

**ARCHITECTURAL DESIGN AND  
CITY PLANNING PROCEEDINGS**

Özgür Öztürk DAKAM YAYINLARI

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**ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS**

# ARCHITECTURAL TECHNOLOGIES FOR LIFE ENVIRONMENT: PASSIVE COOLING STRATEGIES IN THE ARCHITECTURES OF THE MEDITERRANEAN AREA

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## Abstract

The Mediterranean area is a highly interesting place where various States, characterised by different people, histories, and cultures face. Reigns, religions, powers, state structures, people, nationalities, etc., everything seems to be extremely different and far. On the contrary, there are some cultural points that are much closer than they officially appear. Indeed, historically, the commercial trades between the various countries have always been highly intense and the Christian and Muslim reigns, even if in a continuous state of conflict, were reciprocally linked by deep (financial) interests. Therefore, that translated in a wide trade of goods that moved on the Mediterranean Sea across the different countries, regardless of culture and religion, resulting - as a consequence - in a contemporary continuous exchange of ideas, materials and technologies.

In the architectural and engineering fields it is not infrequent detecting some common characters such as the use of building and construction materials (even if strongly linked to the local availability) and, most of all, the exploitation of common construction technologies and devices. For instance, it is counterintuitive as similar climatic conditions, environments and human needs resulted in similar architectural technologies.

In the huge architectural panorama of the Mediterranean area, a very interesting common feature is the joint exploitation of local resources, with particular attention to stone and water, to protect people from the hot climate and make living more comfortable. Indeed, even if considering the local specificities,

it is possible to spot some common technologies using this powerful duo. In line with these observations, this work investigates the exploitation of passive cooling systems in the Mediterranean architectural heritage examining the most common physical principles and examples.

Ultimately, the knowledge of these architectural machines and their operating principles is nowadays particularly important to re-discover the traditional passive systems used to cool buildings down. Their preservation and re-usage also represent a useful way to understand a simple passive cooling system whose principles could be reproduced in a contemporary way in modern buildings intended for a valid and functional energetic control.

### **Introduction**

In the history of construction, technology and design have always found a robust balance between shape, function, appearance, and opportunity. Those, transposed into contemporary terms, may be regarded such a sort of unaware sustainability. The rule of the construction art was continuously adapted to the specific cases with new construction technologies and with the intense exploitation of the local construction and building materials [1, 2]. Moreover, the regional architectural configuration has been strongly influenced by the local climate. Indeed, protecting from external harsh conditions led to a wise use of materials and systems, especially in those geographical areas where extreme environments made living quite difficult or problematic.

Human perception of hot and cold in confined spaces (i.e. buildings) is largely changed during the past centuries, and often completely reversed in the last one. More particularly, in the past, feeling hot in summer and cold in winter was taken for granted and normally accepted as an ordinary weather cyclic condition [3]. Nowadays, in contrast, it is possible to affirm that the environmental conditions, that used to be usually accepted as tolerable (even if not strictly comfortable, i.e. excessive hot during the summer in Southern-Mediterranean – countries), are almost considered as intolerable, not to say unacceptable [4, 5]. Indeed, the threshold of thermal discomfort acceptance varies depending on several factors such as society, educations, economy, psychology, etc.. Furthermore, in the last two centuries, the relationship between local environment, construction, and comfortable living was put aside in the name of speculation and “contemporaneity” that generated a modern built environment based on energy dissipative models, as witnessed by the amazing diffusion of air conditioning systems in all the developed countries. Consequently, the use of air conditioning is growing fast with subsequent

enormous emissions of pollutant in the atmosphere. At the same time, the application of the most advanced architectural technologies, and the manufacture of novel materials and devices contributes in the unsustainability of the system. Such a factor is also facilitated by the production costs abatement (technological advances and aggressive South-East Asian companies’ marketing), drastic climatic changes, more financial means, and a general increased wealth [6, 7].

On the other hand, the historical/traditional construction was mainly based on passive cooling systems that made buildings efficient from an energetic point of view. That is the case of the Mediterranean area where the vast built heritage

still shows a strong synergy between local materials, technologies, and regional environments transposed into an interesting harmony between structure, function, and aesthetic [8].

Notable examples are the cave/subterranean dwellings - i.e. Sassi of Matera, the cave-houses of Modica (both in Italy), the Berber houses in Matmata (Tunisia), etc. – the vernacular “dammusi” in the isle of Pantelleria and the “trulli” of the Italia region Apulia, the towers of wind (Iran, north Africa and Sicily). Moreover, many traditional technologies contributed to the energy sustainability of ancient buildings: large wall thickness, few external openings, use of domes and vaults, complex systems of ventilation, specific orientation (isolated buildings) and mutual buildings disposition (urban setting) [9].

Passive cooling systems in traditional and historical architecture

Passive cooling is an ancient unintentional approach used to improve the indoor thermal comfort without any employment of external energy. Nowadays, it is regarded as a proper scientific discipline that focuses on heat gain control and heat dissipation in a building to avoid needless consumption of energy. To the extreme level, it is regarded as to zero/nearly-energy building [10-12].

Generally speaking, passive cooling works either by removing heat from the building (natural cooling) and, contemporary, by preventing heat from entering the interiors (heat gain control), without the use of any mechanical system or energy consumption. More particularly, the passive cooling exploits the natural on-site energy, taken from the surrounding environment, in combination with the architectural configuration to dissipate heat and naturally cool down the interiors [13, 14]. Therefore, an effective natural cooling depends on several factors related to the architectural configuration/design, materials and constructive technologies, and the specific site natural resources [15].

The most frequent passive cooling techniques are natural physical processes that were smartly used in historical architecture. The most common were [16]:

- Evaporative cooling: exploits the water's large enthalpy of vaporization to cool down surrounding air. The temperature of dry air can be dropped significantly also granting an added benefit with more moisture for the comfort of building occupants. Such system has been recently exploited in some contemporary application.
- Ventilation: exploits air flows to remove heat from the building or provide perception of cooling to occupants. It is achieved by cross ventilation - making wind pass through the building by means of contrasting openings located on the two sides (inlet/outlet) - or stack ventilation - based on the buoyancy of inner warm air to rise and exit through ceiling openings while external cool air to enter through floor inlets replacing the rising warm air.
- Radiative cooling: is based on the objects property of emitting and absorbing radiant energy. In the case of a building, it is cooled down by radiate heat transfer with the night sky that subtracts heat from the exposed surfaces. The larger surfaces, the higher subtraction. In common construction, the roof acts as a proper radiator. During the day, the building overall mass acts as a heat sink.
- Earth coupling: the soil consistent temperature acts as a heat sink to cool the structure down through conduction. In contrast to the present tendency

to verticality, large horizontal buildings are subjected to higher coupling. That is particularly efficient where earth temperatures are cooler than ambient air temperature (hot climates). Another related system consists in using earth as walls buffer. Such an external sheltering acts as a heat sink reducing heat losses and heat gains by limiting penetration.

**Notable examples of passive architecture in the Mediterranean basin**

In the historical architecture heat gain was generally achieved by limiting or preventing external heat to enter the building or by exploiting the thermic potential difference to generate air flows through the structure, often joint to water moisture. A notable example of that kind is the medieval Zisa Palace in Palermo. Its construction was begun in the 12th century by Arabian craftsmen for the king of Sicily, and conceived as summer residence for the Norman kings as a part of the hunting resort. The Zisa is clearly inspired by Moorish architecture (its name itself derives from the Arab term al-Azīz, meaning “dear” or “splendid”). The solid mass of the building, built in local calcarenitic limestone and consisting of three floors, is cooled down by lateral wind towers that draw the cool air, refreshed and moisten by a *salsabil*, a sub-vertical fountain made of an inlaid stone slab where water runs on, through the various floors [17-20].



Figure 1. Top: The Zisa Palace with the (renovate) Arab-style garden with canals

and fountains for a micro-climatic control; bottom: the Room of the Fountain with the salsabil originating the passive cooling system.

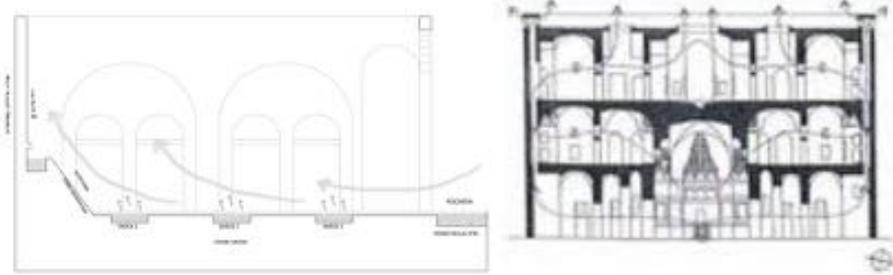


Figure 2. Passive cooling operators in the Zisa: Room of the Fountain/salsabil (left), the lateral towers of wind passing through the whole complex (right).

Another notable example is the Alhambra Palace in Granada (Spain, XIII cent.) where fountains and takhtabùsh (external covered loggia) are located between the courts to generate low-air flows generated by pressure/temperature differences [21, 22]. These result in a pleasant (“climatic”) palace.

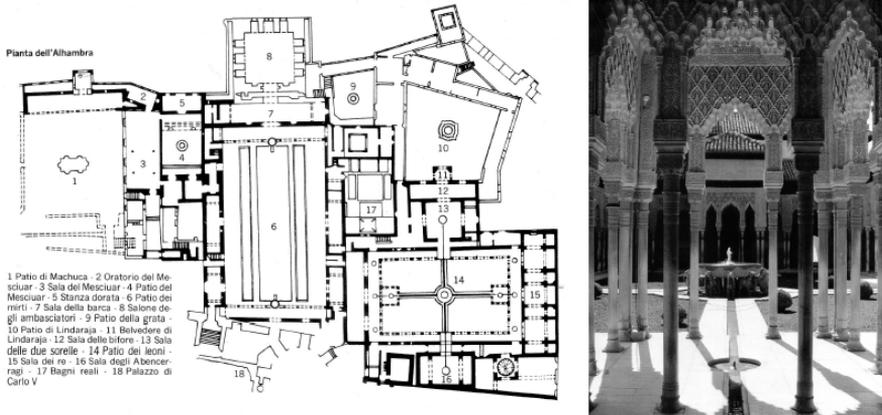


Figure 3: The cooling system in the Alhambra Palace in Granada where fountains, loggias and gardens assure a cool environment in the inner rooms.

Many architectural expedients generally tended to limit the exposition to solar radiation by using shading systems or specific orientation, to use insulating materials (wood, straw, etc.) and structures (colonnade, patio, etc.), to exploit materials and structures thermic inertia. Orientation and shape were highly fundamental to control the heat gain. In the Mediterranean area, a southern or western orientation leads to a high solar gain useful to grant warm internal environments. On the contrary, northern and eastern facing generates cooler and more humid spaces. The positioning of doors and windows also was a key factor to be taken into account intended for the bioclimatic control: as the cold winds used to prevail on the north-west side it was preferable, or even discouraged, not placing openings and, furthermore, exposing as less as possible extended facades to those winds. A longer sides parallel to the prevailing wind direction is then preferred. Another climatic factor to take in consideration is sheltering, if possible, the solar radiation: to offer the maximum shading possible, it was sufficient to expose the main facade to the south.

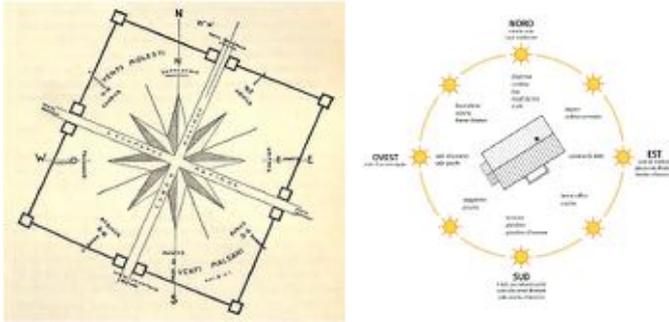


Figure 4. Left: schematic plan of a Roman castrum, oriented to prevent cold winds to directly enter the main streets (Vitruvius, I c. b.C.); right: study of the building disposition scheme according to the elio-thermic axes.

Moreover, the dimension and the disposition of the openings (door, window, vent, etc.) highly contributed in the environmental control, without preventing a sufficient internal lighting [23, 24]. Court-yard buildings, such as the Sicilian farms (masserie), used to exploits the various buildings disposition not only to distribute functions among the various spaces, depending on insolation, but also to shade walls and keep the inner temperature as lower as possible [25]. A similar aim was granted by the middle-east iwan, typical of the dry hot environments. It is a vaulted space that shows three closed sides and an open space over the court-yard.

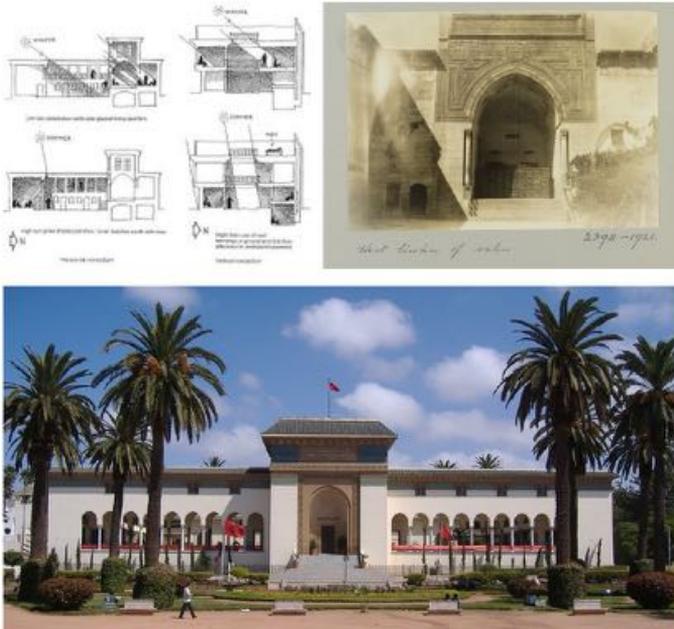


Figure 5. Bioclimatic architectures in Arab environments: orientation and sun exposure (top left); Iwan in the Courtyard of the Shrine of al-Husayn in Aleppo (ca. 1920) (credit: Victoria & Albert Museum) (top right); Palace of Justice in Casablanca, memories of the portico (bottom).

In the historical architecture, stone masonry was usually characterized by quite large thicknesses (0.6-2 m thick), especially in the tallest and most massive buildings. That was mainly due to an indisputable mechanical performance of the structure that, at the same time, generated a sufficient thermic inertia granting an optimal interior insulation [26, 27]. A common expedient exploited in hot climate environments was the usage of white, or light tones external plaster in order to reflect the solar radiation and, consequently, limit the energy absorbance. Typical is the vernacular architecture of the isle of Pantelleria (dammuso) where white domes and walls define the structure generating highly cool interiors. The dammuso represents a spontaneous architecture generally composed by a single room with a quadrangular or rectangular plan, extruded into a cubical building made of volcanic stone masonry and covered by a white vaulted-roof, equipped by a few openings; often there is an underground cistern used to collect and store rain waters, quite rare and precious in that arid environment.

Masonry thickness, ranging from 80 cm to 2 m, along with the stone inertia, the vault structure, the little openings, and the white finishing give the dammuso an extremely high efficient passive cooling performance [28, 29]. The dammuso energy efficiency may be summarise taking into consideration its energy performance in the day and night phases. Daytime phase: the thermal inertia of the building masses hinders the access of solar radiation inside the building, also assisted by the presence, inside the adopted walls stratigraphy, of a layer made of fine aggregates. This synergistic action determines a significant phase shift of the thermal wave that passes through the masonry and reduces the temperature change. At the same time, the vaulted roof, thanks to the surface treatment and its whitish colour, contributes in saving the internal volume by reflecting part of the incident solar radiation. Night phase: it is characterized by the cooling action of the internal environments by irradiation towards the external environment, through the reduced thickness and the considerable dispersing surface of the roof, of the heat accumulated by the structure during the day [30].



Figure 6. Examples of Dammuso in Pantelleria countryside (left); masonry section of a collapsed wall (right).

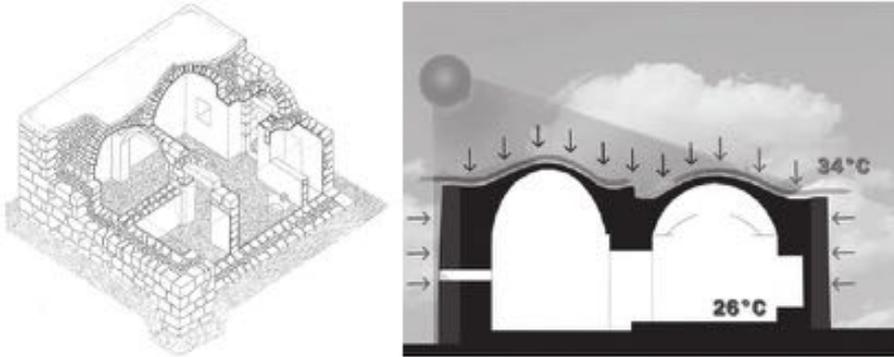


Figure 7. Dammuso: section of a typical building (left); energy performance model (right).

Thick masonry thermal inertia, air flows and high moisture content are also efficiently coupled in the trullo, another traditional vernacular typology present in South-Italy, in the Apulian region. A typical trullo is a dry stone building whose internal space is covered by a conical stone vault. Such buildings were originally built as temporary field shelters and storehouses or, as permanent dwellings by small proprietors or agricultural labourers. Famous is the town of Alberobello (province of Bari), characterised by an extremely dense concentrations of such architectures. Its energy-environmental behaviour recalls the subterranean type. Indeed, the massive building structure (1-2 m thick), associated with the underground water tank, both acting as a heat sink cool down the inner temperature of about 6-7°C. Furthermore, inner stack ventilation and the external white plaster contribute in keeping the temperature low.

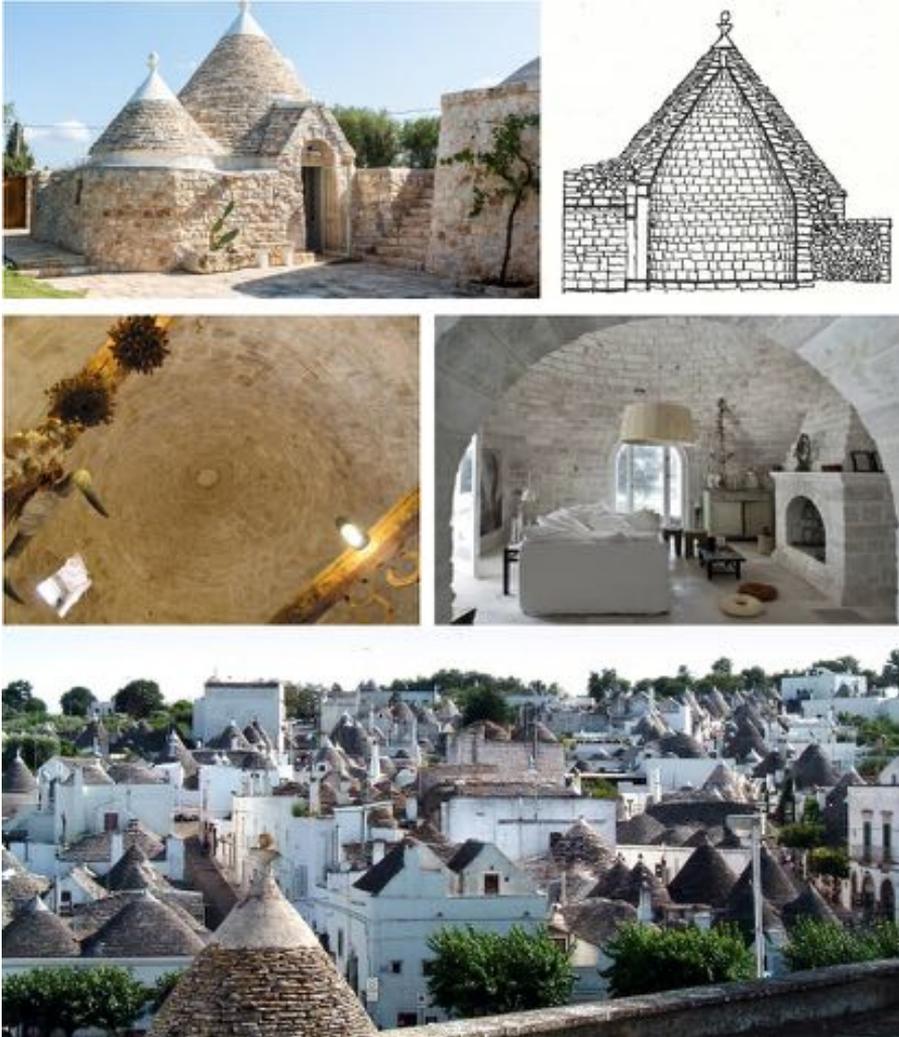


Figure 8. Top left: a typical trullo in Apulia; Top right: typical section of a trullo;  
 Centre left: typical intrados of a stone vault; Centre right: internal room of a  
 restored trullo; Bottom: the village of Alberobello.

Finally, the solar radiation control and protection can also be achieved by several devices of shading that protected both the whole building, the external space, or more generally a single window or door from the sun. The portico and colonnade are common examples of such devices. They both generate covered and usable external spaces granting, at the same time, shade on the inner walls. Those, typical of the western countries, took their origin from the ancient Roman time. Other notable examples are the middle-eastern sabat, roofing vaulted passages that function as supporting structure and, contemporary, cool pedestrians down by maximizing daytime shade and accelerating breezes through the streets. Clastrum and mashrabiya are other traditional shading systems of the middle-east

architecture. The former is a vertical latticed masonry window, usually located at the top of the buildings with the precise scope of ventilating and shading from solar rays. The mashrabiya is a protruding space closed by drilled wooden panels (a sort of bow window) and equipped with water jars to moisture, and cool down, the air. Such solar shadings granted a good thermal comfort beyond representing real typological elements of the traditional Mediterranean architecture [31-33]. Shading systems also consist in covering the streets with fabric, canes, or other materials useful to protect from the sun.



Figure 9. Examples of claustrum and mashrabiya: in a mosque where both the devices are present (top left) and a house (top centre) in Cairo; in a house in old Masdar city (top right) in Abu Dhabi; in Masjid Al-Rifai, external and internal view, in Cairo (bottom).

