplines such as architecture still tend to follow conventional educational models. The digital environment was generally used as a tool in learning and teaching of architecture, and could not turn into a common formal education model widely yet. But, COVID-19 pandemic has radically changed it. Although many architectural schools around the world have enforcedly adapted to distance education during the pandemic, it is obvious that formal education will embody the "new normal" including informal learning and non-formal education in the near future. However, the peculiar nature of architectural design education causes some difficulties in this adaptation process.

Therefore, new educational approaches and methods for the architectural design studios should be proposed in accordance with the dynamics of this "new normal" and lifelong learning. Recent world-wide conditions require internet-based distance education and adaptation of architectural schools to distance teaching and learning facilities included in contemporary formal education -maybe even partially informal and non-formal. In this context, this study aims to share the experiences on internet-based distance education of architectural design studios, conceptually based on the methodology of informal learning and non-formal education in the spring semester of 2019-2020 and the academic year of 2020-2021 at Maltepe University, Faculty of Architecture and Design. Based on that the design is something to be learned, not taught; introducing these experiences not only architecturally but also educationally and methodologically, will provide a more complex and inclusive understanding for lifelong architectural learning.

## **2. Architectural Design Studio Education: Informal Learning and Non-Formal Education besides the Formal Education**

Contemporary architectural education aims to provide the learner the ability to think critically and creatively, as well as various ways of reaching information, instead of transferring the architectural knowledge directly from the teacher to the learner. As the architectural knowledge is not absolute information, the architect is no longer the one who receives and uses the existing knowledge as it is, like the architects of the master-apprentice relationship in the traditional world. The architect is the professional who actively produces the required knowledge and thought and has a wide imagination of design. He is a creative thinker who formulates new and contemporary solutions for the present and also for the future [3]. In this context, formal architectural education is carried out within a structured program including theoretical and practical courses, and given only with a certain period of undergraduate education (4 years in Turkey). The main goal of contemporary architectural education is to develop the architects "could accept the role of an 'enabler' rather than that of a 'provider', where the profession can meet new challenges." [3]. Therefore, architectural education provides individuals with the necessary learning habits

for lifelong learning, sharing and practice. In this respect, it has a feature that converges to informal learning and non-formal education models.

The most dominant element of architectural education is design studios, where students gain and develop the design skills. And the project work, which is carried out in design studios with the one-to-one dialogue between the tutor and the student, is the most important part of the learning process. The learning occurs through sophisticated interactions between the tutor and the student, the student and the student, the student and the project, rather than a linear transfer of knowledge from the teacher to learner. The design studios, where creative and critical thinking and continuous interaction are encouraged, are a synthesis of the knowledge and skills gained with all other theoretical and practical courses. Architectural design studios are based on creativity, imagination, vision, interaction, experience, and learning by doing rather than a teaching-learning process in the classical sense. Therefore, they are based on teaching and learning methodologies specific to the design studio.

Architectural design studios create an interactive learning environment instead of a static education model. Learning activity in the architectural design studio occurs on a trial-and-error process of various design practices through learning by doing and exploring. In design studios, not how to make a design within certain rules, but what could be thought and done to realize a creative design are guided -not taught. So the tutor is simply someone with more experience, not a teacher anymore. Moreover, architecture design is a thought that has measurable features as well as immeasurable ones. In this context, architectural education can not only be limited to formal undergraduate education. The development of the architect as a professional is based on the principle of lifelong learning [3]. Achievement, development and maintenance of lifelong learning considers the individual to be in the center of education by self-learning activities. Hence, conventional teaching and learning methods have been ignored in contemporary studios; instead the learning is defined as a self-centered process based on creating, experiencing, and researching [4]. Learner-centered architectural design studio depends on the tutor's being a guide rather than a role model and having developed a pedagogical formation besides architectural knowledge. In this respect, design studio education ensures for the learner to gain awareness to the built environment individually, socially, culturally, historically, ecologically, technologically, and etc., to understand and question all issues related to architecture, and also to transform this information to architectural knowledge for the benefit of present and future generations.

Since the students transformed to an active actor of the teaching and learning process, the conventional methods of architectural education and training were replaced by more dynamic ones. This dynamism also allows for flexibility and diversity to respond to the changing demands and requirements of the day [3]. For this reason, the methodology of education has always been the main focus point in all architectural schools worldwide. And especially in the last few decades, the adequacy of formal design studio education has been questioned as well as its objectives, content, context and methods in many countries. So it associates formal architectural education with informality. Contemporary approaches on architectural design education agree that architectural training should never be considered only a formal education -a closed process- in schools, but an inclusive one including informal learning and non-formal education.

Informal learning, unlike formal education, is unstructured and unorganized; while it is a more spontaneous form of learning. It is a lifelong learning by leisure time activities, daily lives, friends and various social environments, in addition to the family and business life of individuals. Therefore, informal learning does not have any institutional structure, just as it is not incidental or random learning. "It may include learning activities that occur in the family, workplace, local community and daily life, on a self-directed, family-directed or socially-directed basis." [5]. It is not based on educating or teaching, but a learning process by the individuals themselves. "Like formal education, non-formal education is education that is institutionalized, intentional and planned by an education provider." [5]. It differs from formal education, and also is organized to facilitate certain kinds of learning for a specific purpose, such as short courses, workshops or seminars, and etc.

Recently, architectural students tend to contribute to various learning environments such as workshops, seminars, cultural visits, site trips, conferences, archaeological excavations, competitions, exhibitions,



games, contests, courses of some programs on life skills, etc. as a part of lifelong learning. Some of them may have been pre-arranged, and some may have emerged completely spontaneously [6]. These out-of-school activities are not just alternatives to design studio education; they also have a great role in architectural lifelong and self-learning, for providing a richer and more creative and productive environment and increasing awareness of the context of the architectural profession. They enable students to have professional improvement, broaden perspectives, personal skills, individual capability and experimental design experiences that cannot be gained in formal education as well as more free and creative thinking.

The architectural design studios put individual creativity at the forefront of teaching practices, transformation of knowledge between the project, student, and tutor instead of absolute agreements, sharing of experiences instead of teaching information, learning by themselves and in their way, active interaction. The whole world, even if physically or digitally, is the educational environment of the architectural learner where one can observe and experience the dynamics of daily life physically, socio-culturally and architecturally. Although design studios are environments where students practice design works through informal learning, formal and non-formal education, formal architectural education is avoided from distance education for years. However, the internet-based distance education caused by the COVID-19 pandemic linked them enforcedly. With the disappearance of the organized and structured features in face-to-face formal education, the extensive opportunities of distance education have emerged as a new education environment. While the unique and quite different characteristics of this “unfamiliar” environment led teachers to become learners as well as students, it also caused the content, objectives and methods of the educational practices to change. Thus, a more comprehensive educational environment, “an integrated environment of formal, informal and non-formal education” could be created through contemporary educational methodologies. Moreover, the understanding of contemporary architectural design studio education enables us to adapt to this “new” integrated model of distance education much more easily.

### **3. A Distance Education Experience during COVID-19 Pandemic at Maltepe University**

Architectural design studios are individual-oriented processes that are customized according to the special interests and characteristics of the learner. This process is based on mutual and continuous interaction between the student and the tutor via all kinds of new methods and techniques. Although virtual design studio is one of these methods, it is not gained a widely use in architectural education. The fact that the formal architectural education is based on the face-to-face education model has led to avoidance of technology-based virtual design studios. However, the distance education caused by the COVID-19 pandemic obligated the education system to be re-arranged recently, according to the improvements in computer-aided design and the characteristics of the Z generation. The quite new experiences of distance education in architectural schools have revealed the necessity of developing new approaches and education models in architectural design studios for the future.

In the 2019-2020 spring, 2020-2021 fall and spring semesters at the Maltepe University Faculty of Architecture and Design, the architectural design studios were conducted via internet-based distance education without giving any break by the physical closure of schools during the pandemic. Therefore, it is essential and crucial to share these experiences on distance education to have develop more contemporary and inclusive approaches and methodologies in architectural education for the “new normal” future. In this context, this research is based on the feedbacks of the students and educators on distance education, in light of the information acquired within the scope of the research project titled “A Research on the Internet-Based Distance Education Experience in the Architectural Design Studios” supported by Maltepe University (MÜAR). Discussing this recent experiences by the perspectives of both tutors and students will provide very sophisticated knowledge for the new environment of the education. So, it was examined in detail through the feedbacks of 14 tutors and 130 students within the virtual design studio criteria of Dave and Danahy [7], as digital infrastructure, environment, tools, time, distance, cooperation, and design.

### 3.1. Digital Infrastructure:

Before the pandemic, Maltepe University already had a well-established and well-structured digital tools and infrastructure institutionally for more powerful and efficient teaching and learning facilities due to the digitalization age. Besides, the most of the common courses of different departments and faculties were already conducted on distance education via this digital environment, -Blackboard Learn. And it was also used as an auxiliary tool for the other courses during face-to-face education as homework and exams, file and content sharing of educators with students, announcements, etc. This experience based on the current use led the university, tutors, and students to adapt to distance education more easily. In addition to the existing infrastructure, rapid implementations and improvements such as the technical support and on-line informative trainings provided by already established and experienced Distance Education Unit to students and educators have eliminated many problems that technically, institutionally and educationally.

Therefore, when it was asked about “the technical problems they have experienced during distance education”, the students stated that the major problem they experienced was the poor internet connection. While the inadequacy of their computers’ hardware and software followed it with a much lower rate, only 5% of the participants stated that they had difficulties in using the Black Board interface. Considering the unexperienced first year students, it was very acceptable range. The answers of the tutors also show similarity; most of them stated that they did not have any technical difficulties due to their gained previous experiences on the digital environment and infrastructure. On the other hand, from the very beginning of the COVID- 19 pandemic, the well-established infrastructure allowed all theoretical and practical courses - including the architectural design studios- to continue without any break in the Faculty of Architecture and Design. This new digital environment was nearly a virtual simulation of face-to-face training, with other extensive features provided by Blackboard Learn, such as file sharing synchronously and asynchronously, digital drawing on the screen, organizing jury sessions, and collaborative work (Fig. 1) that were used intensively during the three semesters on distance education by the students and tutors.

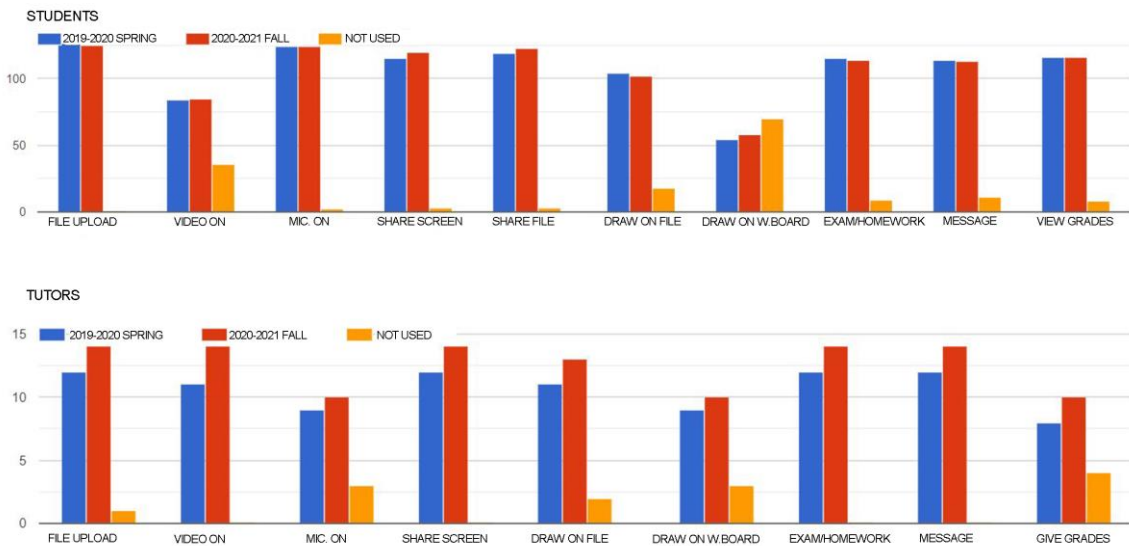


Fig. 1. Extensive features used by students and tutors in virtual design studios in different semesters.

### *3.2. Distance:*

As internet-based education eliminated the spatial, physical and temporal boundaries of distance; it has become easier to meet and communicate for individuals in different geographical locations and in different time zones. Thus, it has also allowed to various professionals, experts and educators in different locations to be a part of the teaching within some conference meetings, workshops, etc. and to students to benefit more diverse knowledge on different perspectives worldwide. In this context, lots of seminars were held to provide a better teaching, in or out of design studio hours that brings learners together with more experienced professionals. This kind of non-formal education facilities in addition to formal education provided a richer and a more creative environment that enable students to have broaden perspectives, theoretical architectural knowledge, more free thinking and creative design ideas. While a more sophisticated discussion environment was created, recording these seminars as well as studio sessions throughout the semester allowed students to reach these discussions repeatedly. According to the results of the research, this type of access to session recordings has provided an environment that aligns with the characteristics of Generation Z that need individual engagement in research, learning, and study activities whenever and wherever they want; as well as being passionate about change and impatient to reach the information, preferring technology-based learning and desiring to experience all new experiences [8].

### *3.3. Time:*

As well as spatial and physical features, internet-based distance education has also transformed the time use and management. It brought a very great flexibility for the students to develop new interest areas and new attitudes for their individual improvement whether or not in the architectural education. Although it seems like moving away the student from the atelier study of the conventional studio environment, for students it has provided a new experience of real professional architectural practice that could be never taught in schools. With an effective time management, they realized lots of self-experienced design practices and self-disciplined adaptation to the design process professionally. While during face-to-face education, students sometimes preferred to attend classes without any pre-preparation but to work on their projects in the studio, during distance education they had to participate in each on-line session with developed and elaborated design works. So this kind of learning by doing practices of self-oriented informal learning process out of studio hours and space embodied with more creative and imaginative design alternatives as it supports students to work at their own pace and system and enables the tutors to discuss and comment on more developed design projects.