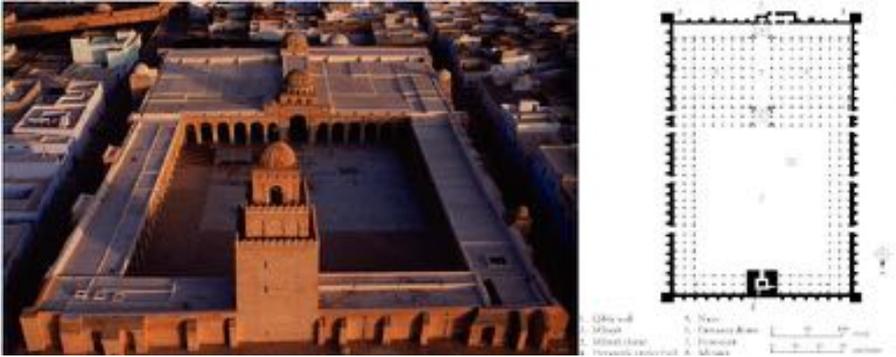


Figure 10. The portico (riwaq) of the mosque of Kairouan, Tunisia (picture and plan).



Figure 11. Traditional toldos in Siviglia (left) and a souk in Marakkech (right).

The wind tower is another typical passive cooling system, particularly common in all the Mediterranean area. It is a vertical structure recalling a venting system whose main aim is activating and facilitating air flow through the inner spaces of a building to cool them down. The most common system is the wind-escape that exploits the stack effect and the natural heat convection, due to temperature-induced differences in buoyancy, to extract warm air from the top and let cool air in from the bottom. Typical structures of this kind are the malquaf and the bagdir [34-38].



Figure 12. The Wind Tower in Masdar City (UAE): modern concept of tower of wind and mashrabiya.



Figure 13. Wind towers in Yazd (Iran): a water reservoir (left), the mosque in the complex Amir Chakhmaq.

The Sirocco room are interesting architectures present in Palermo (Sicily) from the Renaissance, and especially beyond to the XVIII century big vacation, that represent a typical “low passive cooling architecture”. Those spaces are subterranean structure, round or quadrangular, mainly made of limestone, covered by a stone vault and equipped with a water well, or a qanat, and stone seats all around. Built by the aristocracy in the suburban villas or, rarely, in the urban palaces, they typologically are artificial subterranean structures aimed at reproducing the pleasant conditions of freshness that could be experienced in a real cavern. Ancient manuscripts report that in such a wonderful places nobles used to spend their time to escape from the Sicilian hot summer, taking banquets and refreshing in the cool waters in company with friends, relatives, and foreign guests [39, 40].



Figure 14. Sirocco rooms in Palermo: Villa Naselli (left), Queen Costanza (centre), Villa Savagnone (right).

The last typology that will be discussed is the troglodyte house, consisting in the reuse, or sometimes in new constructions, of older subterranean caves to be transformed/re-used as temporary/permanent houses, if not as real large dwellings. A typical example is the refunctionalisation of the ancient necropolis of the pre-Classical or Classic Age that were transformed, refurbished and used during the Middle Age. Sometimes a single cave, or a system of caves, were also reused for religious aims as particular mystic sanctuary. Sometimes, new subterranean structures were also built with the specific aim of generating a proper house. The use of such structures, beyond the immediate availability of built spaces, was also facilitated for the cool and nice inner micro-climate. Indeed, the surrounding environment was often quite inhospitable and isolated, then protection from the excessive sun and hot was necessary.

Famous is the town of Matera in Basilicata (South-Italy), European Capital of Culture in 2019, where a real dwelling was built. Also, in South Italy many troglodyte buildings are observed. Deriving from a rural prehistoric way of living, Sicily is rich in subterranean houses. Extraordinary are the Gurfa grottoes (from the Arab ghurfah meaning gallery, room) also known as Saracen grottoes [41, 42]. They consist of a large bell-shaped space, initially used as a granary, equipped with a superior eye-lighter used to ventilate and dispose of the CO<sub>2</sub> produced by the grains. Other small spaces are then connected generating a two-order structure. Also famous are the Sicilian troglodyte houses in Caltabellotta (South-West), Enna (centre), and Modica (South-East). All of them were dig in the natural rock and used as house-granary-stable-cellar. All those constructions are characterized by deep spaces, generally born from the reuse of prehistoric caverns, and externally closed by brick walls. Protection from the Sicilian sun is granted by the underground nature, the humidity of the inner space, the rock thermic inertia.

Often, a source of natural water was embedded; other times a complex system of pipelines brought the water from lines of confluence. Finally, the surrounding environment, rich in trees and bushes, contributed in the energetic control and in the space safeguard. Similar to the Sicilian case are the caves at Sacromonte, near Granada in Spain. They are proper settlements that gives home to about 3.000 Gitano people, whose dwellings range from a single cave-room to cave-house of nearly 200 rooms, along with churches, schools, and stores all in the caves [43] making a proper dwelling.

Same concept, but different in nature are the Berber homes in Matmata, Tunisia [44]. They are traditional underground troglodyte structure created by digging a large pit in the desert ground. All around that main pit, artificial caves are then dug to be used as rooms, with some homes comprising multiple pits, connected by trench-like passageways.

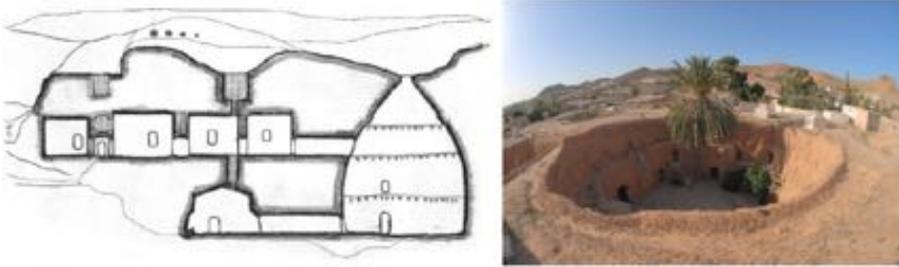


Figure 15. Section of the Gurfa grottoes in Sicily (left), a house in Matmata, Tunisia (centre).

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# ARCHITECTURAL TECHNOLOGIES FOR LIFE ENVIRONMENT: BIOMATERIALS FOR AN ECO-EFFICIENT AND SUSTAINABLE ARCHITECTURE

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## Abstract

Bio-based architecture (usually known as green architecture) is a new way of thinking, designing, and building according to innovative ethical, economic and social criteria, aimed at creating a partnership between innovation and low environmental impact. In fact, bio-architectural constructions contemplate the use of advanced materials, often of organic nature, and renewable energy resources. In this sense, it could be interpreted as a new architectural movement that tends to employ new materials essentially derived from natural elements: stone, such as lime, agricultural wastes, such as potato peel, straw, hemp, farming wastes, such as wool, etc.. Wide use is also given to the reuse of industrial bio-wastes such as those derived from the paper-pulp, clothing and food industries, whose biomass waste is increasingly being studied and researched for the manufacture of novel green materials, intended for low environmental impact buildings. Finally, solar, geothermal, and wind energy, together with various related devices, are becoming the new frontiers of energy supply for an increasingly efficient and sustainable architecture.

The main approach behind a green building is that the whole construction life cycle must be eco-sustainable and environmentally friendly from the beginning to the end of the building process: beyond the use of eco sustainable and highly performing structural materials, new technologies able of reduce the environmental impact of buildings must be used.

Therefore, specially renewed standard methods are adopted and new materials are also tested and used. Needless to say, there is a need for a series of specific skills and technical knowledge to operate in this sector. In addition, it is fundamental for technicians and designers being always updated on the main innovations in the field of sustainable construction, as well as having a good knowledge and awareness of the environmental constraints of the territory in which a building is planned. Furthermore, a careful choice of materials must be done based on their use, taking also into consideration the final destination of the structure to ensure the maximum comfort as possible on a visual, acoustic and thermal level, and in a healthy and safe environment.

This work will present the most popular eco-sustainable biomaterials, considering the most popular commercial trends and the most advanced scientific research. In addition, some preliminary results will be shown on the manufacture of materials and products intended for architecture and design exclusively made using local (Sicilian) waste biomasses, such as straw and mussel shells, bonded by compounds of purely natural origin.

### **Bio-Architecture**

Nowadays, the green building sector is one of the most active in research and innovation towards the new circular economy scenario and in the carbonisation of energy models aimed at mitigating the increasing problem of the climate change.

Among the numerous economic and, above all, environmental benefits of the novel sustainable materials that can be effectively used in the construction sector, are:

- reduction of the environmental impact of mining activities;
- countries less dependence on imports of building materials from abroad;
- creation of new jobs and positions in the sustainable construction sector.

Green building is a new "philosophy" of architecture that try to minimise the environmental impact of a building. It considers the ecological sustainability as an essential condition of the design and the construction of a building. Green building, also known as eco-architecture or ecological architecture, is one of the most emerging sectors of the green economy. In practice, it is the meeting point between home comfort and the quality of the external environment. Some examples of green building are:

- Natural lighting - External light is used to improve the brightness of the indoor environments and reduce the need of electricity consumption for artificial lighting.
- Photovoltaic and thermal-solar panels - Solar energy allows the heating of sanitary water through solar collectors and the production of electricity through photovoltaics.
- Renewable energies - There is a very close link between the green building strategy and the production/use of a renewable energy. In buildings, designed according to the ecological architecture rules, the heating and cooling of the indoor spaces are fully obtained through the use of renewable sources.
- Greenhouses - A greenhouse prevents heat from being lost, allowing

natural heating of the indoor environment. For instance, a glass structure of a public space allows for both lighting and natural heating.

- Air conditioning and natural cooling - The architectural distribution of a building is designed to organise in order to allow the natural circulation of air flows inside the structure, through the use of ducts and pipes between warmer and colder environments. This makes the activation of natural ventilation, reducing the overall expense and, indirectly, decreasing the pollution due to heating and cooling of internal spaces.
- The revaluation of the urban areas - Bio-architecture uses construction to introduce green spaces in already urbanised residential areas. Not only to reduce the environmental impact in new built areas but also to improve the general aspect and the life/health conditions in the urban environments.
- Energy saving - Bioclimatic architecture and green building allow energy saving for heating and lighting of a (ordinary) house. Hence, as an indirect drawback, the inhabitants might save money that, conversely, may be used to improve the green footprint of the building over time. Furthermore, energy saving contributes indirectly to reducing the pollution generated by the production of electricity for heating, lighting and air conditioning of houses.

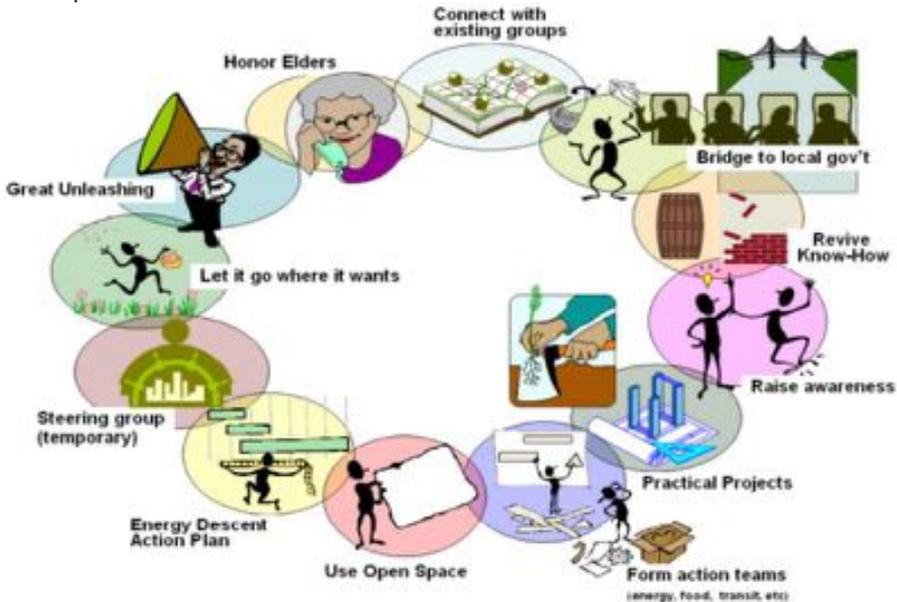


In a broad sense, green architecture aims at reducing the consumption of non-renewable energies and significantly mitigate, through the use of eco-compatible materials, the effects of architectural structures on people's health and on the surrounding ecosystem. If environmental issues in the construction sector have polarised the attention of the public opinion, that has occurred, first of all, for the evident and harmful effects of what is used in civil construction.

The case of asbestos is, for example, one of the most emblematic case. It is true that the manufacturing technologies, during the years in which asbestos materials were used, ignored their extreme danger. On the other side, many alarms occurred more and more frequently, once the high mortality rate due of asbestos

was discovered for those who worked with or came, however, in contact to. Many concerns that emerged not only on asbestos materials, but also on many other materials commonly used in construction, gradually moved from the scientific community attention/investigation to citizenship and public involvement.

The environmental sensitivity that spread in the recent years, fortunately increasing, has made it possible to discuss with a public audience and, consequently, apply the green building strategies to the construction sector with a shared intention. In the industrialized countries there is an immense housing stock that needs to be renovated, or preserved, while new homes are continuously built following mostly the novel environmental criteria of sustainability. But it is on the existing building patrimony that the major action should be taken, where possible, by promoting economic incentives and some forms of tax exemption of the related expenses at the public level. That is an extremely high sensitive topic to be discussed from a political level jointly with experts of the sector to well drive this (desirable) revolution. As a consequence, the saved money might be conversely employed in works of rehabilitation and improvement of the existing architectures. This also raises a number of questions about the continuous, high level and high quality, training of specialised technicians, expert in recovery and/or application/use of sustainable advanced and innovative green materials. For example, the ERASMUS+ Smart Rehabilitation 3.0 project, Innovating Professional Skills for Existing Building, which the University of Palermo is one of the partners, deals with these problems and topics.



It was estimated that in Europe over the 40% of the total produced energy is consumed by the building industry. Moreover, the world of construction consumes a great quantity of raw materials, which around the 50% are non renewable natural resources. An immediate consequence of this massive exploitation is a great deprivation of the environmental resources together with an equally massive

production of wastes. Fatal disposal in landfill and serious pollution problems result consequently.

In general, what are the most suitable and conscientious construction criteria to be adopted?

1) Materials such as cork, wood and coconut fibre, cellulose fibre, cotton, wool, recycled cellular glass - these are reusable and recyclable materials, produced in sheets or granules, are excellent insulating materials - together to other compounds, are usually used to build insulating roofs and walls.

2) A "bio-home" is built, according to the canons of green building, using natural insulation equipping the structure with wood fibre panels, double frames windows, double or triple glazing: all in order to gain an excellent insulation both from a thermal and acoustic point of view. There will also be natural paints to be used in exterior and interior walls, with zero or low environmental impact.

3) The production of hot water for domestic use will require the installation of solar collectors, equipped with circulation pumps and solar collectors with an integrated natural circulation tank. Of course, these plants result in an excellent economic return, since costs are amortized in a very short time.

4) Water will be saved and reused by means of flow reducers applicable to taps (including showers), rainwater collection and reuse systems, even phyto-purification systems for the sterilization of waste waters will be implemented.

5) Electricity can be produced through solar panels, photovoltaics, wind plants: it will feed any household appliance or electrical appliance in the house.

6) In domestic environments, separate wastes collection needs to be arranged with special containers for storing various types of waste.



### Bio-materials

If the future of construction is environmental, social and economic sustainability then it is important to consider that there is a strong need for change, probably more than in the other industrial sectors, in consideration of the fact that construction is

still permeated by a significant number of harmful factors such as use of materials with high environmental impact, non-reversible constructive solutions, low efficiency processes and materials. The use of natural materials, recently deriving from the reuse of organic waste, can provide a different approach in construction, allowing a series of advantages compared to the traditional materials, essentially showing a lower CO<sub>2</sub> content, and reducing health risks and costs.

It was already stressed that the green building strategy includes both the construction of a building and the furnishing of the spaces that will be used. This is to be done according to specific criteria that should reduce pollution, resulting from both the construction works, and the completion of the finishing and furniture of the inhabited premises. More specifically, it is well known how the products used today in construction can be considered as real poison generators for the human health, due to the high concentration of chemicals used for their production. On the other hand, applying modern production criteria and implementation techniques, the green building approach involves the use of traditional materials, already supplanted by the advent of the industrial production, and now re-proposed with high quality standards of sustainability. Then, it is reasonable that such a re-proposed material needs to be joined with highly innovative products. Jointly, they reach an interesting added high degree of quality. The result is that, nowadays, they become extremely competitive if compared to their "traditional" and "toxic" competitors that consequently suffer significant losses in their market assets. Eco-friendly materials have increased in quantity and are constantly spreading in the global market. That forces the major chemical industries to question on their production policies. Some of them are already moving towards the production of these green materials, with a sensational turnaround from the past.

Among the families of materials, we can refer to for the production of novel sustainable materials and products for architecture and design, wastes are a highly interesting alternative. In a broad sense, their disposal, decontamination, or deactivation is today a huge problem that cannot be underestimated both in economic and environmental terms. That could also be solved thanks to a more widespread use of construction biomaterials. Some statistics show that around 2.6 billion tons of wastes are produced in Europe, of those around 43.4 million tons are of natural origin. The principles of the circular economy indicate the logic to follow in order to move from a linear model of disposal towards a circular chain in which the natural waste is a central resource also in an economic logic. Organic wastes are widely available and their production are constantly generated both in the countryside and in the city, and can be easily diverted towards alternative exploitation models such as the production of biomaterials for applications in construction. To date, only a small part of the produced organic waste is effectively recycled, while realistically it could give excellent results in the case of the manufacture of construction products of an almost exclusively biological nature. The most interesting thing is that, according to undertaken approximations and modelling, the commercial value of the organic waste treated for construction purposes would be 5 times higher than the value obtained with normal disposal processes. That is also possible due to an effective energy recovery that allows to implement the production cycles with greater efficiency and effectiveness, thus resulting in greater sustainability of products or materials. Furthermore, organic waste reuse leads to products with a

reduced environmental impact. In particular, considering that these components could be returned to the biosphere at the end of their life cycle (or service life), thus releasing the incorporated nutrients into the soil that plants and animals can take from new for its own benefits.

### **Applications in Architecture**

Fundamental factors for the success of a novel construction product are the technical performance and a competitive price. This is also valid for the biomaterials that are derived from the recovery and reuse of organic wastes. Indeed, to make them attractive and reliable even for the most sceptical, the performance of this family of products must be at least equal to, or even better than, that of the traditional materials with particular respect to mechanical performance, healthy applications, durability to ageing, fire-water-biologic resistance, thermal and acoustic insulation, etc.. There are currently numerous applications for products based on the reuse/recycle of natural wastes. Those could be classified into casing systems, internal partitions, thermal insulation, sound absorption, furniture, carpets and rugs.

Speaking about traditional eco-compatible materials, cork occupies a predominant position in the green building criterion as it is fully compliant with the green regulatory principles whether it is used as virgin or is instead industrially transformed. Cork is very well known and its use is done since ancient times. Cork has always been present in nature and its collection is not harmful for the environment. When processed, it does not cause polluting residues and, in case of transformation, it consumes irrelevant quantities of energy. Cork, produced from cork oak, consists in the thick bark of the plant. A first fundamental element that makes cork a highly interesting bio-material, intended for the environmental protection, is the fact that it is not necessary to cut down the trees to obtain it. The cork is composed of dead cells, consequently its removal takes place in the most absolute respect of times and methods. Precisely these extraction criteria allow the mother plant to reform its protective coating, whenever removed, making cork a renewable natural material. The cork-oak grows in the Mediterranean area and shows a high degree of adaptability, and even helps in converting unproductive soils, moreover mitigating the climatic zone of its settlement. The first bark extraction occurs at around 15-30 years of the tree life, then it is repeated every 8-10 years. In one cm<sup>3</sup> of cork there usually are 30 to 50 million closed cells, containing air and coated with suberine, a natural resin. That is one of the most resistant organic compounds; the cork excellent thermal insulation are precisely due to the presence, in the cells, of a large amount of air compared to a minimum amount of compact substance. With particular reference to the physical-chemical properties, cork shows a very remarkable elasticity and low permeability to gases and liquids. It is an excellent thermal insulator and an equally effective acoustic insulator, it does not fear wear and tear, it is flame retardant and in addition it withstands the aggression of rodents and insects. But the most interesting characteristic is that it can be continuously recycled and therefore effectively reused. In addition, cork also shows other qualities such as non-toxicity, asepticity and absolute lack of allergic effects. Furthermore, the cork is self-extinguishing and does not release any toxic emanation if a fire occurs, opposed to many synthetic materials widely used today.



The reuse of agricultural wastes generates a worldwide fast-growing market with the production, and subsequent marketing, of materials and products. As a matter of fact, they show, depending on the waste, quite good characteristics in terms of real and effective applicability in construction, resource availability, production process, recyclability potential, and manufacture of the novel products. From the wastes reuse deriving from the sunflower growth, mixed with water and treated under pressure without any sort of additive, panels are manufactured. Their use is potentially feasible for their properties of suitable resistance, absence of toxicity and low-cost manufacture. The panels are suitable for internal use to make walls, ceilings or floors. Despite being a seasonal product, the sunflower cultivation is enough widespread (at least in the northern hemisphere); for this reason, the raw material is quite easy to find. Being free of additives, the waste of the panel, both during their actual use and in the event of disposal, is completely recyclable. Potato peel scraps are also increasingly used in the manufacture of eco-friendly materials and products. In fact, potato peel is mainly composed of lignin, cellulose and proteins which are separated through a process of sanitation, drying and pressing of the skins. The obtained paste is then used to produce panels characterized by a low specific weight, good fire and water resistance, as well as thermal insulation properties. The basic waste is widely available anywhere in the world and in every season. Moreover, the product is completely biodegradable and compostable at the end of its life, being free of adhesives and other additives. Even from the use organic wastes such as seeds, leaves and plant stems, mixed with green binders, it is possible to produce panels with a compact surface, both rigid and flexible, also characterized by a low flammability and usable, at first instance, for walls and furnishings, in the second for acoustic interventions. The basic material is globally available and at a very low cost. Regarding the closure of the life cycle, the material is completely recyclable and regenerable thanks to the use of eco-friendly binders.



Nowadays, one of the most used materials in construction is hemp, showing almost zero impact on the environment. It is made of natural fibres, resistant and versatile, allows to make eco-sustainable products, also highly advantageous from an economic and "social" point of view. Once collected, all parts of the hemp can be exploited and the (few) remains are easily biodegradable. It is not a coincidence that the most of the new biomaterial derivatives are used increasingly in various industrial sectors such as textiles, food and cosmetics and, precisely, green building. According to the procedure used to process it, hemp can be used in construction for the manufacture of eco-sustainable and very long-lasting products capable of substituting wood, glass, plaster and bricks, thanks to a special mixture of lime and hemp with water. The main feature of these materials is their antibacterial property, that makes them resistant to mould, humidity, and insects. In addition, these biomaterials are fireproof and show good anti-seismic properties. Biobricks are generated when the silica, naturally present in hemp, comes into contact with the hydrated lime. These are fire-retardant and resistant to extreme atmospheric conditions, and show a good acoustic and thermic insulation, also thanks to the hemp fibre.



Even the waste derived from the cereal cultivation can be reused to produce rigid panels, of varying density and thickness, that can be used for the external envelope and the internal partitions. The fibres have a high cellulose content and the panels manufacture recalls some traditional methodologies already present in the ancient Europe. That is the production of products made of straw (from wheat or rice) and pressed leaves, both used for insulating and for masonry. The material is totally recyclable and completely biodegradable. Straw is a rapidly growing material for the production of biocompatible materials, especially for applications in construction. Numerous studies are underway all over the world both for the production of thermo-acoustic insulating panels and for the construction of real masonry structures. In fact, in some countries such as the USA, the construction of buildings made of wood and straw is widely accepted and traditionally done. Indeed, straw-based products present, in addition to the aforementioned characteristics, also properties of resistance to high temperatures and fire. In addition, numerous studies have shown that straw bales show an excellent mechanical strength which would make them suitable for construction, especially for the structures. However, doubts remain in the event of an earthquake as in the seismic-risky areas appropriate devices must be set up in order to mitigate the risk.



The list of the agricultural wastes that can be valorised and reused for the production of construction and building materials could continue. Indeed, there is almost no limits to the imagination in the reuse of natural by-products or wastes to manufacture novel products. In this sense, it is worth mentioning the reuse of organic waste from the sugar cane processing, from the cultivation of corn, from the collection of coconuts and bamboo fibres and wood, from the peel of peanuts, almonds and walnuts, and even oranges. And still textile fibres, used to produce fabrics and rugs, are obtained from the waste of the cultivation of bananas and pineapples.

A highly interesting field of study is the exploitation of fungi and bacteria for the production not only of bricks and other structural components, but also for the manufacture of furniture in general as well as containers and objects for the design and art. In this sense, these products, the most widespread of which are bricks, are not produced, in the classic sense of the term in dough and firing, but more simply "cultivated". In fact, to produce such "living" and "growing" materials, a particular family of bacteria are added to the sand, incubated into special moulds and fed with a dedicated solution. In such conditions, they produce crystals of calcium carbonate which, in fairly short time (estimated around 48-72 hours) reach the desired size. As those bricks are a real "living organisms", they also retain the ability to absorb polluting agents, thus proving to be excellent for the smog eating facades that are becoming increasingly popular in construction, and are self-healing.

With the exploitation of mushrooms, and more particularly with their mycelium, it is instead possible to make furniture as an excellent alternative to plastic (not biocompatible and sustainable) and wood (a natural source that should be preserved at most). Always with mycelium, chemical foams (EPS, EPE) are already used for the buildings thermal-acoustic insulation and show a completely biocompatible property. In fact, the mushrooms roots form a dense and solid insulating membrane that grows and self-generates within the wooden facade.



### Experimental work

Some preliminary laboratory works were performed in the Laboratory of Construction of the Department of Architecture of the University of Palermo, in order to assess the feasibility of the production of novel biomaterials exploiting local bio-wastes and intended for applications in architecture and design.

A first attempt was done using mussel shells. Several studies have investigated

those shells as they show an inorganic and calcareous nature that makes them suitable for concrete applications. In 2013, researchers from the University of Bath (UK) discovered that the mussel shells could be used in wastewater treatment, improving the water quality by removing contaminants such as fertilizers or pharmaceutical products. The mussel shells, and in particular the calcium oxide of which they are composed, could be reused as an alternative photocatalyst to titanium dioxide, widely used worldwide. In Italy, and in particular in the Venice lagoon, the society Anese Sri in 2014 conducted a study on the possibility of using the bivalve mollusc shells to protect the erosion of the lagoon. For this purpose, the shells were used to fill in particular sausages, which are generally filled in with rocks, then used to defend the lagoon from the erosion. In 2017 Prof. J. Morris, of the Belgian Institute of Natural Sciences, at the annual meeting of the Society for Experimental Biology in Sweden, proposed to recycle and reuse the shells as a source of calcium carbonate, then a more sustainable alternative to the extraction from mines. Furthermore, other possible uses such as fertilizer and to control the soil acidity were listed. Also, properly processed, the shells might become a supplement of calcium in the breeding of birds such as hens and turkeys. In construction, they could be used as a component in the cement mix. In 2019 Prof. C. Punzo patented a material consisting of mussel powder and a particular resin to produce design objects, such as the sink proposed in the following picture.



The mussel valves are made up of 95% calcium carbonate ( $\text{CaCO}_3$ ), as well as calcium phosphate (hydroxyapatite) and a protein, the conchioline (that should be removed). In nature, calcium carbonate is the major component of limestone and the main responsible for its hardness, in construction it is a major used compound. Every year, the seafood industry discards more than 7 million tons of mollusc shells, Europe is one of the main areas of production. In Italy, the mussel production consists of about 63k tons according to 2016 statistics. It is estimated that the apparent consumption in Italy is about 120k tons only by hotels, restaurants, supermarkets and fishmongers. The most of the marketed mussels are produced through aquaculture: the "seed" is inserted into specific places and, after growth, it can be bred in structures with cables, floats or racks. Finally, the adult mollusc is collected, purified or sterilized, and marketed. This is the production cycle of the *Mytilus galloprovincialis*, which is the most common type of mussel in the

Mediterranean. Morphologically, the mussel is composed of two drop-shaped valves, left and right, which joined by a hinge with three or four notches, make up the shell which in turn holds the mollusc inside. Externally, the valves of *Mytilus galloprovincialis* have a black-violet surface with radial growth circles that describe the growth of the shell, while internally they have a smooth surface of mother-of-pearl colour. The valves have a maximum size of 11 cm, but on the market, they are smaller showing an average dimension of 5 cm.

The conducted experimentation consisted in hand-crushing the mussel shells obtaining an initial large granulometric distribution. Subsequently, the flakes were completely crushed using an automatic blender into powder. The obtained calcareous material was then mixed with a binder to obtain a solid and usable compound. As a scientific choice, it was decided to use exclusively biological binders in order to produce a 100% biocompatible and sustainable material. The used binders were: potato starch, egg white and cornstarch. The investigated mix design foresees a ratio binder:shell of 1) 50%/50%, 2) 30%/70%, and 3) 10%/90%. Generally speaking, the produced specimens, some of which are reported in the following picture (90 wt.% mussel shell, 10 wt.% corn starch, 10 wt.% water), resulted homogeneous and compact, did not present cracks, appeared hard to the touch and showed superior cut resistance. The colour was dark grey with a slight bi-refringence. From the carried experimentation it was observed that decreasing the quantity of the binder the density increased, the material therefore resulted much more compact, dense, homogeneous, hard, and resistant to cutting. Among the produced samples, the ones using corn starch showed the best characteristics intended for building applications, assuming the realization of tiles, finishes, bricks etc.. Also applications in interior design could be imagined for the manufacture of eco sustainable products.



Another study investigated the possibility to reuse wheat straw, bonded with whipped white egg, to produce insulating panel for applications in construction. The straw has previously been cut into pieces with a length varying between 1 and 2 cm to improve its dispersion into the binder lattice. The latter was mixed with vinegar equal, by weight, to one sixth of the egg white mass in order to stabilise the bubbles that will have formed inside. Straw and whipped egg white, once mixed, were poured into moulds and placed in a microwave oven at 600 W for 5 minutes, to allow the bubble forming and the material stabilisation. The tests were carried out keeping the oven power and the time of permanence (cooking) constant, and

varying only the percentage of straw (wt.%) (respectively 3 wt.%, 1.5 wt.% and 0.75 wt.% to the white egg). The vinegar has the purpose of limiting the possibility of bubbles collapse that have formed inside the whipped egg white, preventing it from being excessively dismantled and, thus, promoting, in the cooking phase, the crystallization, appearance and volume. At the end of the experiments, the material made using whipped egg white as a binder, once completely dried, appears soft and quite flexible. However, a poor adhesion between binder and straw, and their separation, suggest to investigate different methodologies of production. In any case, a study in this sense is particularly interesting for the possibility of producing novel thermo-acoustic insulating panels with a complete bio nature, thus improving the materials sustainability.



The last proposed study also consisted in the production of a straw-based material that uses a totally biological polymeric binder made from casein. The manufacture process involved some steps: once the milk was heated to about 50 °C, the vinegar was added (24 wt.% to milk). The vinegar acts as a solvent and, jointly with the heat, produces the breakdown of the hydrophobic compounds from the hydrophilic ones, thus separating the solid phase, the curd, consisting mainly of casein and fats, from the liquid one, the whey, consisting of water and lactose. Then, the mixture was filtered to eliminate the whey and obtain the solid curd. The paste was easily modellable until completely dried. The whey can be filtered several times to obtain a more homogeneous and finer grain size product (also using a cotton cloth). That is recommended to obtain more homogeneous, compact, and resistant materials. From the produced specimens, it is observed that it is possible to extract casein for about 13 wt.% to the initial mass of milk and vinegar. The pasta of curd was firstly dried with paper and then manually mixed with the straw. The obtained composite is then poured into mould and left drying naturally in air until completely hardened. Three formulations were tested varying the quantity of straw: 2.9 wt.%, 5.66 wt.% and 10.71 wt.% to the casein. The samples exhibited adequate properties for applications in construction or design, and showed a progressive hardening over time as the drying process kept on. The best sample (to the touch and to the eye) resulted the one with the highest quantity of straw. Here, a lower volumetric shrinkage produced the least number of internal fractures. In fact, a greater amount of straw is responsible for a better dimensional stability and could theoretically help to lower the overall thermal conductivity of the material,

fundamental factor in terms of thermal insulation. The manufacture process and the produced specimens are shown in the previous page.



### Conclusions

Worldwide, the issue of sustainability should be pursued through the experimentation and application of biomaterials and components specifically designed and tested with the aim of producing new products, on an industrial scale, that can improve the quality of human life and the way of living the buildings. Particular attention should also be paid to the sensory aspects, in order to pursue the well-being of users of a building, and to improve the transfer of technology, in order to improve and speed up the diffusion of the technological innovation in the entire world, especially in the Third World Countries or in the Developing ones.

A deep knowledge of the problems related to the various biomaterials and components, intended for design and architecture, are fundamental in order to understand the problems inherent the production, implementation and the related construction methodologies, with particular reference to the sustainability of the intervention, the compatibility of the new biomaterials with the components of the traditional or more advanced building organism, as well as the expected performance and the improvement of the construction quality. Furthermore, particular attention must be paid to the methods of implementation as well as to the evaluation of the qualitative and economic aspects of the architectural and executive project which can evaluate the results obtainable with optimum reliability based on the criteria for choosing the various solutions.

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# EARTH ROOF IN ANATOLIAN TRADITIONAL RURAL ARCHITECTURE

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## **Abstract**

Originality in traditional rural architecture emerges with problems and solutions. An architectural solution that overcomes the challenges of the physical environment and at the same time provides the maximum benefit from the physical environment is produced with materials belonging to the same physical environment. Therefore, it is possible to say that material, construction technique and subjective architectural elements such as bay windows and niches are the main elements of originality in traditional architecture.

At the center of this study, earth roof that is widely used in the rural areas of Anatolia. In the first place, the earthen roof has been handled from historical, cultural and structural physics perspectives. Then, the main problems of earthen roof and traditional architecture are explained today. In the conclusion part, it is devoted to offering solutions based on current technologies. It is devoted to discussing the effects of the proposed solutions on the protection of architectural heritage.

**Key Words:** Traditional Rural Architecture, Earth Roof, Architectural Conservation

## **Introduction**

Climate, geography, economic foundation and cultural superstructure are effective factors in the formation of traditional architectural identity. Climate and geography are the forces belonging to the physical/ material environment surrounding society; economic foundation and cultural superstructure are the powers of society. In the traditional architectural that emerged with the effectiveness of these four factors problems were solved through experience. The success of these solutions is understood from sustaining life in traditional architecture without major

changes for hundreds of years. The problem encountered and the solution found provide the originality. Building material, construction technique and architectural elements such as bay window, niche or stove can be counted as the main elements of originality.

Consumption culture develops in parallel with rapid industrialization. The originality of rural architecture and the cultural heritage are spontaneously preserved when away from consumer culture and rapid industrialization. However, nowadays it is almost impossible to find a place isolated from industrialization and consumption culture. The preservation of the traditional architectural heritage (and therefore the historical accumulation and memory of the people) in totality depends on the prevention of the related works from being museum objects. In other words, the old must continue to survive in the new. For this, the maintenance needs of the traditional architectural products that require constant and intensive labor should be reduced and facilitated without deteriorating the essential features of architectural identity. Solutions based on current technologies can bring traditional constructions to the standards of modern life without erasing the traces of the past. When this happens, the function of the building can also be used without changing.

It is clear that rural architecture, which is as rich as urban architecture, is not resistant to the developing market economy. In this case, a conservation and renewal approach cannot be put forward for rural architecture with only technology support. The issue should be supported by policies aimed at socio-economic structure. For this reason, it is important to develop quick solutions for the protected part of the living cities and villages, and to increase the number of academic studies centered on rural heritage.

### **A Brief Historical Perspective Of Earth Roof**

Earth roof is an architectural and cultural phenomenon that emerges with the settled and/or semi-settled lifestyle. Therefore, it can be said that prototypes of the application were tried in the transition period from Epipaleolithic period to Neolithic period. It does not seem possible to construct earthen roofs in the architectural products belonging to older times than the 'Late Natufian culture' that existed in the Eastern Mediterranean (BP) 12.8 -10 millenniums ago. This determination can be explained by two main reasons.

The first reason is the inability of communities to acquire technological knowledge and resources. The Last Ice Age, which continued until BP 17,000 years ago, has made a life necessary for a large part of the world, pursuing limited food resources. The hunter-gatherer communities, rarely reaching thirty people, were totally dependent on the movements of game animals and the seasonal / regional distribution of relatively edible wild plants. An immigrant-ready lifestyle has developed a flexible organization, high mobility and environmental adaptability in these communities. As a result, even shelters have been built to be transported or destroyed at the same speed. Because the shelter left unattended can cause foreign groups to invade that camp site. Findings obtained in archaeological excavations confirm this finding. No earth roof system was found in any settlement in the world dating to the Late Natufian era.

The second reason is related to the power of transforming the social structure of the changes in the subsistence economy. Due to the natural conditions and the

endless struggle with rival clans, a social structure based on collectivism was born in prehistoric communities; The seized products were also shared and consumed. Since there is no production, there is no accumulation. Thus, a warrior, communal social organization was formed. Tents and wooden sheds are ideal constructions for hunter-gatherer groups with high mobility and few items. However, the situation differs as the agricultural production economy shifts. Along with the arable land, the need to keep the harvest collected and protect it from competitors is exposed. Since the community is divided into large family groups, families are sharing among themselves; they brought solidarity to the forefront if they were among each other. This social structure is focused on defensive, accumulating and settling. Until the technological level of the framing construction systems is reached, masonry structures covered with earth are used. In short, the emergence of sociocultural groups, which Alan Barnard describes as “accumulators”, also includes the milestone of permanent housing construction. The milestone mentioned generally coincides with the Natufian era, but especially the Late Natuf phase. At the last point, if the historical properties of houses with earth roofs are examined based on archaeological data, some important findings can be listed as follows:

- The Nahal Ein Gev-II settlement in the Jordan Valley is dated to 12,500 years ago. This settlement is famous for its initial traces of the transition from hunter gathering to the agricultural economy. One of these traces is a 80 cm diameter storage pit surrounded by a mortarless stone wall. Evidence is accepted that people acquire the idea of accumulating in a period when they have not yet completely abandoned the mobil lifestyle. In addition, as a result of archaeological excavations, it has been determined that the skill of architecture has achieved the level of stone use in the building foundations (Grosman et. al.2016).
- Today, Ain Mallaha, which is within the borders of Israel, also known as Eynan, contains traces of Natuf culture, which took place between 12.000-10.200 before today. Circularly planted houses were built in half the ground, measuring 3-6 meters in diameter. Stone Retaining walls are without mortar. In the ‘131’ building, which is nine meters in diameter, and in the shape of a semicircle, there is a foundation pit belonging to a series of wooden pillars bearing the roof. It is understood that the roof covering consists of wood and brushwood (Figure 1). However, despite the wooden pile reinforcement, earth roof cover can be seen neither in Eynan nor elsewhere until the last slices of the Natuf period.

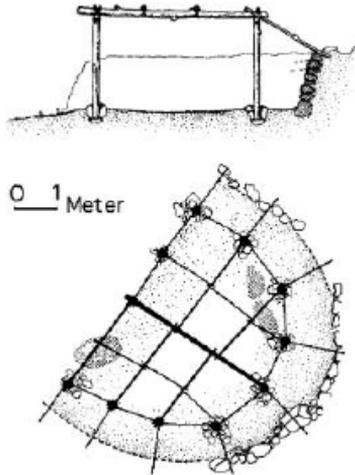


Figure 1. The large Natufian house in Ain Mallaha with a proposed reconstruction of its upper structure.  
Bar-Yosef O., 1998. Pp.163

In the Proto-Neolithic period, the earthen roof entered architecture in many settlement areas. In the circular form encountered in the ancient settlement of Mureybet (BP 11,700-11,300 years) located in the north of Syria, the structure with masonry stone walls (Figure 2) is similar to Jerf el Ahmar, Dja and Tell Abr-III structures. In residues of Hallan Çemi archaeological site, (Turkey-Batman) (BP 11,000 years), stone and wattle-and-daub technique were used circular-walls, and branches and the roof were covered with mud. In Jericho in the West Bank, mudbricks were used on circular walls, and piles of branches on the roof were covered with mud.

After the circular form was replaced by a circular form in the buildings, earth roof became a widespread roof structure in the farmer Eurasian settlements. "The oldest rectangular structures known in the Near East architecture are Mureybet-IIIB and Şeyh Hasan excavation sites dating back to 9000 years in Northern Syria (Özdoğan, 1996 pp. 29). Thus, the technique of earth roof has been applied almost unchanged until today.



Figure 2. A communal building subdivided by radiating walls Stordeer & Willcox 2016, pp. 47

### A Brief Cultural Perspective of Earth Roof

In the preface to his work, "A Contribution to the Critique of Political Economy," Marx defined (1859) the link between the economy and sociocultural identity: "The mode of production of material life conditions the general process of social, political and intellectual life. It is not the consciousness of men that determines their existence, but their social existence that determines their consciousness. At a certain stage of development, the material productive forces of society come into conflict with the existing relations of production or – this merely expresses the same thing in legal terms – with the property relations within the framework of which they have operated hitherto. (...) The changes in the economic foundation lead sooner or later to the transformation of the whole immense superstructure." (Url-2)

Examining the history of humanity within the framework of this fundamental law of dialectical materialism, Alâeddin Şenel (1997) mentions three ways of thinking corresponding to three types of economic foundation:

a) In the living conditions devoid of productive hunter gathering, "a way of thinking that establishes arbitrary cause-effect connections between events, will begin to emerge. This way of thinking is called "magical thinking". ... Objectively it is based on similarities and differences, and subjectively on the needs, emotions, and desires of the person." (Şenel, 1997 pp. 99)

b) In parallel with the development of agriculture and nomadic shepherds, religious thought system has increased.

c) The third type of economy is capitalism. The French Revolution has been the symbol of the dominance of scientific thinking.

In this case, it would not be wrong to say that the earth roof formation was discovered at the dawn of religion-based sociality and gained a cultural meaning within this social structure. What is that meaning?

It should first be noted that the simple agricultural economy is a cycle that repeats in repetitions. The spreading of the seeds, the emergence of shoots, the harvesting and subsequent spreading of the seeds are similar to the efforts of living things to survive. Identicalness established in the axis of religious between the life cycles of plants that cannot move and other creatures that can move, has also established for living spaces. In other words, just like in the fields, nature is imitated in construction of home. This imitation has developed productive forces focused on accumulating action, but more importantly it has been the main force in the creation of religious tools of symbolic devotion to nature.

Earth is one of the objects that gain religious identity. The earth has been regarded as the object of human creation by all divine religions. It is also written in the Sumerian Creation Myth that Enki created the human race from mud and blood so that he could take the burden on the back of the gods (Bottero & Kramer, 1989 pp.213). Behind this mythology is probably the analogical implications of the prehistoric man who observed the revival of plants in the earth where they dropped their seeds.

During the thousands of years of the simple agricultural economy, this belief, preserved in the depths of people's subconscious, has had an impact on cultural behaviors and some interpretations. The expression "ashes to ashes dust to dust (topraktan geldik, toprağa gideceğiz)", the burial ceremonies, the sacrificial blood

pouring ritual etc. example can be shown. However, the indicators of the effect of this belief about the perception of the house and the earth roof are not as concrete as in the phrase or burial ceremony. The relationship between this belief and home and earthen roof can be explained by some ritual and fact. According to this:

- The burial of the dead under the house floor has been a common ritual since the early days of transition to settled life in the Near East. This ritual is related to the “giving life” means attributed to the ground, and the house was entered from the roof simultaneously with this ritual. The ‘private’ individuals who were lost were buried at the bottom of the house. “The spirits of the deceased private individuals had the opportunity to be reborn in the bodies of the future generations, the house was made long-lived or the forces protecting the lineage were kept together. With the first lights of the morning gliding through the roof gap, life energy rising from the earth rises into the house. In the meantime, livings climb up the ladder and go up. They repeat a new birth every day, like a plant sprouting from the earth. Thus, a family center on the smallest scale and a village-centered force on the largest scale are created.” (Şimşek, 2019 pp.212) Briefly, with the door opening to the roof, the creativity power believed to exist in the earth was loaded into the house. Over time, burials were taken from the building floor to a region within the village land, and the entrance doors were taken from the roof to the wall surface. But the changes are formal. An example of this determination is the lantern ceiling (tüteklilik çatı, kırlangıç çatı) which is a relatively recent architectural practice. Lantern ceiling (Figure 3) has seven layers made of wood, representing the seven layers of the sky. The layers are noticeable in the space. The outsider sees an ordinary flat earth roof. There is a square shaped opening in the middle of the last layer. The projection falling in the middle of the space not only fills the daylight, but also emits the smoke of the fire in the stove (Akın, 1991 pp.323). Thus, four items of the universe (earth, sky, fire and air) are combined in the house, which has a four-stage life cycle from birth to death, and belief in the unity of being is emphasized.