### *3.4. Environment:*

By replacing the physical environment with the digital one on distance education, the relation between the students and tutor has changed and evolved into a closer form. The personal lives and personal spaces of all different participants of the design studio teaching and learning gained importance, while they were ignored physically and mentally in face-to-face education. The one-to-one dialogue of the conventional studio on the design works changed to one-to-one dialogue on personal issues such as the physical conditions of student's study environment, psychological status and the other factors that determine their life quality in a quite manner. Individual information about students' and tutors' physical and mental environment as the status of internet connection, comfort conditions, family health status, etc. have become the usual daily topics of the communication during the distance education; and tutors had to develop personalized and advanced responses for each student's problem. This new type of communication arose a closer interaction between the students and the tutor by changing the usual concrete definitions of the studio tutor in the minds of the students. Instead of being only a teacher (educator), the tutor has become a mentor who extends the design studio process beyond the hours determined in the curriculum and a more experienced colleague that students can easily share their ideas to increase the quality of their design

studies. This new studio approach had extremely positive effects on learning process, as well as preparing the architect candidates for their future professional careers, still in their educational training.

### 3.5. Cooperation:

The beginning of architectural education face-to-face in the 2019-2020 spring semester and following on distance education allowed face-to-face interactions between tutors and students and created an environment for acquaintances in physical space. However, it was evolved into virtual acquaintances in next semesters of 2020-2021 academic year with the camera and microphone features provided by Blackboard Learn. Tutors' always activating the camera and being physically visible even if on the computer screen during the long hours of design studio as well as seminars and other training practices on distance education enabled to establish a strong communication, an interactive dialogue between the tutor and students in reducing the lack of motivation (Fig. 2). As the results of the research shows that the major problem that students faced with was the lack of personal motivation during the quarantine period of the pandemic while communicating with the tutor was one of the least problematic issues.

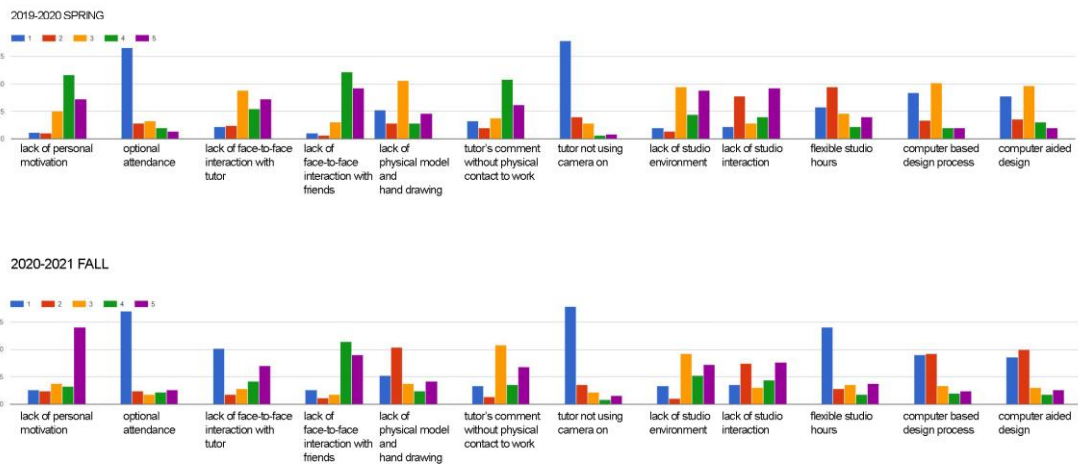


Fig. 2. Problems that students faced with during distance education.

On the other hand, the research reveals that lack of physical social activities and face-to-face interactions with friends in the quarantine period were the main problematic issues of the young learners who wished to have a social and active university life. But students tried to eliminated this failure by attending lots of informal learning facilities. While they met their need for interaction and socialization with alternative methods, they have also developed knowledge and new skills with experience through reading, social contact and incidental or random daily activities such as listening to a radio program, watching a television broadcast [5] or attending some activities on digital platforms that is not structured in the formal education program. In the context of informal learning, in the discussion groups they formed on various social media platforms to communicate, they conducted interview sessions on each other's design work together freely and collaboratively at the outside of studio hours. Besides the interaction between the tutor, student and design was re-created through virtual environments, the student's knowledge about the design proposals and project phases of their friends led to a spontaneous interpretation process in which everyone actively participated during the studio hours. In this integrated design studio model, the students embraced the studio like a tutor/mentor, in which they tend to produce their solutions to all kinds of problems.

### 3.6. Design tools:

As non-formal education can include learning activities of self-development that are not directly related to the purpose of the lesson [5], during distance education students have discovered new means of knowledge on various issues. With the disappearance of the familiar tools of expression in face-to-face design education, the students handled with digital representation techniques and ways according to their own needs, -indeed the design needs. The replacement of the physical model by computer-aided three-dimensional modeling programs has caused some difficulties in the perception of the 3rd dimension and project disproportions, in making design decisions, especially for the students who use digital modeling programs at the beginner level. Many students, who struggled with this inadequacy for a long time, tried to find new representation tools to express their design ideas basically. Technology-based solutions, such as getting the knowledge of required computer aided programs in accordance with the design idea where the students were inadequate, transforming every place into a studio (atelier) when they experienced technical difficulties, and participating in discussions over digital platforms when necessary, have enabled a new generation of architect candidates by lifelong learning.

### 3.7. Design:

While formal education has well-structured and organized structure, non-formal education provides an alternative method due to the individual needs of the learner in terms of lifelong and self-learning. And also in the context of flexibility, the initial procedures and contents of non-formal education can change quickly according to that needs [1], while formal education not. But COVID-19 pandemic has overturned the usual educational methodologies and required a very instant reaction. Although distance education had some difficulties because it has not been experienced before, the transformation of architectural design studios to a more comprehensive environment with integrated educational methodologies increased the overall design performance of the students. According to the results of the research, the new design studio environment and design works were very productive for all learners and teachers in both terms (Fig. 3).

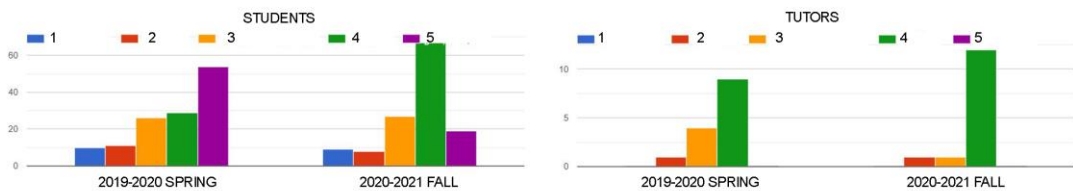


Fig. 3. Overall term evaluation of students and tutors for the architectural design studios on distance education.

## 4. Discussion

For the future qualitative development of all societies and cultures, education practices have always been the main study area of contemporary approaches. While the formal education at all levels is conducted face-to-face in institutions from kindergarten to universities, for 21st century societies the basic aim is to develop the individuals as “generalists” rather than professional workers. As education includes teaching and learning practices, for the individual achievements the recent studies are mainly based on the learning facilities rather than teaching. With the vision of the future world, education is a lifelong learning

process of individuals through various environments. And learning occurs through the “individual acquisition or modification of information, knowledge, understanding, attitudes, values, skills, competencies or behaviors through experience, practice, study or instruction.” [5].

Education is the central point of individual improvement. Educating and training future individuals enables them to meet the expectations of the fast changing world, its unexpected and complex challenges and conditions. For the benefit of present and future generations, education could not be limited only to strictly defined classrooms. different methodologies should be considered with a rich range. In this context, learning could not only be as formal education, but also in other forms such as informal and non-formal. As non-formal education and informal learning has become more widespread over the last decade, especially, in the recent years by the digital and information age, educational practices have gained a wide variety of environments and methods including distance education. Although the digitalization was generally used as a tool in teaching and could not turn into a common formal education model widely; COVID-19 pandemic really accelerated it. While the most dramatic changes were in the education of applied disciplines, it also created different understandings of education methodologies of formal education.

As one of these applied disciplines architectural education that was highly dominated by design studios, faced a kind of crisis in the spring semester of 2019-2020 with the physical closure of schools during the COVID-19 pandemic. However, the disappearance of the studio as a physical space and its transformation to the virtual environment of distance education have arisen questions as how the interactive environment of the studio can be re-created and how the interactions based on experiencing will transform. But technology-based education has turned into a common practice in the 2020-2021 academic year, and architectural education also has to adapt to distance education. However, the inherent characteristics of architectural design education caused some difficulties; new approaches and new educational models were developed on internet-based distance education. This “experimental” process resulted in various methods of formal education and training in architectural design studios, as well as the roles of “teachers” (tutors) and “learners” (students).

Since the students transformed to an active actor of the teaching and learning process, and the tutors to learners of the new environment and methodology on distance education, the conventional design studio education was replaced by more sophisticated and dynamic ones that respond to the changing requirements of the day. Essentially, the objectives and methods of formal design studio education have been questioned for the last few decades, and in order to increase the quality in architectural education worldwide recent studies mostly argued that informal learning and non-formal learning should be an integral part of formal architectural education. Contemporary understanding of architectural design education is that architectural training should never be considered a closed process in schools, but an inclusive one including distance education. So the internet-based distance education caused by the COVID-19 pandemic associates formal architectural education with informality. With the disappearance of the organized and structured features in face-to-face design studio education, the extensive opportunities of distance education which was ignored in architectural education for years led to an integrated environment of formal, informal and non-formal education. As architectural design studios have specific educational methodologies, they are based on creativity, imagination, interaction, experience, and learning by doing rather than a teaching-learning process in the classical sense. This integrated approach on distance education allowed a more flexible environment as in the essence of design education; and the main features of face-to-face design studio were switched to digital infrastructure, environment, tools, time, distance, cooperation, and design. Moreover, the understanding of contemporary architectural design studio education enables us to adapt to this "new" integrated model of distance education much more easily.

Therefore, in architectural education, where the knowledge, skills and competencies are gained with such contemporary understandings, distance education during the COVID-19 pandemic enables to develop a new education model that is more suitable for the habits of the new generation and more individualized. , in connection with the change in the educational environment. Thus, in addition to the opportunities and skills provided to learners, an educational model and environment that encourages learners to acquire

additional skills appropriate to their interests and individual characteristics through their own efforts could be created. Where the boundaries between the teacher and the learner are blurred, it allowed a new model that the architectural design studio could not be limited to only a physical space, moreover that works according to timeless and individual programs of the learners rather than teachers. And it would be possible only by sharing and discussing the potentials, motivations and other aspects of this new comprehensive environment through different experiences to develop more sophisticated trends of the “new normal” in architectural education for the near future.

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# TOXICOSIS: REBRANDING JANE JACOBS

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## Abstract

Where do we stand today in our understanding of the city as an integrated entity? In this paper this question will be approached from Jane Jacobs' point of view as portrayed in her most well-known publication *The Death and Life in Great American Cities*. Although written in the 1960s, Jacobs' integrated thinking has proven to still be relevant today as a wise starting point for making space. Jacobs' approach is much appreciated by designers and producers of space – not only for its disciplinary significance, but also for its socially driven addressing of human values. However, her widely appreciated ideas should be reread in a more radical manner today. Jacobs' socially and culturally driven thoughts on space production are being confiscated by advanced neoliberal economic strategies – driven by big data networks – that constitute a sophisticated but all-determining system of the twenty-first century. Neoliberalism presents itself as an unlimited series of self-determined propositions and choices. Viewed from this perspective, Jane Jacobs' 'iconic brand identity' seems very valuable to persuade all types of stakeholders in the credibility of the narrative being told. We will examine this ongoing process by first explaining the instrumentalization of Jacobs' original concepts in the latest economic narratives. Secondly, the practical application of these terms is discussed through a comparative exploration of two case studies: the renewal of Toronto's Quayside District in Canada by Sidewalk Labs, and the project Brainport Smart District in Helmond, the Netherlands. Both case studies distinctively illustrate the instrumentalization of Jacobs' principles for social urbanism and are exemplary for the tension between these principles and neo-liberal strategies both within and beyond their respective contexts. The main purpose of this paper is a critical analysis of this ongoing process.

**Key words:** *value creation; complexity; space branding; economization*

## 1. Jacobs' Vision

Jane Jacobs developed her thinking in the 1960s and 1970s as an alternative to the paternalistic and authoritarian 'top-down' urban planning applied by private developers and housing associations, characterized by spatial standardization and social homogenization.[1] In line with key radical thinkers of her time, including Herbert Marcuse and Michel Foucault, who defined the subtle control mechanisms of modern capitalism and democracy on a theoretical level as 'repressive tolerance' (the passive acceptance of social and governmental practices)[2] and 'panopticism' (the authoritarian control of knowledge and truth),[3] Jacobs was convinced that the surveillance of urban life should be limited and that a certain level of 'chaos' would help to avoid, or at least reduce, the oppressiveness of bureaucratic authority and the dominance of urban planning.[4]

Jacobs' notion of 'strips of chaos'[5] should therefore be understood as a metaphor for spontaneous and unpredictable social and spatial behaviours and as a key prerequisite of citizens' interdependence. In other words, it was Jacobs' conviction that the overload of data in the possession of planners restricted the unforced actions of residents and limited their self-determination.[6] Therefore, places should be improved and revitalized according to their physical and social particularities with 'eyes upon the streets' and taking into account the ambiguous behavioural interactions among their residents.[7]

Jacobsean thinking was mainly driven by space-related social and cultural visions rather than by economic and financial principles. She recognized the relevance of economy, however, primarily in a way that is conducive to supporting the unique social and physical identity of a place. It could be argued that Jacobs was a capitalist with a small 'c' and especially a believer in community organization and grassroots



developments.[8] Following from this, the recent interest in her thinking by capital ‘C’ parties active in the domains of economy, finance and entrepreneurship is quite astonishing. What might be the reason for this?