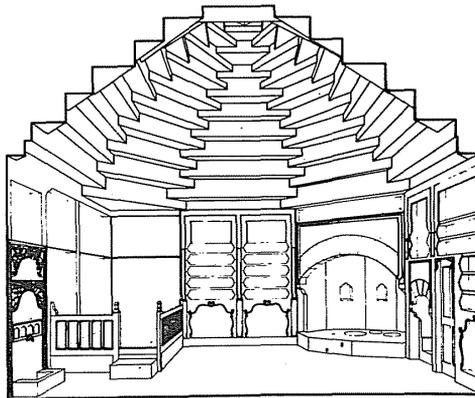


Figure 3. Room with lantern ceiling at Somunoğlu House, Erzurum  
Akın G., 1991 pp.348

- All these changes are related to the development of productive forces in the foundation. However, since the production system has not undergone a structural change and, on the contrary, has gained the ability to regulate within the scope of the state power, religious / symbolic dependence on earth has deepened. Moreover, the process has gained a new dimension by consolidating the laws under the roof of the state. At this point, resident tribes preserving tribal relations inherited from nomadic / shepherd lifestyle in near east and the peasants of the feudalism in Europe have similarity. In both, the peasant and his house are objects belonging to the ground; the landowner can change, but the land cannot be change.

One of the most concrete example in Turkey for religious / symbolic dependence on earth to is the meanings the word “yurt” represents. Yurt is the name given by the nomadic Turkish / Mongolian communities from the tent to their homes in Central Asia. The word “yurt” in Turkish has expanded meaning after the adoption of settled life. The house where the person was born and raised in Anatolia is called “father’s house” and “yurt”. It has a holiness that represents the continuity of the family. The cemetery in the village area is the home (yurt) of the dead; symbolizes the sacred bond with ancestors.

The village and / or hometown is a small country; includes today’s ties. Ultimately, the nation’s identity constitutes the great homeland (yurt). It is clear that although the meaning varies so much, each recipe points to a common point. In all, holiness is symbolized with earth.

Samples can be reproduced. In summary, it can be said that in societies where primitive agricultural production is at the center of subsistence economies, neither earth is only earth, nor house is only house! Images in the mind of the land and the house are shaped in the axis of a symbolic / religious understanding. Likewise, the earth dam, which is an important element of rural architectural identity, is not independent of this reality.

### **A Brief Perspective on Building Physics and Materials of Earth Roof**

Traditional rural architecture is the embodiment of accumulation of up to thousands of years. In results, construction technics were been determined emprical methods; construction materials were been determined by geographical conditions. The design is subject to the norms of the sociocultural structure rather than personal approaches. Construction systems and mass production that could affect the characteristics of traditional rural architecture were not available until the late 19th century world wide. Trade route until the second half of the 20th century in Turkey has not spread outside the city and district centers; modern construction systems and mass production, which have become widespread in the world, could not reach Anatolia simultaneously. Therefore, the characteristics of Anatolian traditional rural architecture have become evident with these conditions. Characteristics of Anatolian traditional rural architecture can be considered in two sub-titles as building physics and materials.

a) In traditional rural architecture, building materials were transported by vehicles drawn by animals and provided as raw materials or processed materials from a distance that can be reached within a few days. Processed materials are

such as ironmongery, profiles, joinery, timber, wooden decoration elements that craftsmen produce in their workshops in the provincial / district centers. Raw materials are obtained from nature. They were collected from quarries, forests, stream beds and brought to the construction site, and were used in the structure after simple physical interventions were made on the site.

Although the supply of building materials from nature creates a destruction, the tradition of using the building from generation to generation gives the nature sufficient time to compensate for the material.

The low need for new housing construction is another effect that allows nature to renew itself [1]. Therefore, it can be clearly claimed that traditional rural architecture carries the sustainability criteria spontaneously under the conditions of traditional living order.

b) Since the first village settlements, master builder have made efforts to create spaces where physical and social environmental factors are adapted to the desire of a healthy person to live. They preserved their technique that reflects their experience until they have the experience of a more successful solution. However, they were successful as far as their knowledge, technical equipment and cultural attitudes allowed. As a result, "... When it comes to the Pottery Neolithic Age, almost all the elements of the buildings that we have defined as 'traditional village architecture' have been exposed. During the 7000 years following the Neolithic Age, there has not been a significant development in such structures, and even adobe dimensions have not changed." (Özdoğan, 1996 pp. 29) "All elements of buildings" cover all sub-components of traditional rural architecture, from space and material dimensions to application details. As a matter of fact, a quantitative leap in building elements took place in the age of industrial capitalism, especially in the context of globalization.

Another important factor that determines the characteristic of traditional rural architecture is building physics. The effects of building physics on traditional rural architecture can be explained with examples.

- Stables are usually built under or adjacent to spaces where households spend time collectively. In this way, it is aimed to benefit from the heat generated in the stables.

- The low ratio of window openings to the facade surfaces suggests that sunlight cannot be used sufficiently. However, analyzes have shown that traditional residential areas are highly qualified in natural lighting. (Çorapçıoğlu & Arpacıoğlu, 2010)

- External wall thickness of the masonry structures in Eastern Anatolia, which has a hard terrestrial climate, is more than 100 cm, and inner walls are around 60 cm. External walls consist of earthfill mixed with rubble in the middle of two rows of stone masonry. Since the heat conduction coefficient of the rammed earth is lower than the heat conduction coefficient of the stone, it is common for the sandwich wall logic to develop for the outer wall in Eastern Anatolia. On the other hand, in masonry structures in warm climatic zones, earth filling mixed with rubble is either too thin or not made at all.

- Due to its ability to insulate earth heat, it has been a preferred building material in wall, floor and roof construction. Earth on the wall is the raw material of mud brick. It is a filling material in half timbered construction in wattle-and-

daub technique. The entrance floors of the houses in the warm dry climatic regions are buried in the earth to a certain degree in order to provide coolness. Steppe region the situation is reversed in the housing; earth is laid on the first floor deck to prevent the internal temperature from spreading. Regarding the use of earth on the roof, except for the Black Sea and Partially Marmara regions, earth roof application is quite common in Anatolia. From this information, it can be concluded that summer-winter temperature difference is low and annual rainfall rate is high in regions where earth roofing is not preferred. Erosion and waterproofing problems that may be encountered as a result of the high annual precipitation rate in the Black Sea region are possible reasons why earth roofs are not preferred. In the Mediterranean and Aegean regions, where the summer season is very hot, earth roof makes the interior spaces cool. In the terrestrial climate regions, winters are long, quite cold and under heavy snowfall. In these conditions, maintenance of the earth roof requires intensive labor such as cleaning the snow accumulated on the roof top and preventing the plants, preventing the earth from loosening.

However, even in geographies such as Bitlis, Erzurum and Sivas, where the winter effect is very high, the local people (although they have sufficient information about the pitched roof installation) have not given up the formation of earth roofs. Because in this geography where terrestrial climate is effective, earth roof reduces indoor heat gains and losses that disrupt indoor comfort. This roof adapts the villages to the topography and provides protection from looting raids through camouflage. Also, doing some of the daily housework on the roof is one of the sociocultural reasons for choosing this roof type.

Therefore, it can be said that traditional rural architecture requires energy efficient building design by its nature. It would not be correct to evaluate earth roof systems separately from this effort.

### **Nowadays the main Problems of Earth Roofs and Traditional Rural Architecture**

The medieval economy, based on simple reproduction and taxation, has been resolved in direct proportion to the rate of rise of capitalism. Consequently, industrial capitalism has gained a globalization dimension since the second half of the 19th century, while social changes have also reached global width. Peasants who could not compete with large agricultural farms in rural settlements lost their land and turned into rural workers first, then migrated to cities and joined the working class masses. This wave of immigration have had a big acceleration with the year 1960 in Turkey. Moving to both European countries and industrialized cities has not been stopped until now. As a result, in the settlements, where life is maintained with traditions, the indigenous population decreased, and the vacant buildings were mostly left to collapse. As a result, in the settlements, where life is maintained with traditions, the indigenous population decreased, and the vacant buildings were mostly left to collapse. With the sparse population, the production of buildings reflecting the accumulation of about 7000 years of rural architecture has also decreased day by day. Old buildings begin to collapse from the roof. The increase in the number of buildings that are physically aged exceeding the number of newly built buildings is an important problem related to rural architecture.

Another problem affecting rural architecture is related to the new sociocultural

identity rising on the finance-capital economy. This new sociocultural identity develops in the axis of consumption, alienation and commodification. In consumption culture, the house is the object of the profit-loss equation, not the symbol of continuity of lineage, commitment to the cosmos and/or memories. Likewise, life in the home does not progress as repetitive years; is focused on changing and changing. Everything from furniture to rooms is changed periodically. The turn will eventually come to the house itself.

Traditional houses are objects that require maintenance and repair periodically. Moreover, this job is a very laborious and time consuming activity. For example, earth roofs are shoveled during the winter so that they are not exposed to snow load. To prevent the plants from sprouting on the roof earth, salt is poured on the roof at the beginning of the spring season and compressed with a cylindrical stone rolled. The same is done to prevent rain leaks in the autumn season. Shape changes should be followed as a result of deformation in roof girders, decaying wooden elements should be changed. Similar maintenance work can be done on walls, floors, etc. It is also required for architectural elements. So much labor can be considered normal for the person who grew up with a culture of religious thought. Because life's natural obligations are counted.

The fact that a building requires so much effort can be seen as a burden in the modern lifestyle. Comfort in the modern lifestyle is related to the fact that everything is easily accessible and that the individual can maximize the time he devotes to him. The tendency to migrate and the decrease of the cultural connection established with space are the facts that feed each other. As a result of the combined effect of these two phenomena, the construction masters and artisans of Traditional architecture decreased in number, and factory-made materials eliminated handicraft manufacturing.

Craft is an occupation that continues from generation to generation through the master/ apprentice relationship. Craftmanship is not in demand in today's society due to reasons such as hard work, low income, and contraction in business volume. But the main reason that disrupts the continuity in the training of new craftsmen is that the work loses its respectability with the society. Today, being a stonemason, master builder or construction carpenter is considered equivalent to being a skilled worker.

The desire to take advantage of industrial materials and modern technologies is another important factor affecting rural architecture. This determination can be simply exemplified for earth roofs: In case of cracking of one of the wooden girder carrying the roof; replacing the girder will require a series of difficult efforts. Earth layer on the roof will be collected aside, the boards will be removed, then the girder will be replaced. Then the boards will be lined up again, the twigs, bushes and needle leaves used for waterproofing will be laid on the ground in a row, forming a thick layer, the eaves-stones will be placed neatly. At the last stage, the earth layer will be lay out and compressed with stone roller. In order to check the water tightness water pouring trials will be made on the roof, and there will be returns. (Figure 4 - 5 - 6)



Figure 4. Earth roof detail from outdoor



Figure 5. Earth roof detail from indoor

However, similar problems can now be resolved very easily. Nowadays, technical equipment is available to lift the roof as a whole with the help of jacks (without much effort) and put it back in place after girders are replaced.

There are also some problems such as the problem of strength in corner joints of adobe or stone walls, which traditional rural architecture could not provide a definitive solution from the neolithic era to the industrial revolution. In these systems, girders transmit the roof load to the wall without framing. Since the girders sit on the wall independently of each other, the roof quickly collapses as a result of the disjunction of the corner joints of the walls in the building. In such buildings, most of the deaths in earthquakes are not due to the impact of building materials or crushing, but because the earth that accumulates in the wreckage cuts the air passage. The fact that the problems that arise due to technical deficiencies in traditional rural architecture can be found in modern architecture does not lead to the modernization of the past. On the contrary, it means to legitimize the understanding of moving to the new building.

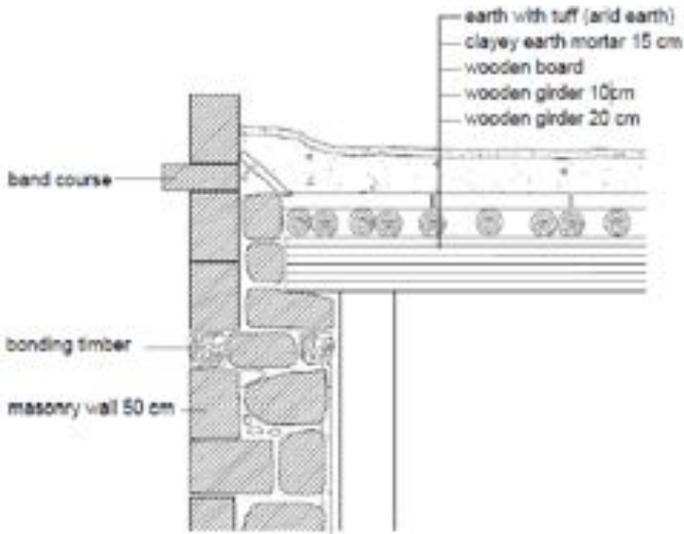


Figure 6. Earth roof detail

### Results

House with earth roof is both a product and a symbol of the first major transformation that humanity has experienced in its economic and social organization. Many scientists consider the Neolithic Age a revolution in the Near East in this axis of transformation. Indeed, the transition to agricultural production and settled life is a sort of demolition and birth. What makes the earth-roofed house a symbol is that the new lifestyle is born and developed within it. This development continues until the emergence of communities that will reach the level of the city-state. The technique of making earth-roofed shelter of the people who are dependent on the earth takes its final form towards the end of the Neolithic age. So much so that during the 7000 years up to now, neither the construction of the shelter nor a new phase in its roof has been in question. The same plan schemes has been continued to be built from generation to generation with the same technology.

Considering this reality, houses with earthen roofs can be accepted as a legacy bearing the burden of history. These houses are not only three-dimensional documents of the past, but also memory areas frequently used in research conducted by various social science disciplines.

On the other hand, the age of globalization changes the world with a speed and power far above the Neolithic revolution, and the rural architecture is disappearing day by day under the pressure of the global economy. Stopping this disappearing is a prerequisite for preserving architectural heritage, geographical originality and social memory. Moreover, each settlement is obliged to transfer its local architectural identity, which means a section from its history, to the future, even with a symbolic number of buildings. To achieve this, it requires integrated protection programs with legal guarantees.

The simple reproduction economy proceeds on the spiral of repetitions; Time does not seem to flow; users change but life flow and places do not change. The

dynamics of today's political economy are in the opposite direction of traditional life. This contrast is the sharpest contradiction between traditional society and modern society. People no longer prefer to live in past buildings or reduce them to the size of their personal belongings. While these buildings, which are regarded as 'historical', are adapted to the modern lifestyle, the architectural/ cultural elements they carry and brought from their own times are often ignored. In a traditional house, when the niches are closed, when the furnaces are replaced by luxurious fireplaces, when the berms are replaced by sofas, the rest is just the form.

Earth roofed houses are the most problematic traditional architecture here. Earth roof requires extra maintenance and the risk of death in disasters is higher than other traditional constructions, preventing such structures from rising to the status of historical artifacts. Moreover, the tendency to dismantle the earth roof and to build a reinforced concrete terrace roof in recent years, has widened the problem. As a result, no matter how successful it is in terms of traditional architectural design principles, the motivations of popular culture are dominant today. In addition, no one can be forced to continue the life habit of an age that has expired.

The need for the conservation program to include a classification scheme for traditional rural buildings appears. Council of monuments in Turkey classify to three categories the registered buildings and areas. A Four graded proposal can be brought to rural architecture examples using this scheme.

- In the first group, it may be considered to collect buildings that have monument values and / or whose architectural elements are dominant from examples in their vicinity in terms of originality, clarity and quality. The buildings in this group can be symbols of the region and, in a way, memory centers. These buildings can be evaluated for functions such as museums, libraries, places of worship etc. for public purposes. Construction technologies, material and plan schemes should not be changed, repair work should be based on traditional methods. Its maintenance and repairs are subject to public service.
- In the second group, simple repairs or partially editable buildings can be considered. All the original elements of the plan scheme and architectural identity of the buildings in this category are preserved. Limited interventions may be allowed with reorganization of places such as kitchens and bathrooms whose usage methods have changed today and installation additions. The intervention style may include modern solutions, provided that they do not deform the original features of the building. In this way, an integrity is established between the traces of different periods and cultural history continues to be accumulated in the space. The second category structures may be open for public service or residential use. They can be described as semi-symbolic units.
- Although it loses its quality of originality at a high rate in the interior, the buildings that protect it on the facades can be considered as the third group. these buildings can be used for public, commercial or residential purposes. The traces of the local architectural identity in the interior and the contemporary space fictions are together. On the facades of the building, an effort is made to maintain its architectural identity on an urban scale. Thus, residential texture and street silhouettes will not only

be conservator but simultaneous synthesizer. Because there is a need for streets that reflect the traditional style for the city memory, as well as the building islands where harmonious transitions are established between the architectural styles of different periods.

- In the last group, there are buildings in which the traditional architectural character is deformed both in the interior and on the facade, but it contains undeformed individual elements of special importance such a wall painting, a remarkable example of the use of spolia, an embroidered wooden door, etc.

Another classification should be made at the point of solving the problems related to construction, which stem from traditional construction techniques. If this proposal is to be explained over earthy roofed structures:

- For buildings in the first and second groups, interventions that are not perceptible to the naked eye and do not change the structure physics and material components are recommended. Some of the applications that can be evaluated in this context are: fitting wooden floor girders to each other by fitting them to a frame in the form of a truss system; welding the stones in the corner joints of stone masonry structures with the help of iron bar elements.
- In the second and third category structures, solution methods that are not perceived by the naked eye but which envisage the use of modern materials and techniques are adopted. The first example that comes to mind is the use of insulation systems, which have many variations in today's terrace roofs, instead of layers prepared with thin branches and leaves in the waterproofing business. Transferring the duties of irregular wooden logs to laminated girder systems, supporting classical methods with contemporary hardware products in material combinations are other prominent interventions of this phase.
- Prevention of the deformation of the facade in buildings evaluated in the third and fourth degrees is the primary goal. While the interventions can be perceived indoors, they remain hidden in the front. Some of the applications that can be done are: Developing permanent solutions instead of salting to earth, adding additives to prevent loosening of the earth, using plaster techniques that prevent the adobe walls from producing dust, plan arrangements, etc.
- Sustainability and energy efficient building design approaches, which are the architectural problems of today, are also taken into consideration in the fourth and last level buildings. For this purpose, the earth can be renewed in accordance with the green roof principles. Flumes can be made part of the water collection.

As a result, human beings can be considered as inputs of architecture, just like space and building material. In this assumption, "human" is a social dynamic. It is the creator and product of human, economic and cultural periods. Therefore, conservation - rehabilitation - renovation efforts for traditional architecture cannot be carried out with the understanding of solving problems solely from the building. Therefore, protecting architectural heritage is a multi-disciplinary task.

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# VERNACULAR ARCHITECTURE MODELLING: FROM 3D LASER SCANNER APPLICATION TO HBIM TO 3D MESH

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## **Abstract**

The structural rehabilitation of the architectural and urban heritage is essential in order to ensure its preservation and sustainability, especially in areas with high seismic risk.

Such an intervention requires first a complete and precise in-situ acquisition of architectural and structural data and the creation thereafter of a digital model which can be used during the FEM Finite Element modeling.

The 3D laser scanner plays a major part during the realization of the architectural survey. Indeed, the use of the architectural modeling software basing on the BIM (Building Information Modeling) and NURBS (Non Uniform Rational Basis Spline), allows to move from point cloud to 3D numerical model complete and accurate.

We propose through the article an unprecedented application of 3D laser scanner on a vernacular architecture which constitutes a unique type of medina. It's an aggregate, which is composed of five houses falling within the Kasbah of Algiers classified "universal heritage" by UNESCO since 1992.

The architectural survey is followed by a demonstration of structural numerical modeling basing on the 10 Grades of Generation using a set of software founded mainly on BIM and NURBS. The numerical model of the aggregate will be followed by an illustration of the mesh, a fundamental step during the FEM.

**Key words:** Vernacular Architecture – Kasbah of Algiers – 3D laser scanner – HBIM – 3D mesh

**1. Introduction**

The main goal of all restoration project through the word is to ensure the sustainability of historical monument the longest time possible through an accurate and suitable interventions.

The sustainability of the historical monument is even more difficult in seismic zones. This complexity is due mainly to the unpredictability and velocity of this natural phenomenon. The incapacity of old structures facing horizontal stress through its architectural and constructive typologies is the principal reason.

Overlooking the gulf of Algiers, the kasbah is situated in the central part of the city, it is founded on six terrestrial faults which place it in the most seismic zone of the country with an acceleration of  $0.4m/s^2$  (Boughazi & all, 2014; DTR, 2003). Unfortunately, this universal heritage is not immune from other natural phenomenon such as tsunami, hence the need to extract and safeguard the maximum information possible during the carrying out the architectural survey.

The introduction of 3D digitization in the world of heritage has profoundly revolutionized it. Indeed, using the new tools and 3D scanning techniques such as the SLAM, the 3D laser scanner, the UAV ... and many others, allows today not only to save considerable time during the survey architectural, but especially the digitization of all the architectural, architectonic, structural and environmental details. This represents a big advantage compared to traditional measurement methods, which, in turn, suffer from inaccuracy and shortcomings.

The transition from a point cloud obtained during the 3D digitization (data acquisition) to a BIM (data processing) architectural model exploitable in various analyzes (data analysis) is obtained thanks to a variety of software that are categorized and analyzed shown in Fig.1.