## **2. Terra Economica or the Promised Land**

Private company Deloitte is one of the biggest multinational services networks that provides worldwide consulting, enterprise risk and financial advisory services.[9] One of Deloitte’s recently published studies, titled ‘Making Cities Smarter’, addresses the key challenges of contemporary city planning. According to this document, a truly smart city will leverage technology to elicit the ‘wisdom, empathy and feelings of its citizens and will enable smarter decisions by city planners’.[10] Surprisingly, Deloitte’s primary reference to achieve these ambitious targets is Jacobs. She is considered to be ‘the pre-eminent philosopher of modern times, and her modest parable exemplifies an idea common to her theories of urban design – namely that the best designs, respect the wishes of actual city dwellers’.[11] According to the report, Jacobs took a dim view of the ‘grand designs of central planners, and once urged her audience to respect – in the deepest sense – ‘strips of chaos’ that have a weird wisdom of their own’.[12]

Deloitte’s ideas about the transformation of market conditions are not coincidental, but instead confirm a radical paradigm change that is discussed in recently published literature. Consultant Umair Haque states in his book *The New Capitalist Manifesto* that the neoliberal capitalist system is in the throes of an irreversible revolution. According to him:

*As the great-grandchildren of the industrial revolution, we have learned at last that the heedless pursuit of growth is unsustainable and, ultimately, unfulfilling. We long for a gentler sort of capitalism. One that doesn’t sacrifice the future for the present and regards our planet as scared.*[13]

Julian Richer, entrepreneur and the founder of ‘Richer Sounds’, argues in *The Ethical Capitalist* that ‘ethically run businesses are invariably more efficient, more motivated and more innovative than those that care about the bottom line’. Jonathan Self, journalist and author of *Good Money*, is convinced that businesses of the twenty-first century should be focused exclusively on improving the world we live in, rather than on financial gain, profits and selfishness. Business should be based on the ethical principles of authenticity, honesty and respect. Entrepreneurs need to show ‘moral capacity, compassion and a desire for justice’.[14]

It can be said that currently, in the first quarter of the twenty-first century, a radical transformation of the neoliberal ideology is taking place, surprisingly signified by a spectacular analogy between its evolving focus on value principles and Jane Jacobs’ thinking of the 1960s and 1970s. In general, ethical principles of right and wrong in behaviour seem to be becoming the most significant subject of concern for contemporary capitalism, making it co-responsible not just for itself, but for consumers, the environment and even the future of the world.[15] While this all sounds rather positive and optimistic, we would like to focus on two key principles of this expanding strategy that are fundamental in achieving this transition and are worthwhile to critically examine.

## **3. Technical and Narrative Perspectives**

We think this process is based mainly on two key aspects. The first comes from a ‘technical perspective’. Currently, we are increasingly relying on new technologies in strategic and logistical management.[16] These management instruments are able to connect and predict accurately the manifold socioeconomically driven phenomena that were regarded as too complicated and therefore uncontrollable in the days of Jacobs. In her book *The Age of Surveillance Capitalism*, Shoshana Zuboff meticulously exposes the

mechanisms that allow the usual big-tech industry suspects, such as Google, Facebook, Apple and Amazon, to steadily become more able to predict human behaviour by way of big data in the form of ‘behavioural surplus’.[17] This behavioural surplus is all the extra information provided when using the different interfaces of various digital platforms and enables their ‘hidden commercial practices of extraction, prediction and sales’. Zuboff argues that with this operation, it is in fact the human experience itself that big tech lays claim to, using it as raw material for the parasitic economic logic of what she has coined ‘surveillance capitalism’. This development enables them, but also a fleet of other type of private and public enterprises, to play into people’s emotions and values by building a choice architecture around them that subtly nudges their behaviour, while remaining outside the awareness of the subject.

Secondly, from a ‘sociocultural perspective’, the contemporary design of almost anything (thus also space) seems linked to value creation other than economic value. There is a shift from the value propositions based on Jacobs’ pragmatic considerations (usefulness of spatial inventions) to a value creation based on sophisticated narratives that have the ability to establish feelings of sense and sensitivity of all relevant stakeholders.

The narrative as a concept is seen in the discipline of behavioural economics as a powerful instrument with which to strongly influence the choices of people, able to help highlight the authentic ‘personality’ of products they might be interested in.[18] As narratives have the ability to resonate on a deep emotional level, it could be claimed that ‘a good narrative soundly beats even the best data’.[19]

Nevertheless, the branding of goods, services and spaces is not new at all. However, what *is* new is that the contemporary concepts of branding addressed above all rise from the importance of authentic corporate identity.[20] This message of – what we consider the ‘branding turn’[21] – proves a strong analogy with Jane Jacobs’ understanding of cities, which she described as an ‘ecosystem’ of ‘physical-economic-ethical processes’ ideally characterized by ‘mutual support and mutual interest’.[22] In a certain way, the civil society of the twenty-first century will be explicitly driven by the collective sharing of authentic values rather than by individual self-examination. Probably, no one would argue against these sincere and seemingly well-intentioned notions. Nonetheless, we distrust the unselfish and generous moral principles that seem to govern the contemporary approach of companies, regardless of whether their domain of business is the production of goods and services or that of buildings, neighbourhoods and infrastructure. The impact of the ‘branding turn’ on space will be discussed in more depth by exploring two contemporary examples: the renewal of Toronto’s Quayside District and the project Brainport Smart District in Helmond.

#### **4. From Sidewalk Ballet to Sidewalk Labs**

The redevelopment of Toronto’s Quayside District is a revitalization scheme by Sidewalk Labs, a daughter-firm of Alphabet, which also owns Google. Jane Jacobs’ thinking and values, such as participation, freedom and collectivity, might not immediately come to mind in the context of a big tech urban development. However, the images related to the project do look like a cosy ‘Jane Jacobsian street festival’.[23] A more explicit link between Jacobs’ thinking and the project was made by Canada’s federal MP Adam Vaughan, who co-led an exploration of Google’s plans for Toronto’s waterfront. He appeared with a copy of *The Death and Life of Great American Cities* in his hand on the May 4<sup>th</sup> Jane’s Walk in 2019, which is ‘an annual festival of free, community-led walking conversations inspired by Jane Jacobs’, and held on to it during the walk as if to prove that Sidewalk’s plans are grounded in her theories.[24]

Jacobs’ message seems to lie at the centre of the narrative and images associated with the Sidewalk Labs scheme.[25] The images in particular take up an interesting position as they convey a message that resonates with people and reinforces a place’s identity *a priori*. They portray a range of activities and a

diversity of people, while simultaneously embedding values such as nature, a healthy lifestyle and aspects of individual sincerity, social involvement and ethic authenticity.[26] This paradox is precisely what we intend to address, as these types of values are incorporated in the (visual) narrative and branding of smart urban development schemes, while the underlying objectives of such developments are of an entirely different nature.

This became public when ‘the yellow book’, a Sidewalk Labs internal vision document, was leaked. The document contained future plans for a neighbourhood like the Quayside District, complete with a social credit system and the continuous monitoring, surveillance and influencing of the behaviour of its residents.[27] A neighbourhood in which the availability of services is leveraged to persuade people to hand over more data and where a ‘private entity’ would operate and collect taxes on ‘public infrastructure’. Even though the yellow book was dismissed by Sidewalk Labs as an old thought exercise, it provides some insight into why a company like Google is interested in urban development. Moreover, it led to the project being critically re-examined by the Canadian government.[28]

As such, Toronto almost became the city in which Jacobs’ sidewalk ballet was recast as Sidewalk Labs: a laboratory ridden with cameras and sensors to observe, monitor, surveil and influence citizen behaviour.[29] In this commercial operation the squares, streets and sidewalks, which Jacobs considered as the most vital organs of the city and on which the intricate sidewalk ballet unfolds, are reborn – read privatized – as the cornered raw materials earmarked for a surveillance capitalist marketplace.[30]

How such a future might look is further exemplified by the development of ‘the smartest neighbourhood in the world’ in Helmond, the Netherlands. While this Brainport Smart District ‘shouldn’t feel like a laboratory with sensors’ its lampposts will be outfitted with sensor hotels that measure sound, movement and air quality. Smartphones are tracked, and the sewerage will have sensors to analyse the health of the neighbourhood. Built-in sensors measure how much you sleep, how you use smart home appliances, how much time you spend on social media and if you exercise enough. As such, data is not only extracted from public space, but also from the most intimate spaces of people’s homes.

Moreover, the data is not only intended for improving the neighbourhood or citizen’s lives, but also for trade, as 100 of the 4,000 residents would be eligible to receive discounts or rent waivers if they share their data with companies.[31] In this way, privacy becomes a currency for basic needs to ensure frictionless communication and seamless connectivity in a city where efficiency is key and the idealized topology of the open web and ‘Internet of Things’[32] is translated into urban form.[33]

## **5. Concluding Remarks**

Jane Jacobs’ exceptional way of thinking seems to finally be appreciated and applied not just by public planning authorities, architects and urban designers, but also by her former ideological opponents, including local and global institutional investors and stakeholders in profit-driven space development. Unfortunately, it is not possible to know what the grand old lady herself would think about the persistent tribute to her principles. One might be inclined to say, congratulations ‘Queen Jane’, you are now seen as an ‘urban guru’ and your former opponents are finally showing appreciation for your ideas.[34]

However, we believe the opposite is true. Jacobs’ socially and culturally driven thoughts on space production are being confiscated and rebranded by advanced neoliberal economic strategies – driven by big data networks – that constitute a sophisticated but all-determining system of the twenty-first century. A system that can integrate social, spatial, ethical and emotional factors under the umbrella of economic logics that smoothly absorb Jacobs’ well-intentioned principles.

The operative logic of contemporary neoliberal thinking does not just accept, but also incorporates evolutionary models of diversity, complexity, flexibility, spontaneity and self-organization. Neoliberalism

presents itself as an unlimited series of self-determined propositions and choices.[35] Viewed from this perspective, Jacobs' suppositions and neoliberal axioms match well, and not only content wise. Jane Jacobs' 'iconic brand identity' seems very valuable to persuade all types of stakeholders in the 'authenticity' of the narrative being told.

However, there is a substantial difference between Jacobs' and neoliberal understanding of 'self-determination' and 'freedom of choice'. We argue that an all-enveloping and inescapable, panoptic world is being developed in which data technology will solve everything. This idea of the commercially quantifiable and measured city results in a narrow understanding of what dwelling in the city is about. It disallows the spontaneity and messiness of 'the strips of chaos' that Jane Jacobs pleaded for, as they will be subjected to rational order, and marginalizes the ability for citizens to give shape to the city, one of the things that makes city life so attractive.[36] Thusly, Jacobs' values are merely incorporated into the branding and narrative of smart city operations. The actual developments remain the result of a view on urban planning as a data driven and technocratic problem that requires solutions. Consequently, the means to achieve those solutions are increasingly encroaching on the rights, privacy and autonomy of citizens.

Apparently, this development is not causing growing concern in neoliberal circles. According to entrepreneur John Elkington, the twenty-first-century business will be based on:

*The Triple Bottom Line (TBL) consisting of three P's: profit, people and planet. It aims to measure the financial, social and environmental performance of the corporation over a period of time. Only a company that produces a TBL is taking account of the full cost in doing business.*[37]

Let us conclude on a positive note. There is no need for nostalgia at all, but the authentic spirit of Jacobsian principles has gone and become an accomplice of smart neoliberal 'Cannibals with Forks'. [38]

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- [17] Shoshana Zuboff, *The Age of Surveillance Capitalism* (London: Profile Books Ltd, 2019). Originally the notion of 'surplus' (*Mehrwert*) was addressed by Karl Marx. Surplus value is the difference between the amount raised through the sale of a product and the amount it costs the owner of that product to manufacture it. The contemporary meaning of surplus is addressing the qualitative and emotional values of products beyond their quantitative and financial values, such as production costs and the market value of produced products.
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# “TROGLODYTIA”: LEARNING FROM UNDERGROUND COSMOS FOR RESILIENT MORPHOLOGIES

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## Abstract

Disasters are destructive events that negatively affect inhabitants living in their cosmos. Conversely, natural and artificial environments assist in the survival of all beings. Until today, faced with the challenges of nature, human beings have become one of the most adaptable livings because of their ability to expand the human cosmos. However, the increasing ecological crisis has demonstrated that human habitation cannot remain safe much longer. Disasters are divided into two types: natural and man-made. For a long time, it could not be grasped that our interventions in nature not only affected nature but also impacted our “cosmos.” Recently, these cases reached a level that is unfeasible in terms of figuring out which one triggers the other. Cosmos, body, and environment are examined together due to the fact that they are interrelated factors.

For some time, environmentalism as a growing research area has revolved around two fundamental issues: sustainability and Anthropocene. While the former directly attempts to pursue resources for future generations, the latter criticizes man-made structures through political and ecological frameworks. However, the inevitable cases, disasters, which cause devastating effects on the planet’s inhabitants need more than prevention and management methods for post-disaster conditions before they happen. Initially, a term in material sciences called “resiliency” was coined for ecology; its meaning is to “recover from bad conditions into fundamental properties.” Subsequently, almost all fields have adapted it for a kind of purpose. In general, architectural resiliency has a macro-level meaning, as well, and this is why it is commonly used within the framework of urban planning. Though resiliency as a research topic can be a novel subject, in architectural practice, it is not. Still, it has not been sufficiently explored, especially in terms of morphological structures. Certainly, resiliency was not a commonly studied or employed method in ancient times. However, underground spaces used during those times to refrain from the outer environment were resilient. Recently, they are re-emerging as a new, fertile field in terms of morphological studies in architecture. This paper aims to first demonstrate the relationships between the cosmos and resiliency and its invisible links to underground settlements. Then, the fictitious concept “troglodytia” is proposed as a new approach for resilient architecture. Elements of approach are, to briefly list them, interconnectivity, separation, and layering. Consequently, several inferences can be made. Some of them are concerned with the search for answers to the following questions: What kinds of interventions are needed or how can the cosmos be effective for resiliency?

**Key Words:** *Resiliency, Cosmos, Body and Environment, Underground Architecture, Introverted Space.*

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## 1. Introduction

Since ancient times, the human population has faced destructive events such as earthquakes, extreme climatic conditions, droughts, pandemics, and so on. However, as we have recently observed, cities are becoming more and more vulnerable to these kinds of events due to the overpopulation of cities, urban mismanagement, insufficient infrastructures, and lack of resources. While some of these disastrous events were and still are human-based, such as wars and invasions, others, which can be even more destructive, were and still are natural disasters. Though, as the most adaptive species in the world thanks to our social capabilities, until today, humans have overcome most difficulties and survived since the past. There is a distinguishing attribute of humans, besides our capability for technological improvement, that enables us to be more resilient against natural disasters. This can be seen even today in the living environment—it is our adaptability in a diverse ecosystem. This is implied in “ecosystem diversity” and can here be understood as earth, water, air, and even outer space. Also, thanks to our collective memory, old or destructive events trigger human imagination in either catastrophic or utopian ways. Even though these survival skills support human adaptiveness, it is clear that our building environments can’t change as quickly as we need in

modern life, at least for now. Ironically, our adaptation process also causes the most devastating of acts — the invasions of the earth in terms of human beings, as well as of animals and plants. During the coronavirus pandemic, people had to change many of their habits due to the many medical and social interventions. Yet, the constructed environments around the world could not adapt to our contemporary needs during this period. Thanks to the internet, however, it was possible to work at home during the various lock-downs. During these, it could be observed that nature has a self-healing power.

Sustainability is currently a well-discussed and popular term in architectural design research; it basically means that resources are restricted and must be used effectively. But today designing sustainably is not enough for those who live naively in the face of our human-made enemies such as global warming and rising sea levels. It must be considered as consisting of saving human beings against nature and nature against humans at the same time. Devastated ecological structures have caused, in many cases, huge impacts on living environments like cities and transportation hubs. The recently increasing number of floods, fires, earthquakes, hurricanes, or more complicated events such as tsunamis, reveals that architecture should promptly investigate ways of quickly recuperating after ecological crises.

Resiliency is the answer. As a term of ecology in substance, resiliency is defined by its inventor as “a measure of the persistence of systems and of their ability to absorb change and disturbance” without changing “relationships between populations or state variables.” [1] As seen after the lock-downs during the Covid-19 pandemic, nature has an inherent resiliency. In terms of man-made structures, this can mean the transformation from a vulnerable situation to a more stable one during an emergency. This is why it is a common mistake to substitute flexibility with resiliency. However, resiliency and the act of becoming resilient are not individual acts but collective reactions.

This is because the concept of resiliency is often expressed with the city and its connection to the masses. Resiliency is also not a global act but a local intervention that depends on knowledge of local geography. This reveals why resilient environments differ from each other depending on their locations. Although resiliency is a very broad concept in architectural research, consisting of interdisciplinary approaches, resilient morphologies have not yet been thoroughly investigated. This paper examines resiliency in architecture in a broad manner: from ancient times to the present day in terms of the way techniques and representations of being resilient have made important contributions. The following section debates the relationships between humans and the cosmos in the framework of body and environment. The other investigates clues on being resilient through topological examples of resiliency that existed before the advent of the resiliency theory. The final section before conclusion proposes the resilient architectural component as an introverted space. This research does not follow any chronological order because it is not important at this juncture. A conclusion makes up the last part of this paper.

## **2. Eco- Adaptation: Expanded Human Cosmos**

An ecological crisis, in many cases, posits that human habitation is attached to a livable environment; in this paper, this is called “cosmos.” Our cosmos defines our livable boundaries as all other living beings do the same in the world. Cosmos, in other words, is defined as a livable environment for its inhabitants. Even investigation of outer space has highlighted how human beings have gracefully adapted to the Earth and have needed very specific things to exist in it. However, in the past, our cosmos was not as vast as it is today. For instance, medieval cities were defended by suspended walls that surrounded the living space and, in this way, served as a cosmos for their residents, as illustrated in (Fig. 1 (a)). Similarly, in Çatalhöyük, the outer wall saved people from enemies and carved out an introvert cosmos as seen in (Fig. 1 (b)).





Fig. 1(a). Ramparts of the historic fortified city of Carcassonne, Aude, France [2]. 1 (b).Çatalhöyük after the first excavations [3].

As seen in ruins until boundaries expanded but later vanished completely in the “global world,” prevention was the way to intervene against threats. Once the cosmos collapses, our perception of normal and living standards turns upside down. How can we behave after a disaster negatively affects our cosmos? Can the artificial environment support resiliency? Neri Oxman, an experimental architect, and her team developed a pavilion called the “silk pavilion” in which silkworms in a rotating structure weave silk on a sheet instead of a cocoon as a reflex to the changing of their cosmos. Some old designs have shown that an artificial environment could be the solution to such disturbances. The architect Buckminster Fuller, who is the inventor of a geodesic dome, designed the “Manhattan Dome,” which can be interpreted as an example of a volatile cosmos under the sky. Lally (2014), who states that architecture “is the reinvention of the site itself” in his book, explains how changing situations affect our “normal” sensations, which exemplifies by interactions of solar radiation and color perception [4]. To him, it was the proposed cosmos made from intense energies providing safety, privacy, and social activity. At first sight, his proposal may be criticized as being delusive but Wi-Fi technology demonstrates that it is possible to generate such a cosmos in this century through communication facilities composed of invisible interconnected waves. Although attaining that level, in terms of architecture, will take time, by using technology, whether it is directed at infrastructure or management, the human cosmos has already expanded (Fig. 2).

In this century, which we call the information age, architectural practice and living environments are

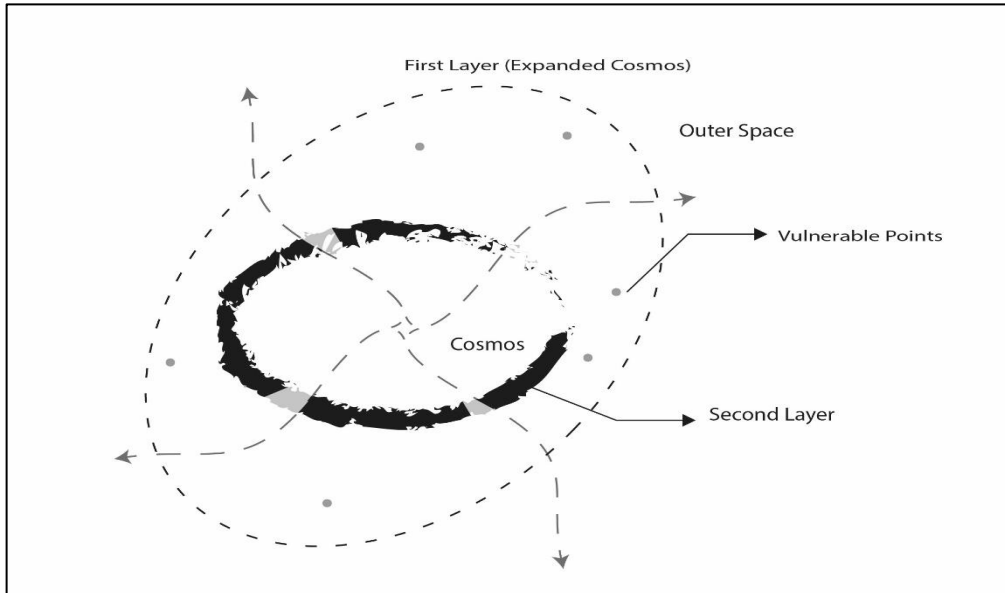


Fig. 2. Expanded cosmos and second layer.

tightly weaved with informational technology. Humans are social beings and need to communicate with others. Managing the post-disaster process is easier this way. As a result, it is important to apply resiliency to almost all fields such as information technology, ecology, and sociology. This is the reason why scholars often mention resiliency in terms of sociality. However, our social and bodily sensations can not be detached from other tangible beings. As Vidler (1990) thoroughly explains, our body sense has been intertwined with architecture throughout architectural history [5]. Therefore, more than representational needs, we, as human beings vulnerable to nature, should create a reliable and comfortable cosmos.

Essentially, like the human body, physical properties are more affected than immaterial ones during the process of demolishing. It is stated in research conducted in Warsaw after the war on the interaction between architectural remnants and sites that “resilience is quality of remnants.” [6] Lebbeus Woods, a post-war architect, produced post-war images during his career inspired by Berlin after World War II. A close look at his productions shows that inner second boundaries in damaged buildings as a characteristic property of destroyed space showed up in illustrations. Especially in “Berlin Free Zone 3-2,” a very sharp, destructive inner space that breaks into an architectural shell can be seen. Both examples confirm that “any intervention in a site is a destructive act.” [7] Somehow, the second boundary acts as a resistant barrier against the enemy, whether it is man-made or natural; it draws an invisible separator line between the inside and the outside. This indeed confirms that there is a close relationship between the mother’s womb and the act of inhabiting a place that is beyond metaphoric or analogic meaning, as it is often indicated in the research [8]. Therefore, architecture itself was presented as a second protective layer until it was demonstrated that there are invisible micro enemies such as microbes, bacteria, and viruses. This micro-scale world is made up of hygiene rules and a detached body from its architectural shell, i.e. its artificial environment. Disconnection of body and architecture accelerated with the invention of antibiotics [9]. However, these hygiene rules have weakened the body’s immune system and its relationship between architecture, contrary to expectations. After a while, probiotic architecture, in which microbiomes live in accordance with architecture and the body, was proposed by researchers as a remedy [10]. Thus, it has become clear that the environment has a multilayer structure consisting of both micro and macro scales.

### **3. Troglodytia “Return to Earth”: A resilient strategy**

The notion of environment originally comes from the French word “environ,” which means “to surround.” [11] Other definitions of the word are “ambiance, atmosphere, entourage, habitat, milieu,” which imply a “set of natural and cultural conditions in which living organisms thrive.” [12] It is a new term in many studies related to “Anthropocene” and was coined after World War II [13]. Natural disasters, in other words macro-scale environmental issues, stand alone in an exclusive area due to their strong devastating effects. Additionally, it presents physical states that are delineated as “unknown unknowns.” [14] If nature stands without visible changes, it can nevertheless be called an “aggressive environment” due to extreme climatic conditions [15]. The 19th century was called “an ice age” in Europe due to the cold weather, and interiors were more protective in ensuring comfortable living spaces. Thanks to the invention of the carbon stove and the adaptation of floor plans, it was possible to manage thermal conditions without today’s energy concerns [16]. Turan (2019), divides environmental approaches into three categories according to imaginary points of view: first, there is the environment as nature; second, as a system and, third, as earth [17]. Even if the third approach is valid in which the image of the environment is equal to the earth, this does not mean that the earth is apart from the whole eco-system. Reversely, robust conditions generally cause hybrid environments within these ecosystems. The hybrid environment is an adaptable system and, from this aspect, it is seen as a more reliable method, instead of mitigation as an increasing rapidity of recovery [18]. For instance, one of the most popular kinds of hybrid environments in recent times is the amphibious environment. Amphibious territories refer to architectures that can adapt well to both water and land [19].

Similar to this example, not escaping but abstaining from threats, whether is by keeping a distance or being completely buried somewhere, is the first one of the resilient strategies. But is there any comprehensive way of designing a more resilient community against destructive and abrupt changes? Moreover, how can we systemically construct something without wasting time? As usual, precious examples can be found in our past. Can you believe that you can live without sunshine, for example?

Though it sounds strange and frightening, it was a survival strategy once upon a time.

Nearly all around the world, underground city ruins can be found, but today we use their equivalents: tunnels, metro stations, or the like. Especially after the 1970s, there has been an increasing tendency to study underground cities again, and this is tied to rapid urbanization issues [20]. Today, it still is a mystery why people preferred living underground in ancient times. However, a more aggressive climate is an acceptable one of the multifarious variations. It is no exaggeration to say that one of the most famous examples of an underground city is Derinkuyu in Turkey [21], (Fig. 3). The only method of understanding an underground city is by looking at an illustrative example. It can show us an organic architectural example using a communicative topological structure. The structure in Derinkuyu has 18 floors, was made for 20,000 people, and was used until the late 19th century [22]. Family rooms are connected to each other in a circulation web pattern. Virilio (2001) asserted that verticality in architecture does not allow communication in contrast to topological architecture [23]. Research on metabolism in architecture also confirms while criticizing it because of focusing on structures rather than on “lost place.” [24]

Lost place here means spatial properties of architecture. This means ability of recovery after disaster depends on morphologies at least for defining gateways, shelters vulnerable areas etc. Size also is an important input when it is concerned cosmos. In other words, our resiliency has weakened as our cosmos has expanded.



Fig. 3. Derinkuyu Underground City [21].

The shape of the cosmos influences relationships and, therefore, affects the social structure. Beyond its metaphorical meaning, resiliency is connected to “planning cosmos” not to urban planning, especially in terms of architecture. Therefore, the main properties of making resilient architecture that have appeared until now can be basically listed as interconnectivity, separation, and layering (Fig.4). In this paper, it is necessary to present short, direct definitions for these concepts:

- Interconnectivity: This is used to address communicative needs. Circulation, communication, and other aspects related to human social nature can be elements of the interconnectivity of any introverted system.
- Separation: Every closed system has weak points within. If these points are surrounded by strong ones, it makes the whole system more resilient. Separation is a method that focuses on weakness and strengthens it by shrinking. It makes up multiple cosmos.

- Layering: Layering organizes the relationships between layers of earth, i.e. lifeline and, second, the inner layer.

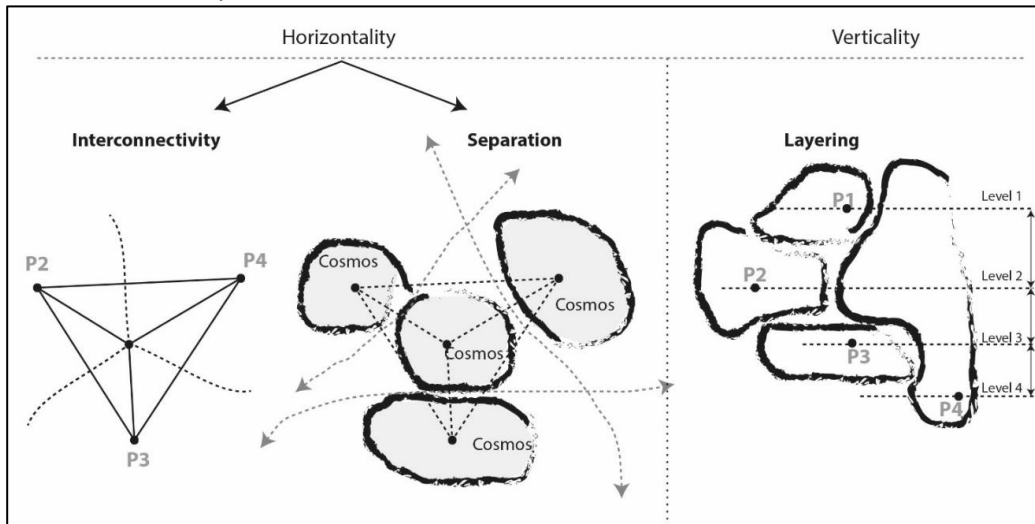


Fig. 4. Elements of Troglodytia as an approach.