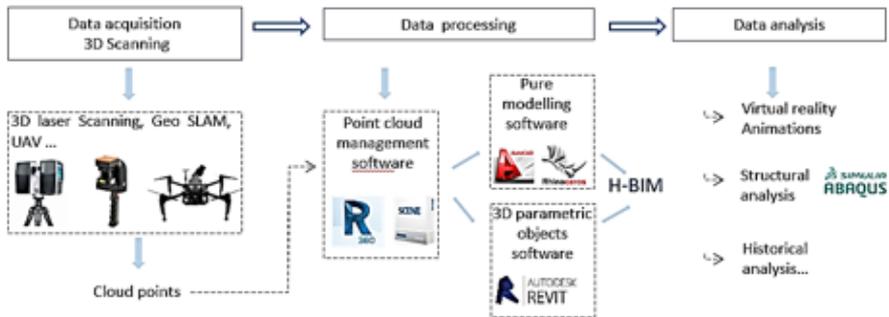


Figure 1. Exploitation process of point clouds (source: author)

The BIM model obtained at the end of the modeling process reproduces faithfully the architectural forms of the studied object regardless of their degree of complexity. This is thanks to the existing complementarity between programs based on parametrization (BIM) and generative modeling software including NURBS (Barazzetti & all, 2015).

Throughout the first part of this article, we illustrate the entire process of architectural modeling and how it has been applied to Vernacular Architecture such as the Kasbah of Algiers, renowned for the organicity of its urban fabric and the complexity of its architecture. In the second part of the article, we present a 3D

mesh demonstration for FEA Finite Element Analysis basing on the HBIM model obtained during the first part and a set of recommendations.

The main objective of this work is to explain how to obtain a parametric and precise model of a Vernacular Architecture from an architectural survey carried out by the 3D laser scanner. A demonstration of the interchangeability and exploitation of the numerical model is carried out explaining how to perform a coherent and correct 3D mesh of this kind of architecture.

## 2. Data acquisition

### 2.1 The aggregate presentation

The urban configuration of the Kasbah of Algiers after the earthquake of 1716 is similar to several medieval Mediterranean cities, such as the historic center of Brescia in Italy or Coimbra in Portugal. In fact, the urban matrix is composed of several aggregates or islands of irregular shapes, of different sizes and which, in most cases, are interconnected with one another (Atelier Casbah, 1981). The aggregate proposed for this work is part of the safeguarded sub-sector 01 of the Kasbah of Algiers corresponding to the most homogeneous and authentic zone of the traditional fabric namely the upper part of the Medina (Wilaya d'Alger, 2012).

The selected aggregate is composed of five traditional houses (Fig.2), it is surrounded along its perimeter by four narrow lanes (Fig.3). Its detachment from other macrostructures gives it a structural independence.

With an area of around 317m<sup>2</sup>, it is the smallest aggregate of the Kasbah of Algiers. It consists of three Wast El Dar patio houses and two houses with a Shebak skylight each of theme.

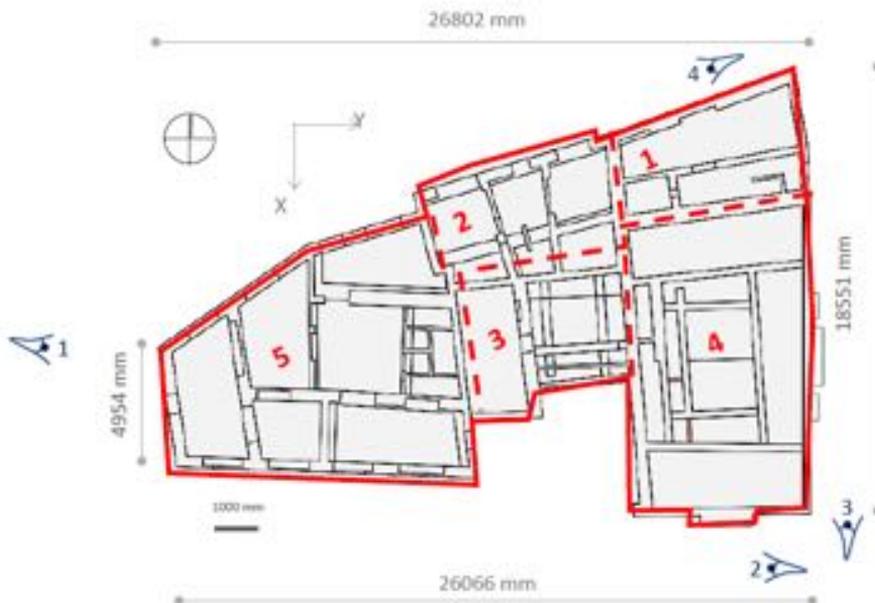


Figure 2. Aggregate planimetry and division of houses



Figure 3. Different views of the streets surrounded the aggregate (source: author)

## 2.2 Architectural survey by 3D scanner laser, data collection and point cloud processing

The architectural and typological particularity of the houses of the Kasbah of Algiers as well as the structural configuration of the aggregate need an accurate digitalization hence the necessity to use FARO 360 scanner laser. The scanning of the entire aggregate requires 188 scans carried out in colors, with an optimum resolution of 3600 points by  $\text{cm}^2$  and a distance precision of  $\pm 1\text{mm}$ . The device used is equipped also of camera which allows the realization of 3D photographic survey.

The total scans obtained are realized for 05 days (60 hours of digitalization). All scans of the same house as well as those of exterior part have been cleaned and assembled by Recap Autodesk program. The six formats RCP obtained (the 5 houses+ the exterior) are assembled into one points cloud using Scene program. This latter allowed us a better manipulation of the final file which the size is close to 130 Go. A final cleaning of the aggregate using Recap program, allowed the elimination of superfluous and unusable points during the architectural modelling (Fig.4).

A certain number of scans has been carried out on more higher terraces higher of neighborhood houses to complete the digitalization of the roofs. A spherical benchmark, often necessary in this type of architecture, are positioned in order to ease the assembly of scans and to ensure at the same time a maximum of accuracy and correctness.

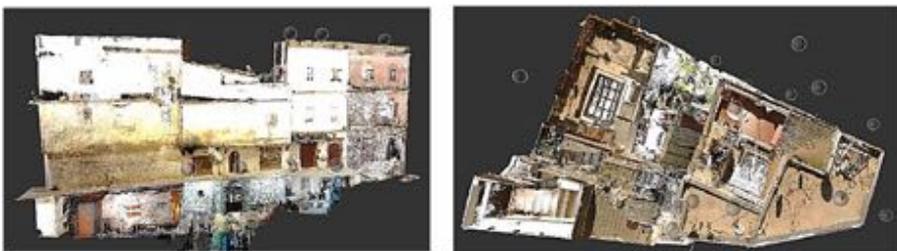


Figure 4. Final points cloud of the aggregate obtained after cleaning and assembling

## 3. Architectural modelling and FEM

### 3.1 From point cloud to Heritage Building information Modelling HBIM

The final assembly of the aggregate point cloud through Autodesk's Recap software and Scene allows us to obtain a file approximately 130 GB in size (section 2.2). It is almost impossible to manage this file with 3D modeling software and especially with the available computer hardware. Obtaining the parameterized architectural model of the aggregate by reproducing correctly the existing regular and irregular architectural forms from the point cloud, was only possible through the passage of six stages in total and the use of four software.

The first step is to use the Recap software to separate and divide the point cloud from the aggregate into five parts, each of which corresponds to a house (Fig.5).

The second step is to import the point cloud from each house into the Autodesk's Autocad program in RCP format. The management of the point cloud in this program allows the creation of horizontal and vertical sections with a thickness of 0.05m. This phase is very important because it allows not only to retrace the plan and to create useful guidelines during 3D modeling, but also to verify the verticality, horizontality and inclination of architectural and structural elements (Fig.6).

The third phase consists in exporting the point cloud in the Revit program as well as the horizontal and vertical sections in the DWG format obtained respectively from the first two phases. Both files must be positioned automatically at center-to-center at the time of import for perfect superposition. Regular shapes are directly modeled basing on the 08 generation grades GoG available in Revit (Banfi, 2017) (Fig.7).

The materials corresponding to the houses of the Kasbah are created in this phase by attributing to them their visual, mechanical and physicochemical characteristics.

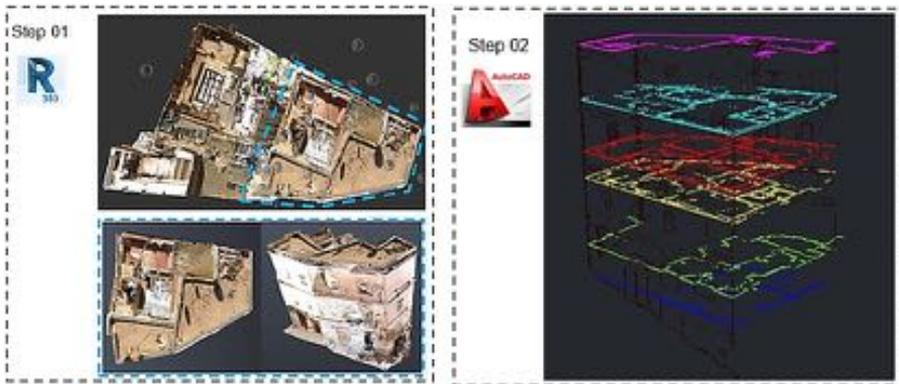


Figure 5. (left) Modelling process, step1: point cloud division  
Figure 6. (right) Modelling process, step2: the creation of horizontal and vertical slices

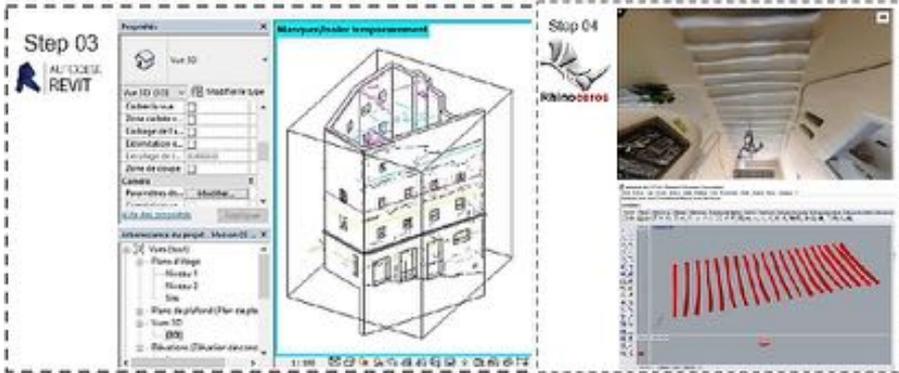


Figure 7. (left) Modelling process, step3: the use of the 8 GoG to model the regular shapes

Figure 8. (right) Modelling process, step4: the use of GoG 9 and 10 to model the irregular shapes

The fourth phase consists in selecting in Autocad the point clouds corresponding to the irregular parts of the houses such as the wooden beams composing the floors, the twisted columns or the uneven walls in plan and in section. Vertical and horizontal sections are created for these parts with a thickness of 0.05m and are exported in Rhinoceros accompanied by their point clouds. This makes it possible to model all irregular shapes using NURBS and based on the two generation grades 09 and 10 (GoG 9 and 10) (Banfi, 2017) (Fig.8).

The fifth phase is to import into Revit all the irregular parts modeled in the previous phase. Before inserting them into the existing project, it is necessary to parameterize them, this allows the transition from a pure geometric model to a parameterized BIM model.

The first five phases are applied to all houses separately, resulting in a total of five BIM parametric models with maximum precision.

The sixth and final phase is to assemble the five models in Revit by referring to the aggregate point cloud of the aggregate (Fig.9). At the end of the architectural modeling, we obtain two BIM models, a first architectural model containing all the architectural and architectural elements that will be used for various kinds of analysis, a second model containing only the structural elements that will be exploited during the finite element structural analysis FEA.

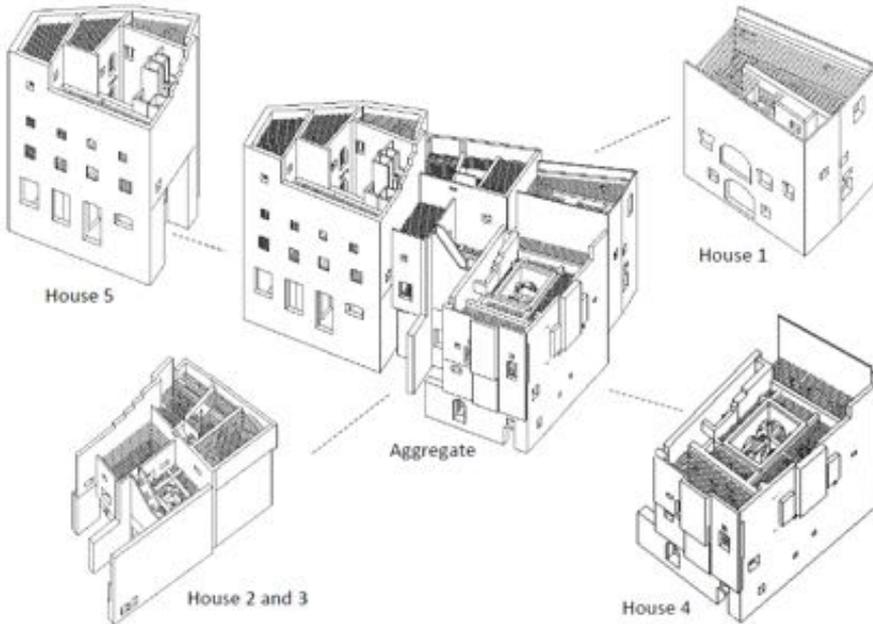


Figure 9. Modelling process, step 6: the final assembly of the aggregate

### 3.2 FEM and 3D mesh

The modeling process illustrated in (Section 3.1) allows us to obtain a parametric numerical model of the aggregate with a high degree of precision.

The structural model contains specifically the elements which contribute to the structural behavior of the aggregate. Indeed, the walls, columns and beams are grouped into 3 distinct families in Revit because the materials that constitute them are different.

Each family is exported separately in ACIS format and then assembled again in Finite Element Analysis (FEA) software Abaqus (Fig. 10). This step is very important because it allows first to assign the corresponding material to each family and second to configure differently the type and size of the mesh.

It is necessary to specify the import mode of the structural models or groups in Abaqus, we note two different ways namely: (1) Creation of separate individual elements or (2) combine into a single model. We choose the unique model with merge of solid regions.

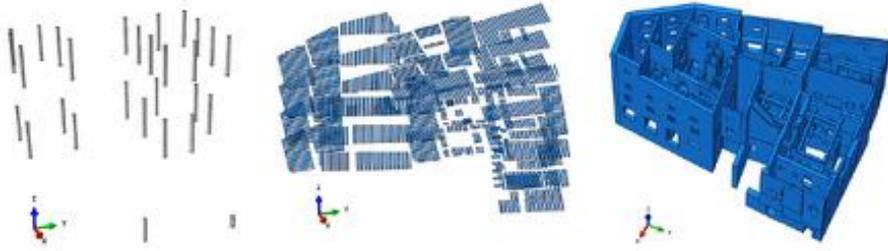


Figure 10. The three families exported in Abaqus from Revit model.

- (1) right: columns
- (2) middle: wooden beams
- (3) load bearing walls

The final assembled model in Abaqus allows to perform several types of structural analysis (linear, nonlinear, seismic, modal, pushover ...).

Creating the global mesh of the aggregate is the first essential step before starting the model configuration.

A first automatic verification of the model geometry is carried out beforehand and has allowed the first observations to be made. Indeed, all the load bearing walls containing niches are represented in brown and could not be meshed by using hexahedral type due to the complexity of certain geometric shapes, only the yellow and green walls represent the walls whose geometry is validated and recognizable through the ABAQUS program. The automatic mesh in this case is partial as shown in (Fig.11). Therefore, the use of manual mesh is essential by using tetrahedral type.

The second mesh obtained includes the whole of the aggregate and outlines some anomalies, such as mesh distortions and concentrations (Fig. 12) around the ovoid, elliptical or oval shapes ventilation openings as well as the decorative niches (Depth  $P$ :  $30 < P < 50\text{mm}$ ) and / or functional niches ( $125 < P < 400\text{mm}$ ).

Adding to this the discontinuity of the mesh between the different levels. Indeed, the point cloud obtained reveals the presence of a shift and a misalignment of a few centimeters between the superimposed walls of the different levels that are taken into consideration during the architectural modeling (Fig. 12).

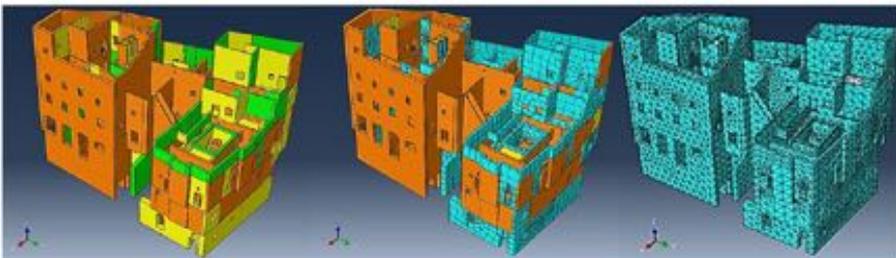


Figure 11. Different phases of mesh (source: author).

- 1- Left: geometric check of the structural model;
- 2- Middle: result of automatic mesh;
- 3- Right : result of tetrahedral manual mesh.



Figure 12. Mesh anomalies noted in specific geometric shapes (right) and on the East facade of the aggregate (left) (source: author)

The geometry simplification of certain architectural and architectonic elements is necessary or even essential. We quote: (1) the exceedance and the geometrical start of the arches (pointed or semicircular) are simplified, (2) the functional niches with basket handle arches are devoid of additional decorations, (3) the purely decorative niches are removed, (4) the twisted columns composing the patios are transformed in smooth shaft column and, (5) the wall offsets less than 70mm are straightened.

It is important to note that the HBIM structural model obtained in REVIT after geometric simplification (Fig. 13) does not affect or even weakly the structural behavior of the aggregate. The structural analysis which will be conducted, is of a global order in other words at the MACRO scale (at the aggregate level) and not at the MICRO scale (at the scale of a structural portion).

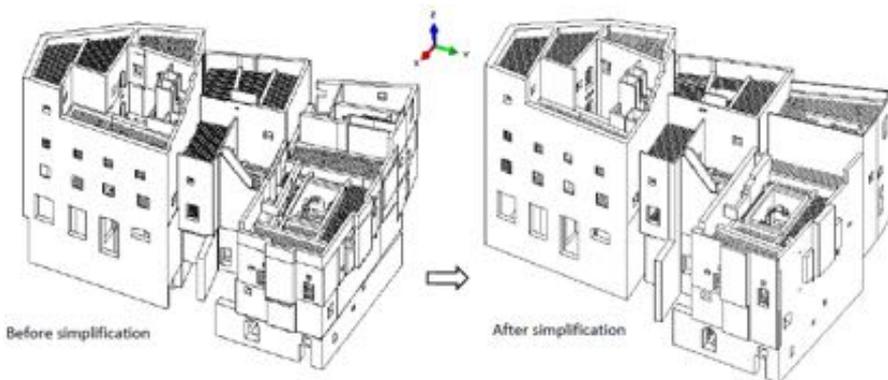


Figure 13. The structural model HBIM obtained in REVIT after geometric simplification (source: author)

The result of the final mesh obtained in ABAQUS after the simplification of the geometric shapes is shown in the (Fig. 14).

Finally, we introduce the size and the type of mesh corresponding to each element, namely: (1) tetrahedral type (TET) for load-bearing walls with a size of 800

mm with 4 nodes, (2) hexahedral type (HEX) for the columns with a size of 170mm with 8 nodes, (3) hexahedral type for chaining elements with a size of 80mm with 8 nodes.

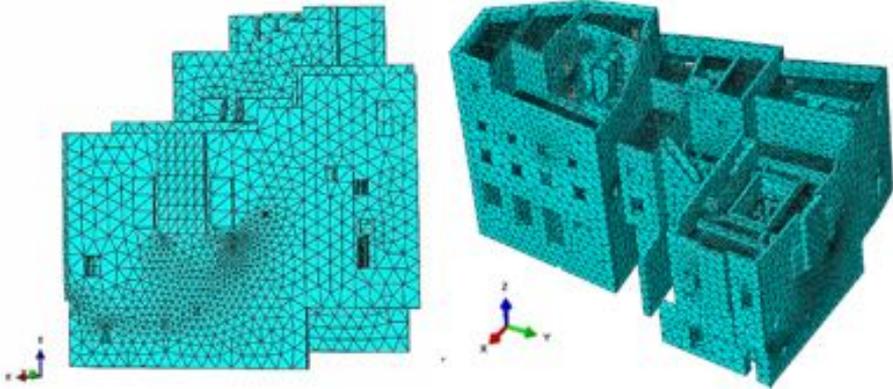


Figure 14. The final mesh after geometric simplification, (on the left) the South facade of the aggregate, (on the right) a general overview of the aggregate (source: author)

#### 4. Discussion and conclusion

The introduction of new 3D scanning tools and devices, and more specifically the 3D laser scanner in the world of building heritage, has become indispensable because of the various advantages it offers to restoration specialists, whether architects or engineers.

The first advantage would be to digitize the patrimonial object (archaeological site, historical monument or historical urban complex) in its entirety which would represent once stored an inexhaustible referential base, saved and usable at any time. We quote as an example the church of Notre Dame de Paris having undergone a fire in April 2019, thanks to the 3D digitization carried out beforehand, the restoration project could be started and this having all the information relating to this architectural heritage (Auclert, 2019).

The second advantage would be to exploit the point cloud through architectural modeling which represents an indispensable and sometimes very complex first phase. This complexity lies in the answer to the question of how to move from cloud of points in a 3D architectural model.

This latter must be as close as possible to the original architecture, respecting the particularities of each architecture. The case of study presented in this article namely the aggregate under the Kasbah of Algiers is extremely particular. First of all, its urban configuration is organic, and its architecture is very intertwined. The division of the point cloud allowed us to understand at first its constructive system and proceed by modeling the different parts according to the geometric morphology of each element.

The achievement of the architectural survey in color with a high resolution is certainly recommended for a better reading of the cloud of point as well as a better precision and accuracy of the architectural model. Nevertheless, the unavailability of extremely powerful computer equipment (hardware) could represent a significant

obstacle at the time of the exploitation of the point cloud.

The adjustment of the 3D laser scanner (number of stations, resolution, colors) must take into account the nature, the importance and the morphology of the architectural object to be scanned, hence the need to carry out several in-situ visits and to have an observant eye. This would reduce the size of the endpoint cloud and thereby facilitate its management, processing and exploitation.

The use of software based on BIM and NURBS and thanks to the existing compatibility between them (exchangeability of formats: RVT, DWG, RCP, PTS, ACIS), is a possible solution to model complex architectural shapes from a voluminous point cloud like the case of the houses of the Kasbah of Algiers.

The architectural modeling process of the aggregate illustrated throughout this article allows to obtain a parametric architectural model integrating a maximum of information.

These are related to:

1. characteristics of building materials,
2. structural and architectural pathologies,
3. and historical data.

Adding to this, the resulting HBIM model could be exploited for other types of diverse analysis such as structural analysis by ABAQUS Finite Element Analysis (FEA) software. Obtaining a correct and coherent 3D mesh of a Vernacular Architecture is a fundamental step for any finite element analysis. This can only be possible through compliance with a certain number of key steps. The degree of precision of the structural model depends on the scale of the analysis that will be carried out.

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# RELATIONSHIP BETWEEN SPATIAL STRUCTURE AND BEHAVIOUR: STUDY OF QATARI HOMES

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## **Abstract**

A collection of detached owned dwellings from Qatar are analysed to understand the relation between the design of the dwelling and social wellbeing of the inhabitants. Around 250 participants answered an online questioner and 38 participants volunteered to do a follow-up interview. In addition to that, statistical data collected using both paper and an online survey. The original material of dwelling layout and design was gathered during the interviews were the participants talk, describe, draw and in some cases show their dwellings. A configurational analysis of the dwellings was performed to understand how the layouts are being planned and to trace any repeated patterns. While the interview analysis supported the spatial analysis by showing social activities located within the physical context of the dwelling. A correlation test backed up with a significant relationship between physical variables and social behaviours. When combining the outcomes of different analysis, a comprehensive deep understanding of design logic is unveiled. What are the significant zones in the dwelling? How they are classified, and how are they connected to each other? Where and why social activities happen in some spaces? These questions shall be answered in this paper. It can be concluded that the culture and norms of the studied community are the driving aspects of the dwelling design decisions. It can be seen from the analysis that gender separation -for example- is an important factor while planning visitors-inhabitants interaction. Furthermore, family privacy is considered as a high priority which derives the design or the changes made on dwellings design. This paper shall give evidence of social wellbeing aspects that are influenced by the dwelling design.

**Keywords:** Doha, lifestyle, culture

## **1. Introduction**

There is a non-stopping interest in investigating the relationship between people and place. Scholars from different research backgrounds looked into how people interact with the physical surroundings and how the physical surrounding impact the users in both direct and indirect ways (Mouratidis 2017b). This interest has

evolved from the increase in health and wellbeing problems which is very related to lifestyle and behaviours (Cooper 2014).

The wellbeing of users has been examined in different settings and scales. However, this research argues that wellbeing studies should focus on spaces where people spend more time such as the residential context. Previous research has found that in the nineties, on average people spent almost 60% of their time at home in Germany (Brasche and Bischof 2005). With the development of technology and changes in lifestyle, people occupied their houses for longer periods. In 2001 the national human activity pattern survey (NHAPS) declared that the US population spent 87% of their time in their residence.

It can be noticed that much of the research on the effect of the residential built environment characteristics on inhabitants' wellbeing has been Eurocentric (Fuller et al. 1993), and there is a lack of research on this topic in the Middle-East where the culture, traditions and the family circumstances are different.

The research will compare the spatial structure of the different residential built environment and their influences on the social wellbeing of its residents in the context of Doha. The lifestyle, the family circumstance, and neighbours' relationships are uniquely different in the Middle East in comparison to other geographic locations and cultural contexts. Therefore, these social aspects will be considered and integrated into the research. This paper aims to identify the influence of the spatial arrangement of the dwelling on inhabitant's social behaviour.

## **2. Literature review and theoretical framework**

The formation of the dwelling is a result of various tangible and non-tangible factors. Yet Rapoport believes that the primary influence is the socio-cultural factors which include religious beliefs, household structure, social organization, and social relations (Rapoport 1969). Some researchers claim that the spatial layout of the dwelling is a direct expression of the household organization, which keep in changing with the development cycle of the household (Lawrence and Low 1990). Lawrence and low called the relationship between the built environment and people behaviour as " interactive", as people create and influenced by their creation (Lawrence and Low 1990). "we shape our buildings and afterwards our buildings shape us" Winston Churchill. This confirms that the relationship is not static and constantly change. Diaz claims that the built environment does not predict inhabitants' behaviour, as it gives a variety of possibilities that the user can decide amongst. Further he agree that the every culture manipulate spaces accordingly, which means that once space is produced, the inhabitants reshape it spatially and socially (Diaz 2017). Pearson and Richards agree that inhabitants give the space a purpose then they behave upon it (Pearson and Richards 2003). The purpose given to space depends on the user ritual, economic and cultural background(Rapoport 1969).

The used physical features to assess the built environment in this research would be discussed in this section. Furthermore, it shows its influence on the social behavior of inhabitants, which consequently measures their social wellbeing.

Dwelling typology refers to the design that distinguishes different types of dwellings such as a detached unit, semi-detached house, and apartment building. Although we are looking at one form of dwellings – detached villas- they have been

found to be different in the design decision involvement. The literature showed that different typologies of the residential buildings have different influences on the inhabitants social life of interaction level and feeling lonely (Evans 2003; Montford 2013; Montford 2015) but methodological issues make it difficult to draw clear conclusions. Mental health of psychiatric patients has been linked to design elements that affect their ability to regulate social interaction (e.g., furniture configuration, privacy)

Spatial arrangement refers to the order of spaces, how they are arranged and configured. People are in need of enjoying their privacy as well as social interaction. It is believed that physical spatial arrangement can regulate and satisfy both needs (Butterworth 2000). Proper spatial hierarchy shall define the private and public territories. Reduction in privacy results in psychological distress which is more common in some demographic groups like young women (Cooper 2014). There are no standards to spaces arrangement as they differ depending on cultures and norms. However, a gradual transition from public to private is recommended.

A private outdoor space refers to the spaces or uses that are in the household territory however they are not enclosed such as gardens or parking area. People from some cultural background use their private outdoor space to be exposed to the public and interact with neighbors or people who are passing by. In other cultures this space is used as a buffer zone from public space – street- to a private space – dwelling-.

In addition to the architectural interest in studying the impact of the dwelling form on the inhabitant social behaviour, studies from ethnography and archaeology found investigating this relationship (Lawrence and Low 1990). Sociologists defined social wellbeing as a combination of five dimensions includes coherence, integration, actualisation, contribution, and acceptance. When looking at the social wellbeing in a built environment context, sociologists found that social cohesion and integration are the primary indicators (Keyes 2016). Mouratidis (2017) believes that social wellbeing in the residential context can be influenced by social capital, sense of community, neighbours ties, and social interactions. His research suggests that subjective wellbeing is affected by a good relationship like having friends, spending time with family members, and marriages and romantic relationships. Keyes (2016) argues that social wellbeing correlates with other indicators of life satisfaction, happiness, and dysphoria. Some researchers have specified some characteristics of happy people, such as gender, education, and high economic status. Yet there was no strong direct relation to their social wellbeing. Other factors like age, unemployment, family level, social capital, faith, and trust have a strong and straightforward effect on subjective wellbeing. These factors found to be influenced significantly by the state of health (Helliwell and Putnam 2004).

### **3. Methodology**

The methodology of this research is identified to achieve the objectives of the research. The aim is to analyse the features of the physical environment of the dwelling that has an influence on inhabitants' social behaviour and therefore, their wellbeing. The research employs a case study method to compare different design and layout within Doha. The cross-sectional data were collected using mixed methods of qualitative and quantitative approaches. The nature of indicators

discussed in section 2 has led to instrument development. The questionnaire collected demographic data in addition to built environment details such as house tenure, design assessment, residence duration, and other satisfaction measurements. Besides, the survey used to trace household social activities patterns such as when, what, where and frequency of social activity within the dwelling scale. For comparative analysis with previous research, some questions in the questionnaire had the same questions and wording from past research such as (Montford 2015; Poortinga et al. 2017). While other questions were designed especially for the research context and to respond to the aims of the study. Participants were randomly sampled or convenience samples ( snowballing).

On the other hand, more than 36 participants across the case studies answered a semi-structured interview that is consisted of four sections including social questions. Dwelling scale level investigates personal space, family space, and visitors space. Visual data were used and it assisted in understanding peoples' interaction and behaviour within the privet dwelling place. Interviews were conducted at the participant's home in order to give the researcher the possibility to walk-through and assess the dwelling. The semi-structured interview which includes visual data elements such as mapping and sketching assisted in understanding peoples' social behaviour in relation to the physical surrounding. Photographing the interior of the dwellings was avoided in order to respect the household privacy and cultural values.

### **3.1 Case study selection and data**

This paper is part of larger research which focuses on neighbourhoods in Doha, Qatar. The dwelling analysis is the second phase of the research. In addition to neighbourhood selection strategies, detached dwellings were selected as they have predominant building permits and it has a variety of layout design. Focuses on one typology was essential to eliminate major influencing variables. The researcher contacted local networks to introduce the research and find volunteers to participate in the interview. Additionally, snowball sampling was used to reach others who might be willing to participate. The houses are mainly built between 1970 and 2008, they have been occupied for more than five years. The cases studies found to be in two typologies; owner designed dwellings and developer designed dwellings, yet all participants own their dwellings. While sampling the interviewees, it was essential to have a verity of age group, gender, and social status.

### **3.2 Data Analysis**

Questionnaires were analysed statistically. The aim was to find the significant correlations between physical features and social wellbeing variables. Spearman two-tailed bivariate correlation test was performed in addition to chi-square tests for nominal data. The significant correlations – p-value below 0.05- were used to analyse the interviews deductively. Open-ended questions were analysed thematically.

Interviews had two sections; transcripts and dwelling layout analysis. The scripts were analysed thematically in both inductive and deductive methods. Dwellings layouts drawn during the interview were used to study and interpret the sociological significance. Case studies plans were simplified into elements and relations -justified graph- which allow tracing pattern. Spaces are represented as

circles and links between them such as doors or openings are represented as lines. The justified graphs would include the exterior of the house -street- as a crossed circle. It was important to include the outside when looking into visitor-household interaction. The analysis would consider integration values of space – describing them with reference to the mean integration value-, the mean depth of the space – with reference to the number of the steps taken it is described as deep or shallow-, spatial structure such as analysing rigs - ring is a spatial organization in which the several spaces are connected and create a loop-. Space syntax analysis illustrates the social qualities of the built environment of privacy and interaction.

#### **4. Descriptive Data Analysis**

This section investigates the dwelling spatial arrangement analysis -justified graphs- in two stages. The first stage analyses the layouts as spatial arrangements without considering the use of the spaces. The second section looks at the functions and investigates the logic behind the arrangement.

##### **4.1 Spatial analysis – form**

When comparing the layout features of the dwellings from both typologies, it can be noticed that the owner designed dwellings are more complex and have a greater number of cells than developer designed dwellings. The statistical analysis shows a moderate positive correlation between the number of bedrooms in developer designed dwellings and length of residence (Spearman correlation coefficient: 0.308, p-value 0.030). Meaning that dwellings with a greater number of cells have longer residency duration. As for the depth -counted from the street and the main living room-, owner designed dwellings are deeper than developer designed dwellings. Rings -both internal and external rings - are more common in owner designed dwellings. It can be seen from the J-graph analysis that developer designed dwellings have less number of entrances, unlike the own designed dwellings, they have two entrances on average.

##### **4.2 Spatial analysis - function**

This section investigates the use of the space and its integration value within the whole structure. The social content of spaces is correlated with its integration/segregation value (Hanson 1999). This analysis distinguishes a spatial pattern of uses and the logic behind it. Organising the functions according to the integration value of the space help in tracing the different lifestyles and moods of interaction within the family and the wider social interaction with the community.

##### **Interaction between visitors and inhabitants**

A low integration values for men *Majles* was dominating most of the case studies. More than half of the cases physically separate men *Majles* than the main dwelling building which resulted in low integration. Men *Majles* has either a direct entrance from the street -which is more common in owner designed dwellings - or by using the front yard as a reception space to direct different users to different entrances. In some cases, *Majles* has a secondary entrance from the privet yard which facilitate easy access and service. As for female *Majles*, it can be observed that space is part of the main dwelling building. Some cases have a separate entrance from the yard for female visitors, while in other cases they may access

using the family entrance. In case of single access for female visitors and family member, a reception lobby is used to direct different users to different spaces. Large dwellings found to have separated set of spaces for both genders, however, some found to have only one seating spaces -space management is found in the thematic analysis section 4.4.3.-. The guest bedroom is used for hosting a guest for a few nights; usually, the guest is relatives or friends. Statistical analysis showed a positive correlation between satisfaction on the dwelling layout design and ease of inviting guests ( owner designed dwelling: spearman correlation coefficient: 0.189, p-value 0.031, developer designed dwelling: spearman correlation coefficient: 0.437, p-value 0.002)

#### **Interaction between servants and family members**

It can be noticed that male servant – driver, gardener, chef- bedroom have a low integration value to the other household spaces. The location of male servant space is away from the family space and from female servants as well. It is often located by the main gate of the dwelling and has a separate entrance, or near men Majles using their gate. The reason behind its location can be found in the thematic analysis section 4.3.5. As for female servants, their bedrooms are relatively more integrated than male servants. It has been observed that the location of maids' bedroom is close to the workspaces – kitchen, laundry and ironing room-. The justified graphs show that in some cases maids' bedroom is part of the main dwelling building, but mostly it is located in the back yard.

#### **Interaction between individuals and family**

As the majority of the cases were extended family dwelling, it was important to report how the layout of the dwelling is affected. Nuclear family bedrooms have low integration value, yet the living room is more integrated into the extended family dwelling. The nuclear family gain privacy through spatial sequence and steps taken from the main dwelling to reach the nuclear family space. Dwelling design and consideration for future household development were discussed with interviewees which results in three forms of nuclear family occupation plans (refer to section 4.4.4). Statistical analysis shows a significant positive correlation between of own space satisfaction and place attachment (Spearman correlation coefficient: 0.208, p-value 0.018). which proofs that satisfaction on own space increase the duration of stay in the dwelling. Young couples interviewee who reported dissatisfaction of own space, wish and planning to move out of the dwelling (015). Furthermore, the questionnaire has an open-ended question about the reason behind moving out, the main reasons provided by nuclear families are the space size and increase of children number. As for single children bedrooms, the integration value found to be moderate to low integration. Master bedroom is also falling between moderate to low integration value.

Living rooms have the highest integration value in a significant number of case studies, which confirm that it is the main space for family interaction. The living room gets all inhabitants together for different activities – interview analysis section 4.3.1 -. The statistical analysis looked at the location of gathering and household activities Table1, the living room has the highest gathering frequencies for all sort of activities, yet significant correlation found between the living room and playing and watching TV. Chi-square test that studies the frequency of gathering and the location emphasise on the living room as the most frequent place of family

gatherings Table2.

Activity		Developer designed dwelling				Owner designed dwelling			
		Chat	Eat or drink	Watch TV	Play	Chat	Eat or drink	Watch TV	Play
Location of household gathering	Living room	68	54	55	28	108	82	74	39
	Garden	22	12	13	10	33	25	21	13
	Kitchen	7	7	4	5	18	18	13	8

Table1 location and household activity chi-square test

		Developer designed dwelling			Owner designed dwelling		
		Garden	Kitchen	Living room	Garden	Kitchen	Living room
Frequency of gathering with own household	Never	3	1	2	4	1	4
	Once to twice a day	8	2	35	11	7	48
	More than twice a day	12	6	52	21	11	78
Pearson chi-square		0.237	0.503	0.001	0.015	0.898	0.655

Table2 household gathering frequency and space used  
 Note: Shaded cells correspond to a significant correlation.

The developer designed dwellings cases have been modified from their original design, which makes the comparison to the owner designed dwellings difficult. However, it emphasises on a certain special arrangement that is common in this community. Table 3 shows the similarity between owner designed and developer designed dwellings.

Spaces		Design typology	
		Owner designed dwelling (19)	Developer designed dwellings (15)
Visitor space	Separate men spaces ( <i>men Majles</i> )	68.4%	66.6%
	Separate women spaces ( <i>women Majles</i> )	57.8%	53.3%
	Guest Bedrooms	94.7%	26.6%
Family spaces	Highest integration value is the ground floor living room	61.9%	66.6%
	Highest integration value is the first-floor living room	26.3%	6%
Extended family	existence of nuclear family	63%	46%

Table 3 Comparison between dwelling typologies using the main interaction spaces

### 4.3 Spatial analysis- relations

The next section looks into the relation of the spaces using the justified graph. It has been found that some spaces are repetitively connected in a ring system. On the other hand, the same spaces are arranged in direct linear form in other dwellings.

#### 4.3.1 Dwellings with rings observation

When looking at the spaces using the justified graph, another spatial relations dimension is found. It has been observed that 47% of the cases studies have an internal ring. Rings are more common in the owner designed typology, very few developer designed dwellings have a ring. Tracing the repetition of spaces included in the rings, spaces such as living room, kitchen, dining room, Majles, and bedroom are the ring components. 93.7 % of the dwellings which have rings have Majles part of the ring, mainly it is the women Majles. The dining room is considered to be an element of the ring in 68.7 per cent of the dwellings. 87.5% of the ringy dwellings include the living room as part of the ring. Looking at the 31.25 per cent of the dwelling which does not have the living room part of the ring, it can be noticed that the living room is directly linked to the ring. Some of these living rooms are secondary living rooms or married child living room. Kitchen is part of the ring in 18.7 per cent of the cases; similarly, 18.7 per cent of the dwellings have a bedroom part of the ring.

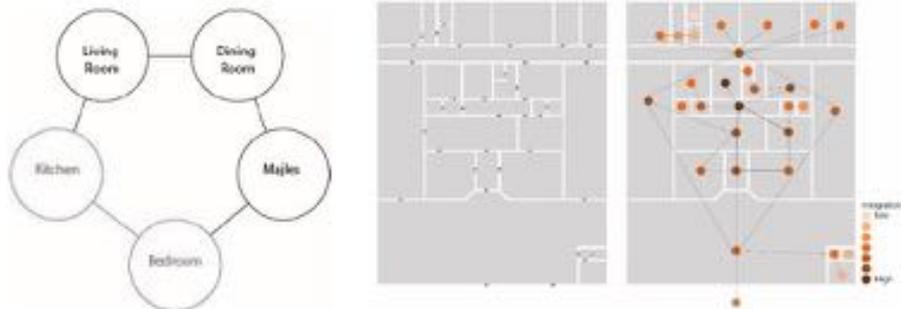


Figure 1 convex map as an example for ringy dwelling layout with integration graph

#### 4.3.2 Dwellings without ring observation:

Around 53 per cent of the case studies do not have an internal ring, the majority of the percentage is developer designed dwellings. While analysing the special layout, it has been found that the same functions - living room, kitchen, dining room, Majles, and bedroom - are arranged in a linear composition. All the case studies have the living room part of the liner layout. More than 77 per cent of the dwellings have the Majles part of the liner composition. The dining room is considered as part of the liner layout in 33.3 % of the case studies. 16 % of the case studies have both a kitchen and a bedroom part of the liner special composition.



Figure 2 convex map as an example for liner dwelling layout with integration graph

As the living room, Majles, and dining room are the most common linked functions in the case studies, they would be further investigated using thematic analysis. The intentions are to study the properties of these key spaces such as spatial depth, and social behaviour and activities of these spaces.

#### 4.4 Thematic analysis

This section looks into the interview transcripts in light of the justified graph and the statistical analysis outcomes. The thematic analysis started from the key spaces reported in the justified graph analysis as a deductive approach, yet an inductive approach unveiled another dimension of the built environment and social wellbeing relationship Figure 3.

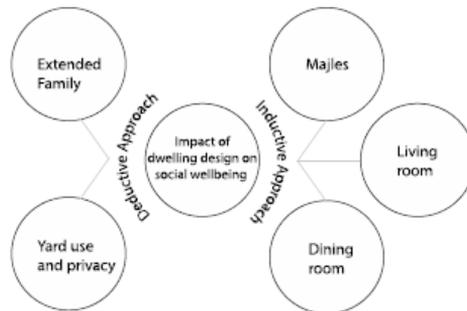


Figure 3 interview thematic analysis diagram

##### 4.4.1 living room: a key space in Qatari dwellings

The statistical analysis and spatial analysis confirmed that the living room is one of the key spaces in every Qatari dwelling (Table2). Many interviewees described the activities and the qualities of the living room such as visual accessibility, size and

privacy. *Visual connectivity has been described by female interviewees as “control”*. They have expressed their use preference of the living room as it helps them to supervise the dwelling.

“The living room,, the heart of the house,, from the living room you can supervise everything. My living room is double-height,, so even if somebody is walking upstairs or talking you can hear from the living room,, there is connectivity.” (062)

“My favourite space is the living room next to my mother in law,, we watch TV and can see who is coming and leaving the house.” (031)

As the living room found to have the highest integration value in most of the cases, it provides the required control by the housewives. The location in which the housewife can supervise her dwelling may differ according to the culture and the era (Cieraad 2006).

Although visual connectivity seemed to be an important feature of the living room, yet privacy is another significant feature that influence inhabitants’ satisfaction in the living room quality. In such family space, people reported the need for privacy from strangers such as visitors, people in the street and even from the dwelling servants:

“Living room is a spacious room,, we have a door that separates visitors from the living room for privacy.” (062).

“I am unsatisfied with the living room privacy as the door is directly opened to the outdoor and we always keep the dwelling gates open” (043)

“After changing the layout to open plan, the living room becomes facing maids bedroom which is disturbing their privacy. My dad always asks to close their door when he is using the living room. He wishes to block this door and open another one in the rear side. If it were my decision, I would move maids room and the laundry on the second floor. For my mum and me it is ok, but my dad doesn’t feel comfortable.” (021)

It has been noticed that some dwellings have more than one living room. Multiple living rooms are for a different use, users and occasions. Interviewees highlighted the space size and its privacy as a reason for the preference of use.