Using these strategies can help to manage vulnerable situations with a planimetric basement. In this paper, the proposed method is called “Troglodytia,” which is a fictitious word made up of two distinct words: “troglodyte” and the suffix “-ia.” The word “troglodyte” means “inhabitant of a cave” or “cave dweller.” [25] Although it refers to ancient times, it is possible to interpret the same word for living in a “cavity” as its contemporary equivalents. The other component, suffix -ia, implies a place to live. This research does not limit the underground as a physical underground space; rather, it includes “introverted architecture,” which can be subjected to the various ecological systems such as earth, air, and water. Troglodytia, in other words, implies an introverted architecture, emerging as a resiliency strategy by creating layers acting as a barrier between cosmos and undesirable conditions. In order to do this, it needs three elements: interconnectivity, separation, and layering. Due to the fact that it is a macro-scale intervention, this concept inevitably depends on local and governmental building codes. Working on a space in a constructed environment has some challenging problems that are primarily related to property rights. Additionally, current building morphologies have complicated how “Troglodytia” will be integrated into the built environment. Perhaps more radical methods such as planned destruction should be used unless they damage social structures. To protect social structure, global communication needs also have to be taken into consideration. It is clear that the construction industry also does not facilitate the application of this new concept. Recent research about intelligent cities can help finding appropriate solutions for the application of Troglodytia as a resilient structure. Otherwise, facing the existence of discrete spaces will be inevitable. Computational methods, especially used for defining vulnerable areas, would be meaningful. If inspiring computational materials are widespread, the theory will be more coherent in practice in the future. Ancient human populations invented it in the primitive sense; but people have to reinvent it in today’s world. In doing so, an underground artificial environment may be the way to protect residents from any kind of disaster.

#### 4. Conclusion

Disasters have influenced the human cosmos throughout history. For centuries, the human cosmos has expanded thanks to humans’ adaptive skills. However, ecological crises nowadays are influencing vulnerable areas such as urban centers, coastlines, and lowlands more severely through rising sea levels, floods, storms, and earthquakes. Following the concepts of sustainability and Anthropocene, resiliency as a

power of recovery presents us with a novel and more comprehensive strategy against natural and man-made disasters. Beyond the technical issues in architecture, resiliency has deep ties established around the relevancy of the body and cosmos. Ironically, our resiliency has weakened as our cosmos has expanded. Consequently, resiliency has become one of the most important issues for architecture. Today, while the human cosmos has expanded because of social and technological improvements, it is possible to establish a new cosmos for the human race. Infrastructural elements such as communication, transportation, and green areas have a primary role in our resiliency, but these are simply preventing acts before the chaos. Artificial environments, conversely, make up multi-layer cosmoses.

Introverted architecture, which includes second layer within and remained as an invisible tendency in architecture for a while, proposed as an artificial cosmos in this paper. In retrospect, creating a second layer somehow was one effective approach to resilient architecture. The architectural space made up by using this approach is named as “troglodytia” referring to underground settlements. Morphologies of underground settlements have some mysterious features. To reach that level of resiliency, three main strategies are defined for introverted architecture, and these are interconnectivity, separation, and layering. First, one should define interconnectivity: if an area is not communicative, this means that it is vulnerable; second, strengthen these vulnerable areas by shrinking and, third, re-connect them by layering. It is one of the key aspects to approach resiliency as not only a technical but also sociocultural issue, although it is significant to use computational methods for making better decisions depending on local data at this step. Because collectivity completely supports resiliency. Therefore, as time goes by and natural disasters spread around the world, it is inevitable that “troglodytia” as a method for resiliency will be more and more significant. We expect that this ongoing research will answer the questions mentioned above through the experimental prototypes. The purpose is to reproduce the knowledge of underground cities by using computational methods and material intelligence in the next step depending on this theoretical framework.

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# AURA MODELLING AS A TANGIBLE APPROACH IN FIRST YEAR DESIGN EDUCATION

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## Abstract

The increase in the flow of information has had a transformative effect on social life and architecture recently. Hence, traditional representation methods are insufficient to understand this new progress. In "ACT-N Architectural Design II" studio held at Gebze Technical University in the 20-21 Spring Term, it was tried to boost students' ability to bring new interpretations to their surroundings with various experimental methods and practices and also, students had the opportunity to develop their own knowledge without denying the importance of design knowledge. Each student tried to design "A Responsive Reading Nesting" in a close neighborhood which will be experimented through aura modelling. In the process, architectural information was re-worked with experiments and new architectural information was tried to be produced through aura modeling, which is a unique representation approach. In this sense, the students questioned the narratives of daily life and made an effort to reach the information of the place where the design process would take place before producing the aura model. A polyphonic possibility of embodying everyday dialogues and representing adaptive interfaces is produced. Additionally, the tectonic value of the material in the modeling process also has an important place in the translation of the phenomena felt about the place. Therefore, the aim of this study is to determine the relation between aura modelling and architectural thinking. The focused situation is investigated through the works made in the "ACT-N Architectural Design II" studio. Aura modelling can be considered as an approach to increase the particular productivity of students during design processes in the studio. It creates the opportunity to show itself as a new phenomenological layer in the relationship between place and design in architectural thought.

*Key Words: Aura, Design Education, Prototyping, Tangible Material*

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## 1. Introduction

In the first year architectural design studio, knowledge about fundamental design elements and unique concepts are gathered. Design tutors have a variety of perspectives on modeling these elements to create spatial stories. This study aims to present a design method by interpreting the relationship between aura/atmosphere and environmental /architectural models.

In the field of architectural education, acceleration in spreading the knowledge, paradigms and ideas have been increasing and the education process transforms through a collective aura. On the contrary, the world

has become a big studio for the students due to informative society and easy access to various datas. Through all this ready knowledge, exploring unique and inclusive concepts and ideas needs a new way of thinking and experimenting. In these circumstances, an architectural school is a place for laboratories of experimentation. This point of view has shifted studios to laboratories and ready-knowledge to experimentation. The term of laboratories and experimentation and their reciprocal relation will be discussed related to our experience in the "ACT-N Architectural Design II " studio held at Gebze Technical University in the 20-21 Spring Term. Therefore, this study tries to answer the following basic question on the first year design education; How the concept “aura modelling” may affect architectural thinking?

Process of study in the laboratories depends on the individual's explorations in order to find “new-interpretation” within a new way of thinking. The first year design education deals with exploration of how architecture speaks with the concepts, and what the language of contemporary architecture is. Processes could not be understood without an individual's unique intuitions and abilities improved by experimentation. Main aim of experimentation-based learning is to improve one’s self-knowledge without denying the importance of design knowledge. This helps the student to find his or her own way of thinking. Intuitive way of thinking gives opportunity to control all possibilities and alternatives. This process needs experimentation through un-forming and unlearning the formation. It is a kind of synchronic understanding between all design information through space, time, body and materiality. Intuitive thinking differentiates from rational thinking in that it does not depend on reaching to false and true ending products, it depends on gained experiences and stories. Experimentation is gained with the shared stories between actors of the first year design laboratories who are both educators and students. That means in the design laboratories, there are no masters, and learners in a conventional way that linear communication between tutors and students. *Teaching and learning process of creativity is not a kind of transmitting of knowledge from educator to student, it involves creating, experimenting, searching processes as same as the design process itself* [1].

Due to these senses, each student tried to explore “A Responsive Reading Nesting” in a close neighborhood which will be experimented through aura modelling. The studio is considered as an experimental area which not only benefits from architectural knowledge but also re-processes and transforms it and produces new knowledge of architecture through aura modelling. In this study “aura” tells us about experimentation versus a data set. Daily life experiences and fragmentations tell us much more than all the information about a specific context flow on our desk via screen of computers or maps. World becomes a turning sphere around us and carries all the information to us. But the aura of space is more than a data set to deal with. This paper aims to study by interpreting the relationship aura/atmosphere and architecture models in design studios. “...*The principal danger of information technology is its seductive tendency to stand in for embodied experience...*” [2]. How the phenomenon about a place should be comprehended so clearly without an interpretation is a critical question. *Either the phenomenon acknowledged is totally affected negatively by the split of space-time, the split of mind-body and displacement from our “place” or these phenomena acknowledge totally affecting positively by bringing new enlightenment on the essence of knowledge* [3]. The problem of site specific data sets is being non-filtered. Also this data set cannot involve the experience of self. Design process is facing this situation in order to transform information or –ready knowledge to new knowledge, which needs self-experience. In the study, it will be argued that design studios should focus on self-knowledge instead of ready knowledge in case of aura modeling.

*The context of the “micro-reading nest” was questioned in a re-territorial and de-territorial manner. Instead of searching for a proper location or analysing an existing set, the process involves a kind of self-contextual behaviour with responsive actions. The concept of de-territorialisation it implies a contrast between “earth” and “territory” (terre and territoire) understood as the two fundamental dimensions of nature describes biological instances of de/re-territorialisation, of the detachment or unfixing of elements and their re-organisation within new assemblages* [4]. *A ‘territory’ within a Deleuzean language can be defined as a perpetually changing configuration of various interrelated assemblages. Dynamic*

*configurations of diverse assemblages form a specific territory in time, which may then become the surface where both de-territorialisation and re-territorialisation take place. "Situs; The embracing bay that harbors the possibilities of life. The site of; what was, what is, what can be, what will be...."* [5]. Aura modelling experiments are searching for answers for these questions.

## **2. Aura Modelling and Possible Tectonic Practices in Architectural Design Studios**

The reproducible state of the work of art has made the concepts that refer to the aura of natural objects problematic. It is possible to define aura as facts that give originality to an object or event [6]. In the Cambridge Dictionary, an aura is described as a feeling about a place [7]. Aura can be considered as an inquiring, constructive concept. Indirectly, thinking about the "aura" from the perception of place, generating different representation possibilities for this can be regarded as an effective tool in the design process.

*"The concept allows us to define our environment by reducing the complexity of the environment we live in; It is the common name given to ideas and objects with similar characteristics that help us make associations between objects and events. Concepts summarize and abstract our complex and detailed perceptual life. Each individual creates a concept by perceiving and interpreting the effect of stimuli through sense organs"* [8].

The perspective of modern thought, which defines the relationship of the human being with the environment within certain limits, has been broken after the modern period and phenomenological thought has come to the fore, enabling the definition of different possibilities in thinking about space. Schulz states that the place has a dynamic and changing character from beginning to end. This dynamic character becomes an existential connection point for the place people perceive [9]. Tilley, on the other hand, sees the place as a phenomenon that records overlapping events, memories, and experiences that are meaningful to humanity. Hence, it is noticeable about the importance of experiencing the space by feeling [10]. Similarly, Pallaasma, Bloomer, and Moore refer to the sensational experience of space and the importance of perceiving the place personally [11-12].

*"My concern about the information society and "new knowledge" is that it leaves less room for the discernment of the emotional world. The world is not black and white. Difficulty is the beginning of color, richness, depth, and resonance. And difficulty is the birthplace of the modern soul." Importance of the difficulty opens the door of creativity* [13].

Tectonic acts allow the human body to structure its environmental feel. The students are expected to redefine any kind of body through re-reading the infinite number of relationships inside an inert action both in their existing environments and through space. The parameters of these relationships are explored from the interaction of daily life with the limitless actions of selected primary school gardens in their hometowns. *"The critical action is precise (intentional) and transgressive (undisciplined); a nasty but salutary shock of and for possible dormant scenarios, aimed at stimulating the present and arousing possible future spaces. It signifies alternative possibilities-anticipatory lines of research or decidedly innovative projects-and accepts, at the same time, the risk of all hazardous adventure that ends up involved in-and marked by the action itself"* [14]. In this sense, it is possible to say that the usual and repeatable forms of representation in architectural model making, expressed as an integral part of the space in architectural design, have a distracting effect from different perceptions of the place. In a typical representation, frequently encountered abstracted representations of the existing environment where planes cut from corrugated cardboard are stuck together and then cut and pasted to fit the scale of the environment and model. On the other hand, the architectural model may have the opportunity to be reinterpreted with representations that are more immanent to "the aura" and that the perceived daily elements are more prominent.

During this process the limits of the place, body and nature were redefined not just by surrounding the things but also the aura by the things. Therefore, formation of the aura finds its materiality through



unexpected interfaces. It may occur in alternative sections of daily life as a responsive ground through bodily experiences; a new morphology for unexpected situations with questioning *Grange argument*; *“Posture initiates us into a situation as distant. The human body is a value and always is ‘already there’. Flesh is diaphanous, the sheer transparency that feels the contours of every context, registers it and expresses the consequent values. If place is ever to be seen in its concreteness, the implicit, subconscious prose and poetry of human flesh requires explicit articulation”* [5].

Tectonic aura models are more than a representation of the site. Their process both in materiality and technique represents more than physical structures. They keep all tangible and intangible fragments of the site as a source for interpretation; a new sort of reality without relating to any real condition but real live fragments. This process is in turn a-subjective experience varying from site to site while using new material tools. *“Body - space relationship established here allows a space-making practice beyond abstract representations of space. Experience, which is the temporal and spatial effects of senses, becomes an integral factor of space making. In this process, instead of conventional reductive-abstractive representation tools, students produce representation tools that allow them to put forth potentials of their multi-layered experience, so that the representation does not diminish the space established in the mind. With these tools, the network of contingent relationships in the mind is preserved as a whole of possibilities that will not turn space into a concrete phenomenon”* [15].

Typical and limiting representation techniques used in associating the existing cannot go beyond being a frozen image of what is perceived and experienced. Such representations reduce space(site) to frozen images rather than a living cosmos. The layered and fluid nature of experience gets stuck in these reductive representations and pushes the practice of space production to be a limited kind of ready-made product. In this context, aura modeling and this form of representation enable the student to realize the multi-layered possibilities of their experience, and notions of "spatial" space emerge from relational rather than "containing" spaces that can be defined as static. Thus, rather than the existence of limited ready-knowledge and its use, the student gains the practice of revealing the knowledge of their own experience in the studio process (Figure 1).

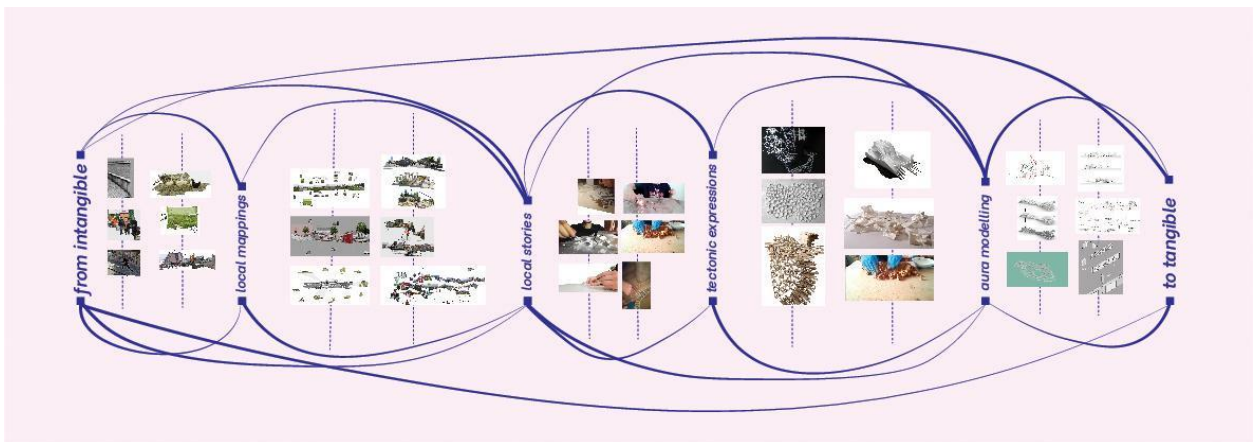


Fig.1. Studio process and dialogues

### 3. ACT-N Architectural Design II Studio

Aura modelling is an exploration of bodily interfaces of the place in an intuitive manner. It is about a transformative experience thinking for a space with unexpected constructive dialogues. Each student produced both the constructive space and perceptual dialogues with aura modelling of the site. Performance of the fragmented daily interfaces expressed by alternative tectonic constructions in 1/100 scale. Towards a newer tectonic perspective student, critically rethink daily experiences considering space as an extension of human existence in selected environments. The process is established with unexpected possibilities during the model making process so that students understand the content of the design problem by focusing on blur boundaries rather than following the traditional approach based on a site specific data map. In this study Aura modelling process acts as the dynamic and elastic trajectories in space and material. In order to control and order these trajectories, students explore material-based dialogues in order to search adaptive daily morphologies of the site. Aura models are responsive and adaptive. *“These adaptive references have re-codes from living patterns especially in micro scales. The information of these codes and operational patterns creates a formation of responsive systems. Responsive design both learns from living materials and lets us understand and create as-living materials at the same time. All possible reactions deepen the meaning of the construction.”* [15]. Re-morphologies of the site formation by tectonic explorations is an interpretation through the agents of invisible boundaries of the space. All tectonic agents are explored by perception and are not directly related to physical boundaries of the site. They are beyond the physical set-up. This process broadens student’s creativity and triggers an open-ended design knowledge and ability. There is no expectation for perfection, but there is a medium to keep the process alive and responsive. Such a performative process improves to find a new way of rethinking existing articulations both in space and life. *“Unlike form, performance focuses on the behaviour of objects instead of the outer or inner static appearance. Instead of space we talk about spatial configurations that imply temporary and fluctuating characteristics.”* [16].

Students chose design areas that they already knew and experienced. Throughout the design process, their previous experience with the environment influences material choices and aura modeling. Students trigger the narratives in daily life of their chosen areas instead of ideal forms and models. The possible actions of all tangible and intangible modes are valuable to mediate the process. Students' both personal awareness and attachments with sites differentiate and create unexpected narratives for practicing These narratives are unique and intertwined with context specific dialogues which are shared and social. Students both create a dialogue modelling and also explore at least 5 sectional interfaces in order to match with existing reality. New tectonic principles and methodologies create a new way of daily fragmentations referring to existing interfaces. These interfaces are highly integrated to living routines and give references to adaptive operations. Aura modelling mentions construction and tectonics together with a corresponded attachment through sectional interfaces. Irem Sari explored a continuous sectional interface that refers to existing topology through the school and the streets (Figure 2).

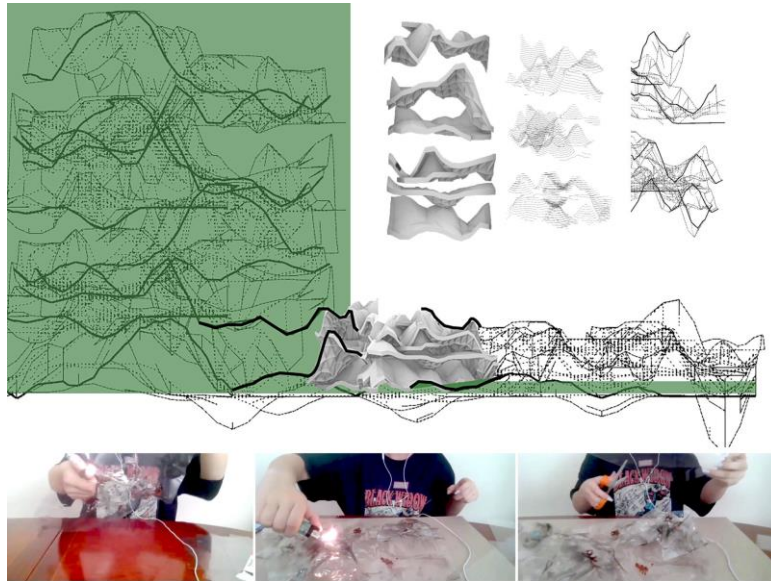


Fig.2. Sectional interfaces by İrem Sari

The aura modeling carried out in the process of representing the existent allowed the students to represent not only the material side of their personal experiences but also all the "things" they perceived in the transition from the conceptual field to the constructive field of the design process. In this process, besides visual materials, different cinematographic and sensory representation approaches (such as video, gif, soundscapes, focus) were used to support the perceptual aspect of aura models. *“The essential activity of the body is to feel the world. This is brightly clear when looking through the living environment to catch up to the ordinary.”* [17].

In the process of representing the daily, the students tried to reach the knowledge of the existing information with fragmented collages before the aura models. Since it was aimed to analyze the environment better as a whole, the concept of being fragmented proceeded in the second phase of the studio. This idea which aims to perceive better the environment by utilizing the power of the parts' own knowledge, better explained with the contemporary fragmented concept. The contemporary concept of fragmentation is conceptualized as the fundamental potential of imagination and contingency. It is a determined and projected conscious intention to leave things, concepts and forms open to new interpretations and readings. Each piece carries its own information, therefore, in the studio process, it has been tried to reach the whole with the inherent features of the concepts of fragment and fragmentation between form and formless. The fragment in its full sense is the idea of something complete in itself and yet essentially incomplete [18]. Complete in its incompleteness, the fragment indicates the plurality of potentials - Each fragment stands for itself, as well as for the whole from which it is detached [19]. In the studio process, the aim is not to find unity, but to consider unity as combinations. Because complexity is an ever-evolving reality in which each element has its own inherent properties, it can diverge or overlap (Figure 3).

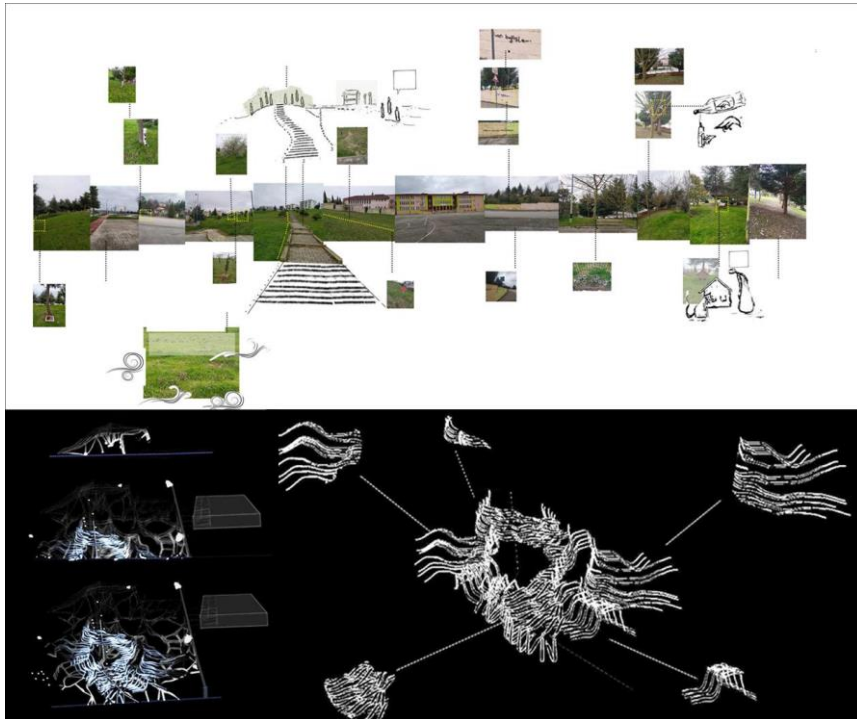


Fig.3. Aura college by Rumeysa Kolcu

Human experience shapes places. *“It is through our engagement with place that our own human being is made real, but it is also through our engagement that place takes on a sense and a significance of its own”*[20]. During the studio process, the students began to examine the situations that they constantly experienced but were not aware of their potential by breaking out the sequences in their daily routines. This was reflected in the aura models and material choices. The materialization of daily dialogues creates an unformed way of representing the adaptive interfaces. The tectonic aura experiments are telling self-stories about site visits with a responsive feature of practice, which never comes to a form. For the exploration of an ordinary spatial interface, learning by analyzing extended to learning by living and making with personal intents. These intents were transformed to aura modelling with one unique material without any artificial bounding. In this sense, as an example the material chosen by Kamile Nur Çoban was a soil that changes and turns green due to its natural structure in the area. She observed a material which she was surrounded by or constantly exposed to and realized that it was greening, in this sense, she began to define the site as more than a physical set-up (Figure 4).

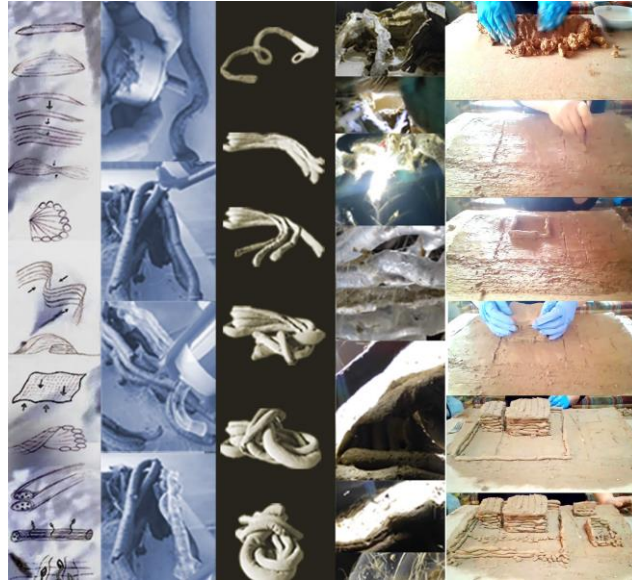


Fig.4. Aura Model by Kamile Nur Çoban

Although 36 students worked on the same subject in different fields, each developed different aura models. The fact that the field was handled as a product of a detailed perception from the beginning of the process is undoubtedly one of the reasons for this situation. In their place perception, the students tried to shake the idealized static situations by separating the experiences in their daily lives and the fragments of these experiences. Since every experience is a personal situation, the resulting products are just as unique. For example, the hyacinth tree next to the chosen school has shaped the sense of place with its scent in Zeynep Ece's work (Figure 5).

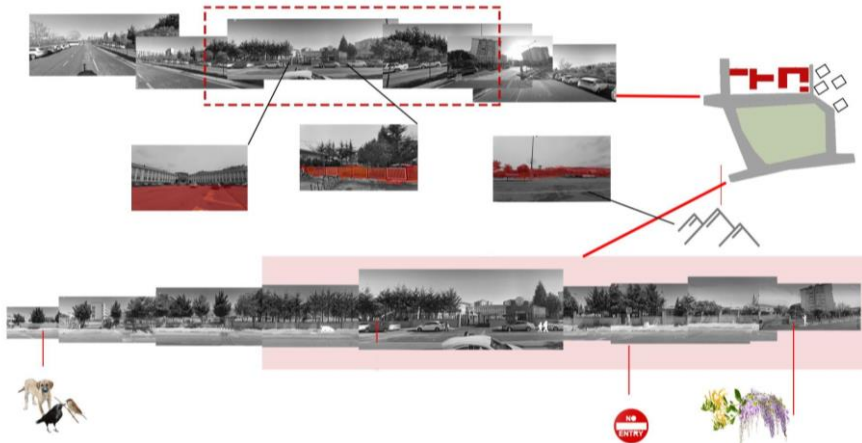


Fig.5. Local mapping by Zeynep Ece Katipoğlu

The model that Zeynep Karşlı produced from the surfaces she created by melting and overlapping the silicone, then questioned the possibility of creating digital screens by taking the semi-opaque structure of silicone as a reference. The gap pattern produced by Faruk Emre Bilgin has revealed a structure that can be included from anywhere. The rough surfaces that Ali Kuzu produced from cardboard brought up the relationship between material and adhesion (Figure 6).



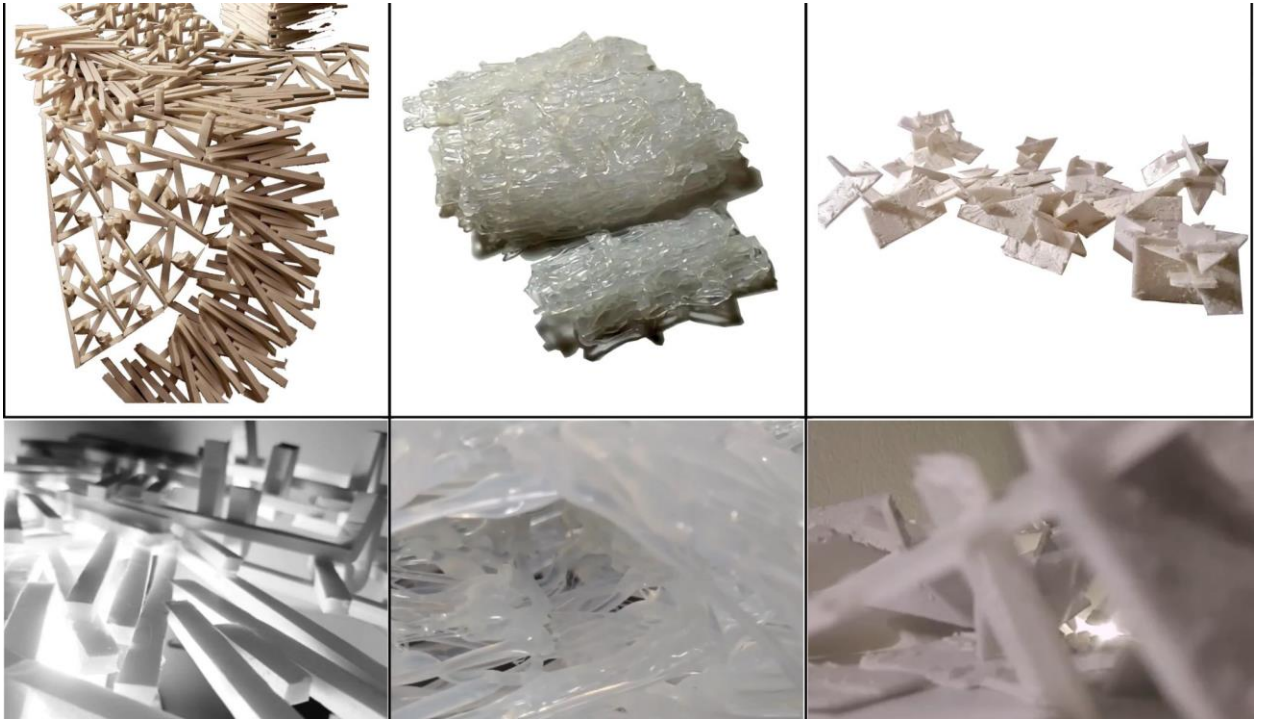


Fig.6. Aura models by Faruk Emre Bilgin, Zeynep Karlı and Ali Kuzu

The structure of the material that allows the aura model to be read (sticky, combustible, foldable...), color, possibility of combining (by sticking, overlapping, nesting...) constitute an important intuitive reference in translating the elements felt about the place. In this context, Allen states that the architect is the determinant of the building technique rather than building, and although he knows the materials and construction methods, he conveys the information indirectly. This approach stresses that it gives a correct perspective to research the results and possible experimental phenomena, rather than thoughts about the reality of the material [21]. In the production of aura models, the aforementioned techniques and the questioning of the relationship between architecture and materials come to the fore rather than the final product. The modeling process, which started as a means of understanding and making sense of the place, introduces a new cognitive layer to the architectural design process Ayşe Betül Simsar (Figure 7).