“My favourite space is the daily living room as it has a cosy size and it is fully furnished (carpet) unlike the rest of the house (tiles).” (013)

“We gather in the living room,, everybody like the small living room,, they say it is cosy,, we chat,, we ask each other for advice,, we watch TV together. My girls like to play together. I and my daughters we spend most of our time together,” (034)

“I like to use the first-floor living room more than the ground floor living room because it has a TV. The ground floor living room is used to host my brothers in law, and now it is used for the grandchildren.” (014)

It can be noticed that the household prefer cosy size living room for daily use. However, in large relatives gathering or for occasions like breaking fast during Ramadan spacious living rooms are used. Multiple living rooms are more common in dwellings with one *Majles*; therefore they use the living room to host visitors in

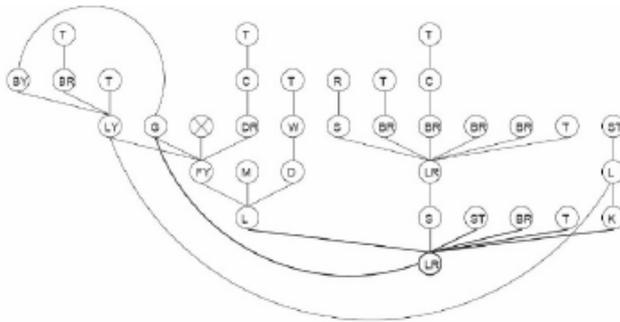
an informal setting.

The living room is described as ‘the centre’ by many interviewees. This adjective describes the spatial quality of the space Figure 4, in addition to the social activeness of the space. All sort of interaction between family members happens in the living room, it is even used as a dining room for some dwellings.

“Mostly, we use the living room. The place is very good because it is enough for the family members, in addition to visiting relatives. Its location is central in the house, surrounded by the rooms, let’s say it is the interaction place.”(016)

“The living room is the activity centre. It is not enough space for the gathering and requires separating the grandchildren, but slightly linked, total separation of the kids results in an emotional separation between the kids and their parents.” (012)

“I am home all day,, mostly on the ground floor living room with my parents,, we watch TV, chat, and I do some readings. The TV is in the living room, the main setting is in the living room,, anybody enters the dweeling can be seen from the living room.” (022)



CASE STUDY : 042

Figure 4 Spatial centrality of the living room

*In a nutshell, household interaction is an important aspect which correlates with the dwelling design. The statistical analysis indicates positive correlation gathering frequency and the desire of making changes in the dwelling design (Spearman correlation coefficient: -0.174, p-value 0.045). In other words, the more the household get together, the more satisfied they are with their dwellings.*

#### 4.4.2 Dining room

As shown in the spatial analysis of the dwellings, the dining room is another key space in the Qatari dwelling. Interviewees who have separate space for the dining reported location advantages and gathering frequencies with family members.

“I stay with my husband mostly,, boys don’t stay at home for long. We gather mainly at lunchtime,, we wait for them to eat together.” (033)

“This place – dining room- we use it only during Ramadan,, it has a big dining table,, we gather their” (051)

“We used to gather every day for lunch when they were younger,, but now they are in college or work.” (034)

Although the dining room found to be part of the ring in many dwelling, yet the interviewees emphasised on the activity -eating together- more than the space quality. Food in previous research is considered a special event that gets the household together (Hanson 1999). The activity importance -having food together- is reflected in the dwelling layout.

#### 4.4.3 Majles

*Majles* is a sitting room for visitors, in some dwellings it is connected to a dining space. Visitor spaces are an important part of the Qatari dwellings, which have a strategic location in both ringy or chained layouts. The justified graph illustrated some dwellings have a single *Majles* space for hosting the visitors; others have multiple spaces for each gender. The statistical analysis shows that satisfaction on dwelling layout correlates positively with the ease of inviting guests (developer designed: spearman correlation coefficient: 0.437, p-value 0.002. Owner designed: spearman correlation coefficient: 0.189, p-value 0.031) The space used for hosting visitors depends on the visitor and the formality of the visit. In the case of single *Majles* dwelling, it is managed earthier by time or physically using doors and partitions to ensure privacy for both family members and visitors. Also, in these dwellings, the living rooms are used to host informal visitors.

*"There is no conflict with family privacy as we make sure that my brothers and father are not at home during the visits." (014)*

*"We have guests 2 to 3 times per week for 2 hours in the evening. Privacy is achieved by closing the doors when we have female guests." (016)*

*"I use the Majles and living room to host visitors,, the formal visits are in the Majles,, my neighbours like to set in the living room because it is bigger. We spend one hour to two with visitors during evening time. Mostly, I have visitors once a week." (025)*

*"Formal visitors in the Majles,, if we have females and males visitors, we use the living room for females and the Majles for males." (035)*

As for dwellings with multiple spaces for hosting visitors. These spaces are categorised depending on gender, nature of the visit, and the number of visitors.

*"Majles for me and my visitors,, the tent for my son and his friends,, we have visitors weekly. In case of a large number of visitors we use the tent as dining room" (055)*

*"Majles is only for formal visitors,, depends on the events that are happening,, sometimes we have gatherings every day,, otherwise weekly visitors." (033)*

It can be noticed that people prefer to locate men *Majles* away from family space Figure 5. As they describe the guest spaces in their houses, they mentioned spatial properties which influence the privacy:

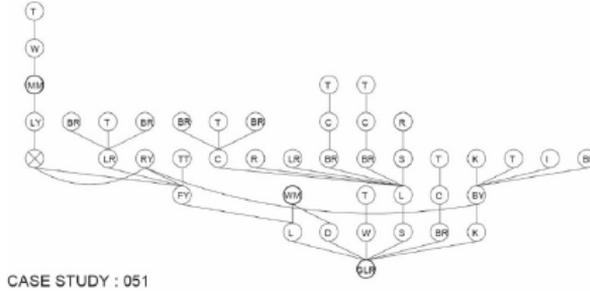
*"I built an exterior men Majles, so women in the family can move freely in the house" (033)*

*"When we have men and women guests,, both of them has their full privacy,, because I have two doors in different directions,, and the places are separated." (061)*

*"We build a men Majles in the outdoor space,, with its dining room and toilets. The Majles inside the house we made it for female,, because women*

*Majles was a very small room and not enough. Also, when we used to have men Majles in the house,, we -as girls and women- needed to keep quiet, when they built the exterior Majles,, both of us -family and visitors- become comfortable and happy.” (062)*

*“Satisfied with my outdoor space,, men Majles is not opened to the yard to increase privacy in case I have my friends in the outdoor space.” (034)*



CASE STUDY : 051

Figure 5 Multiple spaces for visitors in relation to the main living room

The preference of male Majles location recalls the location of the male visitor space in the traditional layout of dwellings in Qatar. Separation of stranger men can be traced from the Islamic domestic spatial organization, which ensure excluding outsiders from privet household space and allow women to move freely in the dwelling (Nevett 1994).

The next section discusses other social-cultural phenomena that have an impact on the design of the dwellings in Qatar. The development of the family and the change in the members is reflected in the uses of the spaces in the dwelling. The spaces and the dwelling form are in a dynamic change as a result of household age (Hanson 1999). It has been noticed that the Qatari dwelling design passes through a cycle which corresponds with the family statues. Children marriage is one major influencing factors on dwelling design. Some dwelling owners consider the growth of the family and design the house to occupy extended family. Others made changes after constriction completion to host the new nuclear family.

**4.4.4 Nuclear family within the dwelling: spatial description**

The nuclear family spatial layout can be observed in the justified graphs. More than 47 per cent of the analysed cases are extended family dwellings, where they occupy one or more nuclear family. Extended families are more common in the owner designed dwellings, more than 52 per cent of the cases have married children live with their parents. Forty per cent of developer designed dwellings are extended family dwelling. Looking at the spatial connection of the nuclear family to the extended family space, one to four steps are taken from the main dwelling ring to reach the nuclear space in the owner designed dwellings. However, only two steps are taken from the main dwelling ring to the nuclear family space in the developer designed dwellings.

While analysing the transcripts of the interviews, it was very clear that family extinction is an important element which was the reason behind the initial dwelling design and modification, change uses of rooms, dwelling extinction, and stability/

moving out of the dwelling. Some of the owners have planned their dwellings with family growth in mind, physical evidence can be seen in using the suite design system:

“My children moved to suite rooms after their mirages.” (045)

“Two rooms were joined together for my son to get married and the dressing room was converted to the pantry for him.” (013)

“My house is rectangular with five bedrooms,, two of them were joined to make a flat for my married son,, and recently he left.” (023)

The use of flexible designs in some dwellings express the importance of the family cohesion. On the other hand, it can be considered as social support. Young couples are usually unable to afford to rent a house. Furthermore, they need lots of advice and support when they have their own children.

Some interviewees who didn't consider family growth while designing the dwelling, extended their dwellings in both vertical and horizontal forms to satisfy the growth:

“We didn't consider family growth,, after my son got married we built him an external extension.” (033)

“We built an exterior extension for my son,, he got married and when he had children he moved out,, then my other son got married and used it for a while and then moved out again.” (042)

“The swimming pool was replaced by a small house for my son when he got married.” (063)

It can be noticed that people satisfaction on the yard depends on its size and privacy – yard privacy is discussed in section 4.4.5-. Interviewees showed dissatisfaction of yard size when they are unable to extend their dwellings to accommodate family expansion.

“Unsatisfied with the size of my yard, I would like larger outdoor space,, I wish my children to be around me,, I don't want them to go away.” (026)

“The yard is good but small,, when we moved in we didn't consider that our family would grow,, at that time we had the chance to buy the land next to us for future extension,, but it didn't come into our minds. Now the neighbourhood is full of houses.” (062)

In some cases, owners changed the use of a room to occupy the new nuclear family. In many cases, the Majles was converted to a suite for the newly married son. It is more common in the dwellings which have multiple spaces to host guests or abandoned spaces :

“I built a Majles,, then my son got married so I expanded it,, I made him a small house,, then I built a tent as a Majles.” (026)

“ The exterior men Majles was converted into a flat for my married son. Once he left , we convert it back to a Majles.” (011)

“My brother got married and he used the living room with its toilet as a flat. I got married and moved to the penthouse,, my bedroom was taken by my other brother,,” (044)

Having the children and grandchildren in close proximity is an important aspect for parents especially when they grow older. The correlation test shows a significant relationship between the emotional wellbeing and frequency of gathering with the household (Spearman correlation coefficient: 0.176, p-value 0.045). Many of senior interviewee reported their feelings versus the frequency of gathering with married children.

“ My married son and my daughter in law are in their own flat upstairs, busy with their life and work, I meet them once a day only. On Fridays, we have lunch for all my children who live with me or in their own houses.” (011)

“I regretted that we haven’t considered family growth,, now I see my grandchildren once a week. I wish if they were around me.” (042)

“I wished to add rooms in the roof for my children to stay with me,, but now the children have moving out and we have empty rooms.” (0332)

Many owners wished to move to another neighbourhood where they can live next to their children as a family – evidence can be found in neighbourhood scale thematic analysis-. The correlation test shows weak positive correlation between availability of relatives in the neighbourhood and length of stay ( Spearman correlation coefficient: 0.197, p-value 0.002).

Dwellings accommodate the new nuclear family in three ways. The first way is to pre-consider them, in which the dwelling would have single children bedrooms and suites for them to move to when they get married Figure 6. The second method is to re-arrange or make a few changes to the dwelling to host the nuclear family **Error! Reference source not found..** The last way is to build an extension – either vertically or horizontally- when children get married **Error! Reference source not found..** The three methods vary in privacy and integration of the nuclear family to the extended family, yet it maintain more frequent family interaction than when children move out of the dwelling.

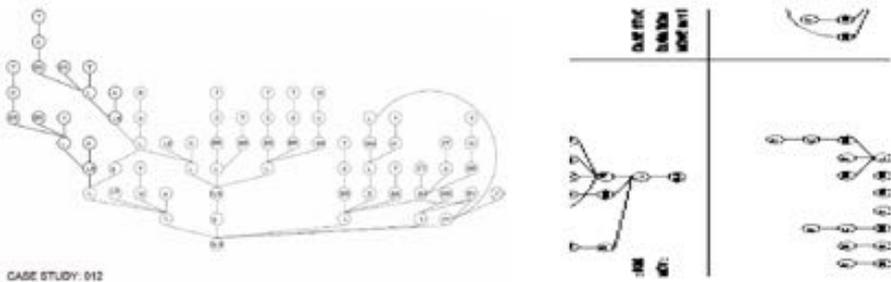
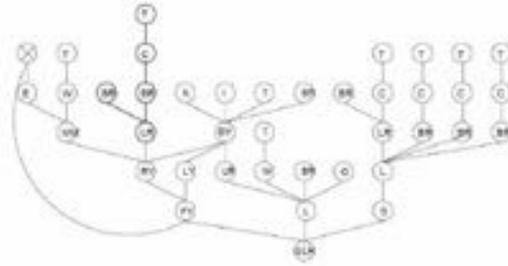


Figure 6 Nuclear family flat was considered while designing the dwelling



CASE STUDY: 011

Figure 7 Minor changes to accommodate family growth



CASE STUDY : 033

Figure 8 Horizontal extension built for son marriage

#### 4.4.5 Yard use and privacy

The yard is an exterior space that surrounds the dwelling – in most of the cases- which consequently form an exterior spatial ring. It may have several entrances from the street depending on the location of the plot. Every access has different users and purpose (Figure 9). The common spaces accessed from the yard are the male servant bedroom, female servant bedroom, services, married child extension and men Majles space.



Figure 9 Example of several entrances for the dwelling

Referring to section 2, the privat yard found to have an influence on the inhabitant wellbeing. The statistical analysis shows a significant correlation

between population stability and privet yard satisfaction (developer designed: spearman correlation coefficient: 0.543, p-value 0.000. owner designed: spearman correlation coefficient: 0.218, p-value 0.013). The thematic analysis found that the yard use has an impact on the relationships between neighbours as a result of its spatial characteristics. Although there is a seasonal variation of yard use, yet some physical features such as the neighbours' windows and the height of the dwelling fence impact the satisfaction on the space.

Seasonal variation:

"If the weather is good,, we take out the furniture to the garden and the TV,, the dwelling gates are covered by the movable partition." (061)

"I say maybe the yard is exposed,, but we use the outdoor space during winter,, our neighbours don't overlook,, but it is better to have the fence higher,, you don't know who might live next-door in the future." (022)

The statistical analysis shows that the satisfaction on the yard has a positive correlation with the its privacy (developer designed: spearman correlation coefficient: 0.380, p-value 0.006. Developer designed: spearman correlation coefficient: 0.369, p-value 0.000). In other words, the more privet the yard is, the more satisfied the inhabitants are.

"I wish to make the fence higher,, but this is the maximum height we can reach. We have used partition for the side walls as neighbours windows overlook our house." (061)

"The yard is privet because we have my son house from this side and the neighbours do not have windows toward us,, from the other side we have a distance between us as neighbours and the trees grow high,, so we are not exposed,, the third side the dwelling back is oriented to us,, so no windows." (063)

The inward-looking structure in the traditional Islamic dwellings was satisfying social requirements (Nevett 1994). Yet, the force of institutional control system nowadays restrict culture representation through the dwelling layout (Hanson 1999). Nevett clarifies in her research that traditional Islamic dwellings did not seclude the women from public life as some researchers suggested. She uses houses plans from archaeology materials to prove that women and the family were provided privacy from the community using the spatial layout of the dwelling. Although the yard is not totally privet in some cases, yet social trust and mutual respect between neighbours influenced the yard use:

"Satisfied with the dwelling fence, if you raise the height a lot,, you will feel like in prison,, our neighbours collaborate with us,, for example we have a first floor,, but we tell our children not to overlook neighbours houses. And we expect the same from them,, we trust the neighbours and that is why we set outside," (031)

"No, if the fence was higher it would be better,, sometimes when we go outside it is not privet, although our neighbours make sure to not overlook to our privet outdoor space,, when they build they avoid opening windows toward us. Still, if the fence was higher it would be better." (022)

Some interviewees reported yard privacy issues as it was affected by the presence of a male servant room. Some dwellings located the male room by the dwelling fence with access from the street, with no access to the family yard for maximum privacy.

“Satisfied with the yard privacy, it was my chose because I like to ride the bike around the house back then I had more freedom as we didn’t have a driver. The privacy depends on if the Driver in the house I can’t use the entire outdoor space, otherwise it’s ok.” (014)

“The doors of drivers rooms are to the street,, they don’t enter the outdoor space,, they ask before entering if they want to take the car out. I get annoyed when I see houses they don’t use the outdoor space because of the lack of privacy. I go out and walk in my outdoor space,, I know that nobody overlooks our outdoor space. “ (061)

In sum, the use of the exterior yard of the dwelling correlates with its privacy. Privacy is affected by several physical variables such as neighbours windows, main gate location, fence height, and the male servant access to the yard.

**5. Discussion**

By revising the integration values of spaces from different typologies, a repeated special sequence can be traced. The linear diagram below (

Figure 10) illustrates the order of uses depending on the integration value. It starts with the family living room which is the most integrated space, finishing with the men *Majles* which is the lest integrated space within the dwelling. The mean integration is somewhere between the female servant bedroom and single children bedrooms where the integration starts to decrease. In other words, the integration starts to reduce in the own privet spaces such as the bedrooms, nuclear family space, and male servant room.

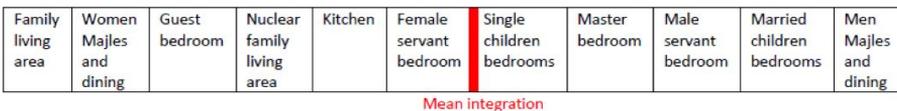


Figure 10 spatial order according to the integration value of the function

**5.1 The genotype of typical Qatari dwelling**

Dwelling may appear to have different layouts and forms, but when analysing them, a unique typical spatial organization is found to be used in the majority of the case studies. It can be seen from the illustration Figure 11 that the cultural values and norms of gender separation and hospitality. The arrangement and sequence of spaces control the interaction between privet family space and visitors’ space(Hanson 1999). Male strangers spaces are places close to the street – public space- and it is separated physically by a buffer zone which is the yard. The spatial arrangement ensures low integration value to the private family spaces. Although not all the dwellings have a separate space for male visitors, yet they expressed their plans, wishes, and reasons for building one. The graph then shows the interior of the dwelling which has a ring that includes the ground floor living room, *Majles* and a dining room. The ground floor living room has a high integration value within the dwelling. The interior *Majles* in most of the cases for female visitors, and it is

not directly connected to the family space. The dining room has a strategic location between visitors and family space. Some of the households use it for guests only and others use it for family gatherings. The ground floor level has a bedroom which is directly connected to the internal ring. This room is used differently depending on the stages of the family life cycle and social activity. In extended families, this room is used for daughter birth reception, a playroom for grandchildren, bedroom for the grandparents, or a master bedroom for the parents if they have physical difficulty to climb the stairs. In socially active families it is used to host guests to spend a few nights with the household. Guests can be family member or relatives from other countries. Service spaces such as kitchen laundry and storage spaces are placed at the back of the dwelling and separated by a yard. Female servants bedroom are placed in between their workspaces. The second floor is mainly privet spaces for family members. The privet spaces can be reached by passing through the first-floor living room. Married children suites ensure their privacy through a spatial sequence. In some cases, the married children have an exterior extension in the yard or in the penthouse level.

Again, the most significant finding is that culture, tradition and religious belief are the most substantial driving aspects of arranging the dwelling layout. Gender segmentation and partitioning can be noticed in the location of the male/female sitting room (Majles) and the location of male/female servants' bedrooms. Men Majles in most of the cases has the lowest integration value of all spaces, which ensure no direct connection to family space. The yards are used as a buffer zone to separate men spaces – men Majles, driver room- from other family spaces. Another feature is privacy, although bedrooms are the most segregated spaces, yet married children have the ultimate privacy for nuclear families.

## 6. Conclusion

The dwelling design found to have an influence on inhabitants' social behaviour within the household and the community. This research investigated the relationship between detached villas design in Doha and social behaviour of the occupants and found that the Qatari culture can be read in the dwelling structure. Hanson said: 'Architecture can carry culture' (Hanson 1999) p24. The physical patterns and their properties of depth, integration, or segregation can represent the culture and values of the community. The data analysis proofed that the dwelling form is significantly correlated to the social behaviour patterns of the household. In summary, the main spaces discussed in this paper – living room, dining room, and the Majles- are the footprint of the Qatari family dwelling. Furthermore, this paper investigated the extended dwellings and their positive impact on social cohesion and social support. Additionally, It can be seen that gender separation– visitors and servants- is an important aspect which correlates with the privacy of the family and the women specifically.

Dwellings are more than satisfying basic human needs, culture has an influence on the form of the dwelling (Hanson 1999). The findings of this research can be used in future residential design in the studied community. The genotype suggested by the research shall provide the household with a domestic untie that satisfy the social behaviour of the community. Reproduction and dwelling extension shall be flexible as the family develops and grow.

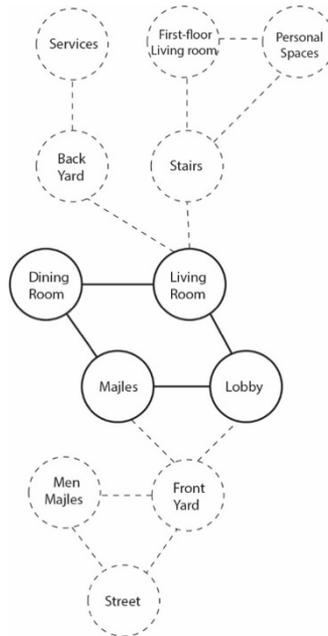


Figure 11 The justified graph represents the typical layout of owned dwellings in Qatar

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# SUSTAINABLE ARCHITECTURE: CONSTRUCTIVE DESIGN SOLUTIONS FOR RESIDENTIAL BUILDINGS

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## **Abstract**

Sustainable architecture has a direct impact on the way people live in a particular region. Climate change is becoming a great issue for our society, especially in warm countries of the temperate, subtropical, and continental climate zones such as Russia, Turkey, Italy, Greece and the rest of Southern and Eastern Europe. One of the most topical and challenging questions today is ability of a building to adapt to the country's climate conditions and to coexist with the local environment. Therefore, in development of projects it is necessary to take into consideration factors that can make the construction process and outcomes more sustainable.

During the design process, the environmental damage caused by a still, static residential building structure is not always taken into account. We often hear the following statement: "Form follows function", but today, creating the form, it is necessary to focus not only on the functional purpose of the building, but also on technological systems that use renewable resources. In the paper, we present several examples of houses, to illustrate how a certain type of structure can coexist with nature, minimizing its pollution. We will discuss important components of a structure, which are responsible for engineering process in a residential building - creating a favorable indoor climate and use of water and power to ensure comfortable living. Very often, the form helps to improve these technical systems because, for example, constructing in warm climate zones means that there is no need to use additional heating resources as this function can be performed by the structural design of the house.