Fig. 7. Aura model by Ayşe Betül Simsar

#### 4. Discussion and Conclusion

The Aura modelling process tries to explore responsive ways of understanding and expressing the space. Main brief is to transform the environmental knowledge to an adaptive formation for alternative performative actions. Environmental knowledge means all kinds of responsive and ordinary effects as strong as the basic characteristics of the space. The process needs an inclusive critical thinking due to spatial narratives of selected sites for the project. It is becoming a sort of a discovery that each student perceives and reacts with the information differently and creates own story of concepts. Students gain architectural design intuition, design experience, design knowledge which are ready for the unexpected. In this study experimental processes are intertwined both in design and representation. A linear process was not followed. Each project has created its own unique route. With the aura modelling, as a new representation skill, each student is allowed to represent their own experience and knowledge with more unlimited possibilities and so on, the originality of the processes led the creations' themselves to uniqueness.

As compared with the rest of the society, architectural designers are exposed to virtual representational environments which new technology is dictating, because of their occupational situation. The democratization of the use of computers and the development of the fast internet allow large numbers of designers to access a wide range of informational elements and to use new computational tools which are a constant challenge for them in the design process. As Moles mentioned in his paper (1988), The design activity itself is changing because the designers' tools are becoming immaterial with computer aided-design and various CAD programs. [22] In addition to the conveniences they provide, the complexity of the CAD systems does not allow designers to focus on the design task (McCulloch, 1996). [24] This restriction of designers is also dominant in online education. But especially in the education and design process, which became more digital with Covid-19, aura models and this representation method created a new range. During the transition from intangible to tangible, some of the students experienced fixation during modeling because they wanted to reach the final product quickly. They modeled their auras with more concrete representations. Modeling with the help of computers has been one of the reasons that cause blockage for 1st year students who are just learning modeling, as it requires program mastery. Actually the desire to produce design products quickly, which is customary in daily life, was also reflected in the design in the studio, and some students tried to produce their works by frozen images of their experiences with this desire. To avoid this kind of fast production, tangible materiality related with intangible environmental issues were questioned during the process. The importance of experimental modelling was asked and discussed.

Modeling with aura, environmental information, and its layering with daily life become an integral focus when students are constructing the "reading nest". The model, which is made in the last phase, has become a design layer within the project, not far from the project, which is always involved in the process rather than a final phase. In this sense, it can be said that the model has become dynamic and revived every time with the process.

Aura modelling aims to relentlessly zoom in and out to integrate the relationship between the environment and the human across the frameworks of the organizational, morphological and social spatial encounters for producing a reading nest. This approach set out to explore the techniques (tangible materiality and tectonic researches) with which to re-think and re-design the brief of space making for a reading nest. Instead of typological site models, aura modelling triggers diversity in the design process. Even in similar sites, inclusive ways of understanding the environment through aura experiments transform the given task "reading nest" to more interactive and collective approaches. Studio tools are questioning how tectonic researches, spatial models and visual essays for this process can be a part of the design problem which collectively discussed, and managed that has open, ethical practices of engagement. Studio process tries to

occupy a context to have the moments where the codes can flip, so people have an escape hatch, a choice about material, scale, pattern and other unexpected dialogues.

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# MOTION-BASED DYNAMIC FORM GENERATION TO CONTRIBUTE TO THE KINETIC DESIGN DIVERSITY

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## **Abstract**

Social and economic living conditions are changing rapidly due to technological innovations and social crises. The most striking example of this was experienced in the Covid-19 pandemic, whose effects are still continuing. The problem in architecture is that static architectural spaces cannot adapt to these rapid changes. Designing buildings capable of transformation is considered as an effective solution to this situation. However, sufficient design diversity may not be provided while meeting the increasing demands of large masses of people in the post crises. This research aims to generate motion-based dynamic forms to contribute to the diversity of kinetic designs and explore the potential of motion capture in kinetic architecture, hence being well prepared for similar challenges on the global scale in the future. Within this scope, motion capture technology and movement visualization techniques were studied. Then, available online data sets of motion were searched, and fifteen different motion types were collected. The steps of form-finding and giving these forms the ability to move were determined and applied to the selected motion types with the help of Maya and Rhinoceros software and the scripting language Python. At the end of the research, the collected movements were classified to make inferences regarding the kinetic mechanisms to be used within the forms and facilitate movement selections in future studies.

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**Key Words:** *kinetic architecture; design diversity; motion capture; movement visualization; dynamic form finding*

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## **1. Introduction**

This research was conducted focusing on motion capture and movement visualization to bring new design perspectives to kinetic architecture in order to increase the kinetic design variety. To this end, existing publications about motion capture technology and movement visualization techniques were reviewed.

According to the research of Jensenius [1], the visualization of movement started to be done by researchers working on anatomical studies on human and animal movement. These visualizations made a tremendous impact on the field of photography at the end of the 19th century. Eadward James Muybridge, one of the pioneers of this field, succeeded in demonstrating the movement of a horse in the 1870s in series of pictures called "timelapse photographs" using high-speed cameras [1]. In his visualizations, the movement could only be read temporarily, and the relationship with space could not be perceived. Étienne-Jules Marey, who lived at the same time as Muybridge, also worked on visualizing movement in the field of photography [1]. However, he tried to show the movement on a single photo, which he called 'pictures of time', instead of a series of pictures. Thus, both the continuity of the movement and its relation with the space can be read in the same frame. In his work with a horse's movement, while the horse is moving slowly, the horse's body in each pose is clear. On the other hand, while the horse is moving fast, the body in the poses loses its clarity. Even though this allows the speed changes of the movement to be detected, the overlapping poses cause confusion in the perception of the motion's content. To solve this situation, Marey captured the movement of a human wearing a black outfit with metal sticks on his limbs [2]. Thus, he was able to capture the essence of the motion independently of the physical characteristics of the subject. With this technique he developed, Marey laid the foundations of motion capture by only visualizing the markers on a single photo.

A technique similar to Marey's was developed by Gunnar Johansson nearly 100 years later [1]. In his study called the Johansson experiment, Johansson placed reflective markers on the joint points of the human body and captured them with the help of a video recording technique. As a result, he visualized

only the movement of the joint points in space. With this study, it was understood that the type of movement such as walking, running, and jumping can be perceived even from only a limited number of points set. This gave the idea that in order to capture human motion or any rigid or non-rigid motion, it can be utilized from these dots put on the critical parts of the subject/object. Today's advanced versions of Johansson's technique are optical marker-based motion capture systems. The subject is surrounded by more than one infrared camera, and the 3D coordinates of the sensors located on the subject are captured and transferred to digital platforms to be used mostly in the creation of animations in the film industry. In addition, these systems are also used in medical applications and the set-ups of Virtual Reality (VR) and Augmented Reality (AR) [3].

There are so many emerging uses of motion capture systems in various fields as well. In particular, besides visualizing the captured data as a digital character, there are lots of research in the literature on turning digital point data retrieved from any motion into a form. One of them is MoSculp [4], a research done at the MIT Computer Science & Artificial Intelligence Lab. The aim of this study is to represent the continuous movement path of athletes with a form. In this way, other athletes can improve themselves by analyzing the traces of a movement that has brought success in the related sports branch. In architecture, the process of obtaining form from movement was applied in Hirschberg's research to reveal new design potentials in architecture [3]. Different motion scenarios captured in this study were translated into wooden motion sculptures whose forms are difficult to think up in usual design ways. After reviewing and being inspired by all these studies, a new subject which is thought to be a continuation of the transition from motion to form, would be to bring the ability to move to the resulting form.

## **2. Statement of the Problem**

Kinetic solutions took place in architecture from past to present in many ways. They are being used in many parts of buildings, on a small or large scale, such as in the components, structure, facade, or furniture. In this way, the buildings gain the ability to adapt to changing conditions. Depending on the requirements of the time, the technology, and especially the conditions of nature, the mechanisms and materials used in kinetic systems have varied. For example, there are scissor mechanisms, pneumatic systems, tensegrity systems, membrane systems, and many more in the literature.

However, in today's world, social and economic living conditions are changing more rapidly due to advance technological innovations and global social crises. The most striking example of this was experienced in the Covid-19 pandemic, whose effects are still continuing. The static architectural spaces cannot adapt to these rapid changes, so it is predicted that the use of adaptable, flexible, and transformable kinetic systems in architecture will become more common. However, sufficient design diversity may not be provided while meeting the increasing demands of large masses of people during and after the social crises. In order to increase the diversity of kinetic design, it was decided to utilize motion capture technology, which is not yet widely used in architecture. In the light of all this literature review done on this technology and movement visualization, it was predicted that motion capture systems could be effective in the search for kinetic form generation in architecture. Accordingly, the objectives of this research are to generate motion-based dynamic forms in order to contribute to the diversity of kinetic designs, to explore the potential of motion capture technologies in kinetic architecture, and as a result, to be well prepared for similar challenges in architecture on the global scale in the future.

## **3. Research Methodology**

Within the scope of this research, the existing literature was reviewed from the perspective of how the movement visualization progressed in time and how it revealed motion capture technology. In the light of learned information, fifteen different motion types were collected among an online dataset to do experiments with. The steps of form-finding and giving these forms the ability to move were determined and applied to the selected motion types with the help of Maya and Rhinoceros software and the scripting language Python. Finally, the speed of the collected movement types was analyzed, and the movements were classified accordingly to make inferences regarding the kinetic mechanisms to be used within the forms and facilitate movement selections in future studies.

#### 4. The Utilized Motion Capture Database

The motion capture database of Carnegie Mellon University (CMU) Graphics Lab [5] was used in this research of obtaining kinetic architectural forms from the traces of movements. According to the information page available on the website of CMU Graphics Lab, the movements available in this database were captured by using optical marker-based systems. There were forty-one markers placed on the joints of special clothes that the subjects wore, and the movements were recorded with cameras that can detect the changing positions of these markers throughout the movements. The 3D data obtained were presented in the CMU Database in two different ways: marker positions and skeleton movement. Taking advantage of all 3D data of a movement causes overlapping surfaces in the process of obtaining architectural form. Instead, in this study, it was decided to use the data of some selected joints, which are head, hands, and feet. In the case of using marker positions available in the CMU Database, it is difficult to identify the markers representing certain joints and understand their relationships with each other. Therefore, it was decided to use the second data type, which is skeleton movement, in this research. From there, it is possible to read the skeleton hierarchy depending on the subject and which markers this skeleton was created from. In light of these, the CMU Database was scanned, and fifteen types of movements having the least overlaps were determined. The first attempt of this research aiming to obtain kinetic forms began with the motion type '0101 (subject 1, trial 1): forward jumps' (Fig. 1).



Fig. 1. Taken screenshots from the video 0101 of a man jumping forward

#### 5. First Trial: The Kinetic Form of Forward Jumps

Forward jumps skeleton movement offered in BVH file format was first converted to FBX file format which is supported by Maya, an effective program for visualizing movement, and then imported into Maya. In the CMU Database, it was often seen that subjects performed the type of movement to be captured by repeating it in different directions, such as back and forth in the same recording. This caused selected joint traces that did not overlap when the motion first performed to overlap in subsequent iterations. It was foreseen that it could pose a problem for the next steps of the research; hence the parts where the performance fell into repetition were trimmed in the selected fifteen movements. For the forward jumps, it was decided to use about seven seconds of the twenty-four-second motion.

While trying to avoid complex surfaces that would make it difficult to construct the form to be created, it was also desired to read the movement type from the surface of the form. For this reason, instead of visualizing the traces of all skeletal joints, only five significant points were decided to be visualized. These are head, hands, and feet. The traces of the displacements of each of these five points were visualized in Maya. In order to obtain a closed surface from these traces, a new step was taken in the research. A Python code was used to convert the trail of the movement to a curve in the program Maya (Fig. 2). Thus, a closed surface was achieved (Fig. 3) by referencing the curves obtained as a result of coding. In addition, it was

intended to generate the centerline of the surface (Fig. 4) in order to be used as a reference line for the design of the architectural spaces within the form. Again, this was achieved through Python coding in Maya.

### 5.1. Steps taken to bring movement to form

The main motivation of this research is to give movement ability to an architectural form obtained by using motion capture technology. In order to decide on the ways to be followed to achieve this, motion trails that created the form of forward jumps were examined. The position and orientation of the motion at a certain time are called frame. Based on this, the time display of a motion can be expressed in terms of time duration as well as the number of frames. In optical marker-based motion capture systems, the markers on the subject create a 3D point in each frame during movement. In the program Maya, when the movement accelerates, these points move away from each other (the number of frames decreases), while the points get closer to each other when the movement slows down (the number of frames increases). By connecting selected head, hands, and feet joint points in every frame, the isocurves of the form's wireframe are created in the {u} direction.

In line with this information, where the isocurves become frequent on the form of the forward jumps motion, in other words, in which time periods the movement slows down, was determined using the Rhinoceros program (Fig. 5). In a way, it was decided that these areas could be joint areas where a kinetic mechanism can be placed to give the form the ability to move, because it was aimed to separate the form from each joint area depending on the changing functions of the spaces and reassemble them. For this reason, the form was split from the boundaries of the determined areas on the surface. Moreover, isocurve extraction and tween curves commands of Rhinoceros were used to regenerate surfaces on the parts where smoother transitions were desired. Finally, a small mock-up model was made to test how the parts of the form could separate and combine (Fig. 6). In this model, the scissor mechanism was chosen as the type of kinetic system that would allow movement.

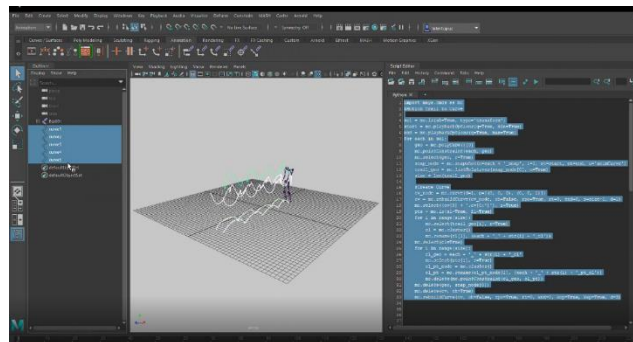


Fig. 2. Visualized traces of the displacements of head, hands, and feet

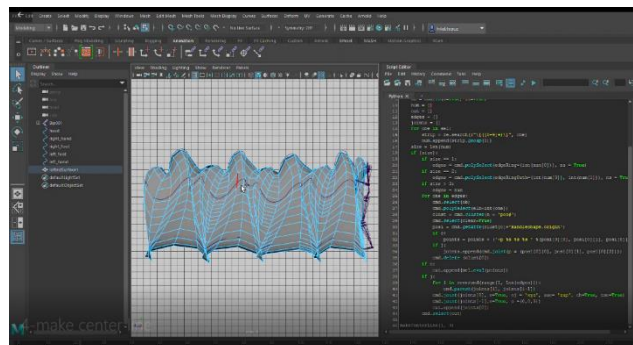


Fig. 3. A closed mesh consisting of quad polygons obtained from curves

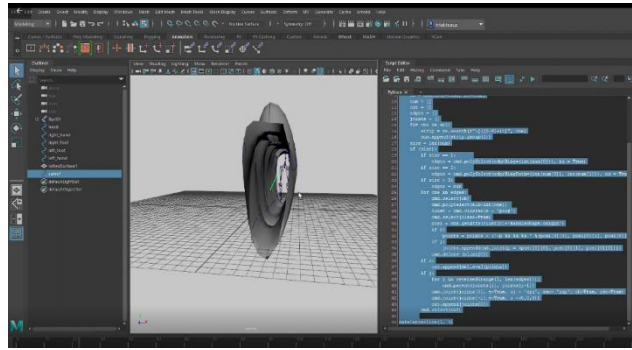


Fig. 4. The centerline of the resulting surface obtained via coding

### 5.2. Placement of horizontal and vertical planes for spatial use

The centerline of the form, which was previously obtained through Python coding, was used to design the outlines of architectural spaces. Horizontal and vertical planes were positioned around this centerline. In case the parts of the form move away from each other depending on the function, the relevant planes will also move together with the separated parts of the form (Fig. 5).

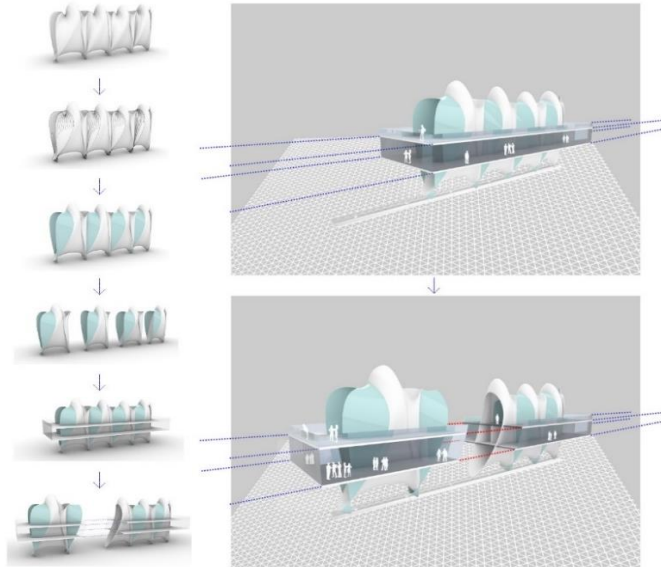


Fig. 5. The generation process of the form of 'forward jumps'

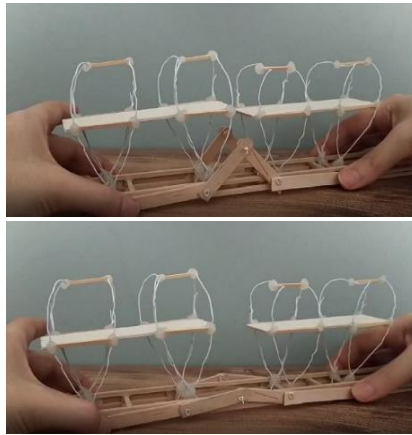


Fig. 6. The mock-up model of 'forward jumps' in open and close states

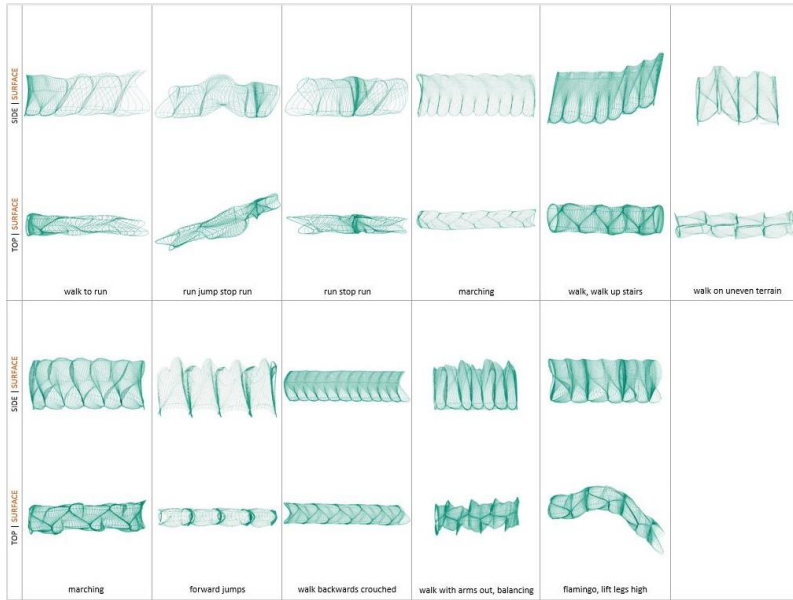
## 6. Repeating Steps Followed in the First Trial for All Motions

In this research, which is based on creating kinetic forms by using motion data, experiments were started with forward jumps among the fifteen different movement types collected. As a result of the experiments, it was understood that a kinetic form could be achieved by taking into account the isocurve distribution on the surface, which changes depending on the velocity changes of the subject performing the motion. Then, the same process was applied to the remaining movement types collected. From where each form can be split and how many pieces can occur were determined according to the motion trails they have. The top, side, and front views of the surfaces created from the traces of the selected joints were brought together (Table 1). By looking at these, it is possible to interpret what kind of movement they might have created from, whether they were a single type or a combination of different types, how their speed changed, hence from where the forms could be divided. This has added a special excitement to the research. In addition, it was observed that each type created very different patterns from each other (Table 2). For example, when a walking movement is performed in different styles, it has been observed that there is a significant difference between the resulting surfaces. It was thought that these two-dimensional visualizations could also inspire various artistic designs.

Table 1. The top, side, and front views of the surfaces obtained from fifteen different motion types

	00:00:00:25	00:00:02:00	00:00:02:55	00:00:03:00	00:00:03:00	00:00:03:05	00:00:05:20	00:00:06:00	00:00:06:10	00:00:06:20	00:00:06:20	00:00:07:10	00:00:08:50	00:00:09:10	00:00:09:55
FRONT TRACES															
TOP TRACES															
TOP SURFACE															
SIDE SURFACE															
FRONT SURFACE															

Table 2. The motion types which have more clear joint positions



## 7. Speed Analysis and Classification of The Movement Types

By knowing the joint positions and number of joints that the form can have, the type of kinetic mechanism that can be implemented in the form, and how complex it might be can be deduced. It was previously stated that the joint positions of the forms were determined depending on the speed changes of the movements. In order to facilitate the selection of movements in future studies, the features of the sample data were recorded in order to make generalizations. These features are motion type, motion duration, number of frames, and number of joints of the resulting form. The duration of the fifteen movements in the original data was different from each other. At this stage of the analysis, it was intended to examine how the number of frames, which is another time display way of the movement, changes when the variable duration (in seconds) is the same for all motion types.

Accordingly, the original data were resized until the types have an equal duration (assuming the motions were iterated). Then, they were sorted by the number of frames (Table 3). In the software Maya, the number of frames decreases when the movement accelerates, while the number of frames increases when the movement slows down. While the movement is performed by the subject, the frame distribution is shaped according to the changes in speed. In each of the fifteen motions selected, both slow and fast movements involve. However, within the scope of this study, the motion was considered as a whole, and the speed was evaluated according to the total frames of that motion. In light of this information, the classification of the motion types corresponding to the fast, medium, and slow intervals on the number of frames vs. duration plot was made (Fig. 7a). The aim of the study at this stage was to understand the effect of the speed of movement on the number of joints that the form can have. In the fast and slow types of motion, clusters were observed in the range of values that the number of joints could take, while in the medium-speed motion types, there was a big difference between the values that the number of joints could take (Fig. 7b). In this case, choosing fast or slow types of motion in future studies may bring consistency to the study in terms of giving closer results within themselves.



Table 3. Speed analysis when the movement types have equal movement duration

Increasing	Equal				Speed
Number of Frame	Duration (second)	Number of Joint	Movement Type		
11550	630	420	walk up stairs and over		High
14700	630	420	walk backwards crouched		High
15750	630	2520	run		High
18585	630	252	flamingo, lift legs high		High
18900	630	630	walk and step over		High
18900	630	840	walk to run		High
18900	630	630	run jump stop run		High
18900	630	525	marching		High
19600	630	280	walk with arms out, balancing		Medium
19800	630	360	forward jumps		Medium
19950	630	840	run stop run		Medium
19950	630	420	walk, then walk up stairs		Medium
21000	630	420	walk on uneven terrain		Medium
21000	630	315	marching		Medium
21420	630	504	walk with right arm up and down		Low

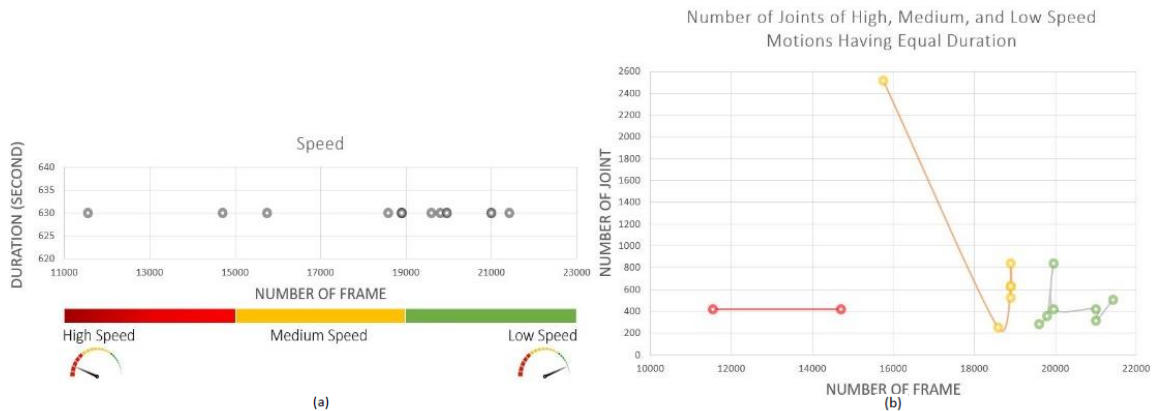


Fig. 7. (a). The plot of duration vs. number of frames, (b). The plot of the number of joints vs. number of frames

## 8. Discussion

As the main focus of the research was on architectural form-finding having movement ability, the priority was given to identifying the steps to achieve this with non-overlapping movement types. In this way, the obstacles within the form that would complicate the use of spaces were prevented. However, dealing with the human-body motion is very complicated, and the vast majority of the captured movements have intersecting trajectories. This research utilized only the trajectories of five joints of the human body: head, hands, and feet. Besides this strategy, some other methods can be developed in future studies to broaden the use of motion capture systems in architecture and apply the determined form-finding steps in this research to many more motion types.

## 9. Conclusion

In architecture, it is necessary to bring innovations to kinetic systems that have been and will continue to be solutions to the rapidly changing needs of users so that their yet undiscovered features will be revealed. One of these innovations was introduced in this research by benefitting motion capture technologies. Motion is four-dimensional, meaning the position of the subject changes with time. However, perceiving and examining this change as a whole is possible only by capturing and visualizing the disappearing traces of the movement. Designing an architectural form using motion capture and movement visualization techniques was the first step of this research.

As a result of the experiments done with fifteen different types of motion with the help of Maya, Rhinoceros, and Python, the methods to transfer motion data to form were determined. The first of the challenges encountered in this step was to find the appropriate movement types for architectural form generation. After the initial choices, which were done by trial and error, certain strategies were developed



based on observations. Classification of movement types was also conducted in this research in order to facilitate the motion selection process in future studies based on the search for architectural form. According to what features of data that this classification could be done was the other significant challenge of the research. The first idea was to categorize them by considering that similar movement styles could create similar patterns; for instance, different walking manners were grouped within themselves. However, it did not work as expected. Instead, it was decided to analyze the speed of the motion types and make the classification accordingly. In this way, the locations where the kinetic mechanisms can be embedded in were determined to enable the resulting forms to acquire movement ability depending on the changing functions of spaces, which was the second step of the research.

Finally, regarding the subject matters presented in this research, it can be concluded that in order to meet the rapidly changing demands of people in architecture without compromising design diversity, it is essential to embrace an interdisciplinary approach, as in this research, it is the integration of motion capture technology with kinetic architecture. This study showed that using particularly human body motion in the kinetic form-finding process can lead to unexpected and inspiring results.

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