The topicality of this issue is increasing every day, as most of us do not pay much attention to the fact that we spend the largest part of our life in public and

residential buildings, and almost every person at some points of their life faces some sort of natural discomfort. Without our conscious participation, our buildings often adversely affect our environment including ourselves. It is necessary to investigate this issue more closely, because sustainability means not only creating a “new nature”, but also taking care of it.

**Introduction:**

Today the problem of nature’s relationship with architecture remains unsolved. It is not always obvious and is expressed mainly in the preservation and development of green areas in the urban environment, in improvement of neighborhoods and adjacent areas, green roofs, in visual combination of interior and exterior design and in the use of environmentally friendly materials. Architecture should speak with nature, should be integrated into it; and vice versa: if there is no green nature around, then it must be integrated into architecture. Although, installing live green structures in houses or introducing it into the construction of the building is an effective way of merging with nature, it is not the ultimate one. Nature and ecology are expressed not only in the biological form of green spaces, but also in the resources surrounding us, such as wind, sun, earth and water. The proper use of these sustainable resources will help not only to aesthetically transform a residential building, but also to develop its ecological component, which is, in greater scope, responsible for all its function processes.

The fact that a residential building produces more CO2 than motor vehicles or manufactories is not only a well-known fact among scientists, but also the biggest exciting problem for ecologists and builders. (Murphy P., 2007) Edward Mazria, an American architect, writer and educator, found the following progression: between 1940 and 2000, the energy use of the building increased significantly compared to transport and manufacturing - factors that differ slightly from each other (Figure 1). According to Marzia, 48% of the amount of global energy is absorbed by residential buildings (1/6 in the construction of the building - construction waste, vibration, transportation of facilities from other countries, and 5/6 in the exploitation of the building).

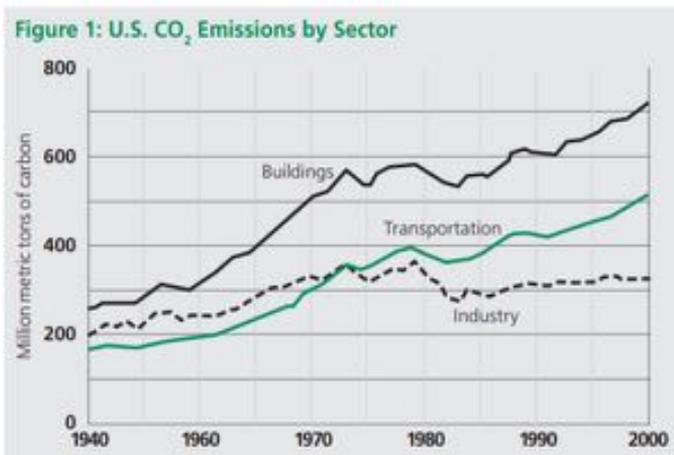


Figure 1- CO2 Emissions by Sector (CommunityService, Inc.)

If CO<sub>2</sub> emissions are considered at a more local scale, country-specific, the following statistics from 2014 should be considered (IEA Statistics © OECD/IEA 2014).

In the moderately subtropical climate, which covers most of Europe and Russia, the percentage of fuel combustion that results in carbon dioxide emissions in residential and commercial buildings in relation to total fuel combustion varies on average from 2 to 23 percent, where France has the highest rate (23.4 percent) and Montenegro has the lowest rate (2.252 percent) (Figure 2).



Figure 2- IEA Statistics © OECD/IEA 2014

Man-made greenhouse gases in the atmosphere disturb the Earth's radiation balance. This leads to an increase in the Earth's surface temperature and the associated consequences for the climate and sea level rise. CO<sub>2</sub> emissions arise from the combustion of oil, coal and gas for energy, wood and waste, and from industrial processes such as cement production. When we discuss residential buildings, it should be considered that not only basic engineering networks for comfortable living can affect CO<sub>2</sub> emissions into the environment, but also technological systems - "active" energy systems that are able to generate energy, have the same adverse effect on the environment. Such systems of solar energy utilization, at high efficiency, allow using solar heat for hot water supply and home heating. However, these systems are expensive and are dysfunctional without the electricity they absorb for generating heat.

In this paper "passive" energy systems are taken into account, as these are the most versatile and multifunctional ways to convert energy in terms of interaction with the environment. Distinctive features of architecture in a residential building are a submission of its form to annual course of solar coordinates in the summer time and prevailing winter winds. Installation of active solar systems on buildings' roofs in traditional architecture, usually, leads to a decrease in their efficiency that is compensated by unnecessary panels of collectors which are not cost-efficient. The topicality of the problem, connected with the passive energy system, is increasing

every day, as in Russia as in most Southern and Eastern European countries such as Italy, Austria, Greece, etc.

**Solar power:**

**Materials.**

In an absolutely passive design, heat is distributed over the room through heat conduction, convection and radiation. In some cases, ventilators and ducts can be used as auxiliary means to facilitate heat distribution. For example, we can imagine a wall made out of a thick layer of concrete or brick, which is installed at a certain distance from the insulating glass unit. Ultraviolet rays from the sun hit the surface of the wall and part of the rays are reflected from the it as infrared radiation, which does not pass through the glass, thus heating the air.

Such wall is called Trombe wall. This French solar heating system (patent CRNS Thrombus, 1956) is based on the principle of solar energy accumulation only in the mass of the building and is similar to the Lefebvre system. The solar radiation is absorbed by a vertical, south-facing glazed concrete wall. Warm air flows through the openings into the living space and is distributed by natural convection. The first house to use this system was built in the Pyrenees in 1962. Brickwork (brick, block, and stone) requires very little energy to produce this material. Usually the material can be produced locally without having to leave the country, and the masonry is resistant to wear and tear from moisture and insects. It is also well suited for warm climates where less thermal insulation is required. Saman is a particularly environmentally friendly material that uses less than one sixth of the concrete block's production energy.(Karolidis, 2003) The stone has always served humans as the main material for the construction of buildings, especially residential ones, since prehistoric times.

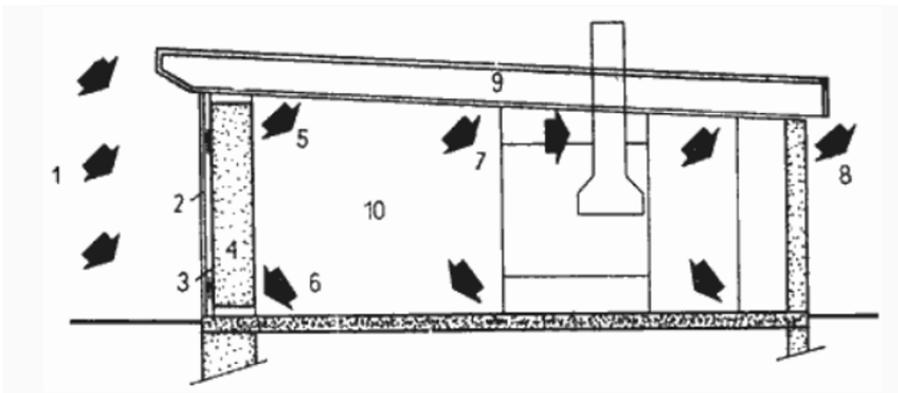


Figure 3- Trombe wall (Scheme of solar heating system for a house in Chauvency les Chateaux (France))

It is also necessary to take into account the level of toxicity of any material and the minimum level of CO2 emissions in the atmosphere when exploitatinga building. Wood has always been considered the most environmentally friendly material in housing construction. The residential building in Figure 4 was built by the architecture firm William Mc Donough+Partners in North Carolina in the United

States by architects Allison Ewing and William Mc Donough. In winter there is good heat retention from passive solar orientation, 'though Ewing says that "we weren't dogmatic about orienting the house directly to the south. It was a synchronicity between passive solar and the views." In addition, no formaldehyde or vinyl was used, and all the materials are non-toxic and were bought locally where possible. The walls are made of SIPS panels, a super-efficient building material that sandwiches a polystyrene core between two layers of oriented strand board, or OSB.

Every architect at McDonough + Partners will tell you that green design fails the minute it becomes just a checklist: "We are trying to define sustainability as broadly and holistically as possible," says Ewing. You can calculate a million green functions, but in the end it's about customers, their lives, their health and well-being. In this case, there are several environmental and CO2 control organizations for the building. (Stang A., Hawthorne C., 2005.)



Figure 4- wooden façade of the house (William Mc Donough+Partners)

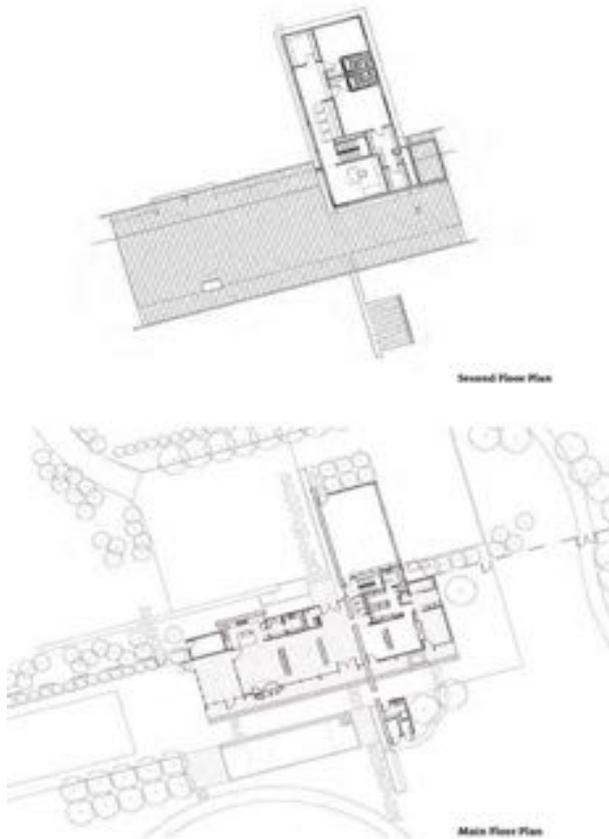


Figure 5- main/second floor plans (William Mc Donough+Partners)

**Quality Control:**

Energy use in construction is controlled by legislation. Building codes are established by the International Council on Codes (ICC), whose mission is to provide codes, standards, products and services for the safety and performance of the environment. The International Code Council (ICC) was established in 1994 as a non-profit organization to create a single national set of building codes combining codes from three groups - Construction, Officials and Administrators Codes International, Inc. (BOCA), International Conference of Building Officials (BWC), and Southern BuildingCode International Congress, Inc. (SBCCI).

**Zero Energy Homes:**

All energy efficient residential buildings can be divided into 3 groups: passive, zero, active.

- Passive houses - houses that use a minimum amount of energy, even during the heating period.
- Zero energy houses (Net-zero) - the amount of energy produced fully meets the needs of the residents. The house does not require connection to energy sources.

- Active house - a house that generates more energy than it consumes. Excess energy is given to the central network. (Skachedub A.V., 2015.)

A new report by JRC (JRC Publications Repository - an online service that provides access to data on research publications produced by the Joint Research Centre of the European Commission) explores the advantages and challenges associated with the “zero energy house” approach. Buildings account for around 40% of energy consumption and 36% of EU CO<sub>2</sub> emissions. Almost 75% of buildings are energy efficient, but only 0.4-1.2% (depending on the country) of buildings are reconstructed annually. By improving the energy performance of buildings, the EU can achieve its energy and climate goals more quickly.

Generally, when it comes to energy efficiency and renewable energy production in buildings, the focus lays on individual buildings. However, the implementation of the EU energy and climate goals until 2020 is currently stimulating the transformation of European neighborhoods into zero-energy areas.

The new ECI report analyses seven (4 are presented in the paper) advanced municipalities with very diverse experiences that have set ambitious targets to reduce energy demand and increase the share of energy supply from local renewable sources.

- In Cloughjordan, Ireland, 350 buildings have already been renovated, reducing energy consumption by 3.5 MWh per year. The new ecological village, consisting of 132 houses, is fully heated by renewable energy sources.

- Helsingør (Denmark) and Helsingborg (Sweden). Helsingborg wants to be a carbon-neutral municipality by 2030 and 100% district heating with renewable energy by 2035. Helsingør sets a goal to be carbon neutral by 2050.

- The Croatian island of Hvar wants to achieve 20% energy self-sufficiency by 2020 and to increase the security of energy supply on the island by optimizing the energy consumption of buildings in the private and public sectors.

- The Austrian Stadtwerk in the Salzburg region aims to become climate neutral, fossil fuel free and almost energy self-sufficient by 2050. The heat demand for new buildings is 75 % below the existing standard. Solar energy currently covers around 35 percent of the annual heat demand, and the district uses 78 percent less energy from fossil fuels.

However, talking about a house with zero energy use is like talking about the utopian history of our time, because not all of us are ready to spend money on the implementation of this type of residential building, and the choice of the architect-designer himself will be just as difficult. After all, creating a house in which there are all energy-efficient systems is almost impossible, or will require a long period of designing and construction works. On the other hand, both in Russia and in European countries, the climate allows the use of such constructive solutions that could partly create a comfortable living environment and will not harm the environment. Such constructions include passive systems, which can be both a bearing element and an energy source.

**Constructive method:**

Passive solar heating systems are designed to store solar heat in massive building structures naturally - through windows, usually facing south. The energy savings are 25-30% and can be increased up to 50% in the perspective future. Among the

components of such systems are: direct sunlight on the surface (flooring); use of pipelines laid on the outer surfaces of walls that are heated by the sun; heating of water stored in tanks, which are located in the upper part of the building (loft) and etc. (I.V.Chereshnev, 2013. Page 80)

Unlike active systems, passive ones are interconnected with a skillful application of architectural and planning decisions, corresponding designs and materials, without requiring any additional technical devices. American expert in the field of passive energy D. Balcombe notes that the trend of modern architecture to use glass surfaces quite meets the requirements of passive solar heating systems with their glass walls, bay windows and overhead lights. The development of passive solar heating systems heralds a reconsideration of the very idea of what architecture should be like. Reducing energy consumption in buildings saves resources and money while reducing pollution and CO<sub>2</sub> in the atmosphere.

Renovating an existing building can also save money, time and resources. If a new building is needed, it should be the size it is required to be for people to live comfortably. Smaller buildings require less materials, less land and less energy to operate. Our cultural education suggests that we should buy (or rent) as many square meters as we can afford, and the more, the better. Unfortunately, the average size of a new house has steadily increased over the decades, as families have become smaller. (KarolidisA., 2003.) Smaller homes and commercial buildings allow us to spend our budget on quality rather than an “empty” space. An example of a compact home is the Carbonpositive House (CPH). The Australian company ArchiBlox has released its design for the world’s first carbon prefabricated house. The CarbonpositiveHouse was created to free us from the challenges of modern life and to contribute significantly to society. Designed and built with innovative sensitivity to architecture and new technologies, CarbonpositiveHouse goes beyond carbon neutrality, making an additional “positive” contribution by producing more energy locally than the building needs. (Figure 6)

Key environmental features:

- Pipes for ground cooling
- Sliding garden walls to block the penetration of the sun
- Green roof for additional thermal insulation
- Buffer zone (light houses and food basket) divides the outside environment
- High quality resistant materials, formaldehyde and no VOCs
- An airtight building envelope improves sound insulation and saves energy.
- Rigidly wired data lines to reduce electromagnetic radiation

The lack of mechanical heating and cooling enables roof-mounted solar systems with a capacity of 5 kW to supply excess energy back to the power system.

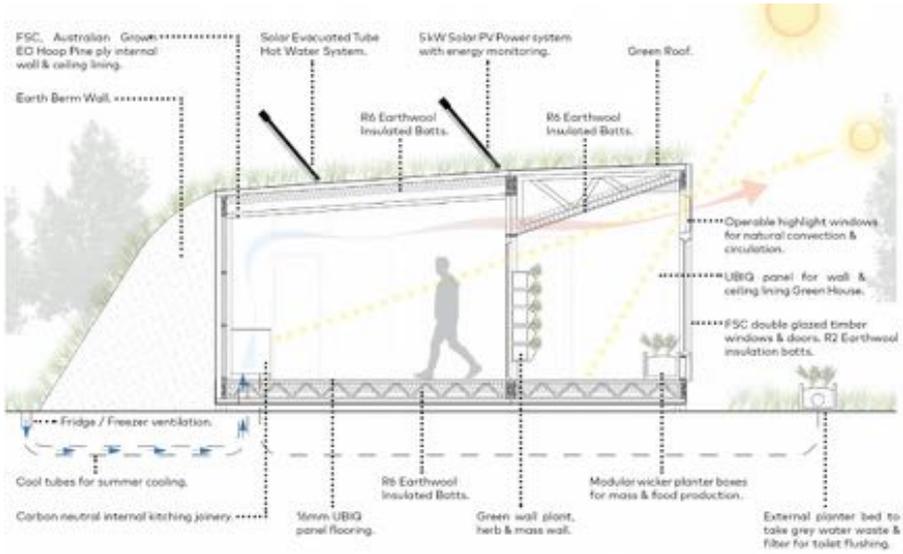


Figure 6- section drawing of the CPN's systems (ArchiBlox)

This house sets an outstanding example of what the future might be for architecture. The more we investigate into these simple details as e.g. using the right eco-friendly material, the more likelihood of the structure to be sustainable and be long-lasting throughout the years of exploitation.

GiffordStudios (Southampton, England.)

Gifford & Partners' headquarters is located approximately 10km west of downtown Southampton on England's south coast. The 1600 m<sup>2</sup> Gifford studio building is part of the practice campus of the organization (Figure 8). While the Brief's main objective was to create a large open plan design studio, an equally important objective was to demonstrate that it was commercially feasible "to build a building that is more energy efficient and more sustainable at no additional cost than a traditional building" (Pettifer, cited in Koehla, 2004). The systems used in this project can also be used in residential buildings, as their functionality does not depend on the purpose of the building. The building was announced "Service Building of the Year" in 2003 in BuildingServicesAwards, won the local competition "Sustainable Business". The "Award" in 2004 and the Institute of Design Engineers in 2005, the David Alsop Award for Sustainable Design.

For the new GiffordStudios building, the goal was to 'maximize the ability of the building envelope to mitigate environmental impacts by allowing simple, low-intensity, low-energy maintenance systems to be used' (Pettifer, 2004); at the same time making full use of available daylight.

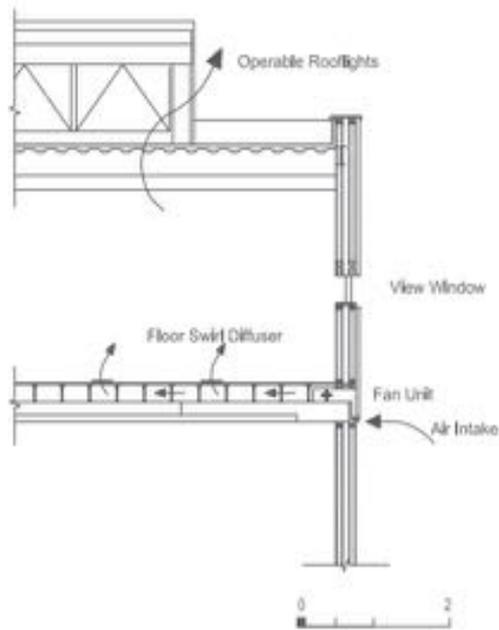


Figure 7- flooring systems of the office (Gifford & Partners' headquarters)

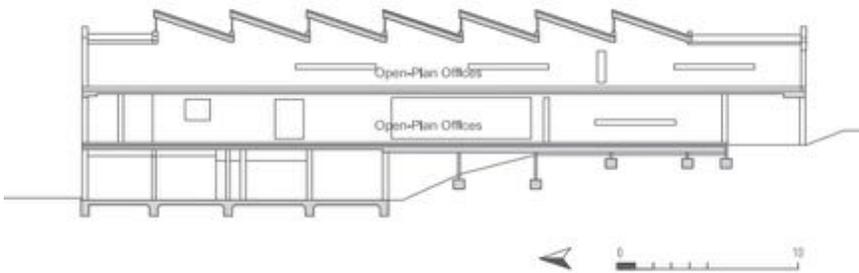


Figure 8- section of the office (Gifford & Partners' headquarters)

Mixed-mode ventilation is used, which includes a mechanical ventilation system with low energy consumption and additional natural ventilation controlled by people. The system uses low-pressure fans installed in the floor cavity that draw in outdoor air through the cedar coating. Floor cavities act as supply chambers, and the air is distributed into the space through floor vortices. [100% fresh supply air can be stored in the floor cavities.] (Figure 7) It is also possible to open the headlights in ground floor windows and roof openings, providing means for additional cooling through natural ventilation in intermediate seasons.

Despite the fact that all ventilation systems are used in this case in a public place, it is possible to implement such a scheme in the living space of the house,

which can provide low energy costs for ventilation of the house, as well as provide a cool airflow on hot days. (Baird G., 2010.)

Another example of sustainable architecture is developed for an international competition, based on the analysis of existing projects in a team with another participant. The project involves various systems for the use of renewable energy sources, namely solar panels (collectors), roof heating systems, a technical room for storing and filtering water coming from local reservoirs or from precipitation, and a system of "black water treatment" waste. This project was designed for a temperate climate zone with warm summers and cool winters, with possible snowfall. Figure 9 shows water inflow into the residential building, its filtration and supply by all sanitary appliances. In the project, the emphasis was placed on water supply and drainage systems, but also, the rational planning of the house, and the specific location of window openings for the use of solar energy was not ignored. In addition to the installation of solar panels, which could store energy and supply it to the living space in the form of electricity, the expansion of window openings in living areas - living room and bedroom - was implemented. These rooms were not chosen by chance, as in these rooms people spend most of their time than in any other, moreover, it is necessary to take into account that this dwelling house is intended for temporary living of people. The purpose of the competition was to use such material as wood in space, respectively, we conceived to use wood flooring. It looks exactly like a usual conventional wood flooring, but its low-tech facade masks an innovative technology that will soon contribute to a wider range of renewable energy sources. The energy flooring includes an additional environmental certificate in the sense that its functional component is mainly made of recycled wood pulp, an abundant waste material. A research team led by Xudong Wang, Professor of Materials Science and Engineering at the University of Wisconsin-Madison, in collaboration with the Granger W. W. Madison Institute of Engineering, has installed a high-tech flooring prototype that collects energy from steps and converts it into electricity. (Cushman W., 2017.)

This facility is a prime example of how maximizing the use of structural solutions, combined with an intelligent choice of materials, helps reduce CO<sub>2</sub> emissions into the environment as well as improve the quality of life of residents. It is the foundation of the environmental architecture behind which the future lies.

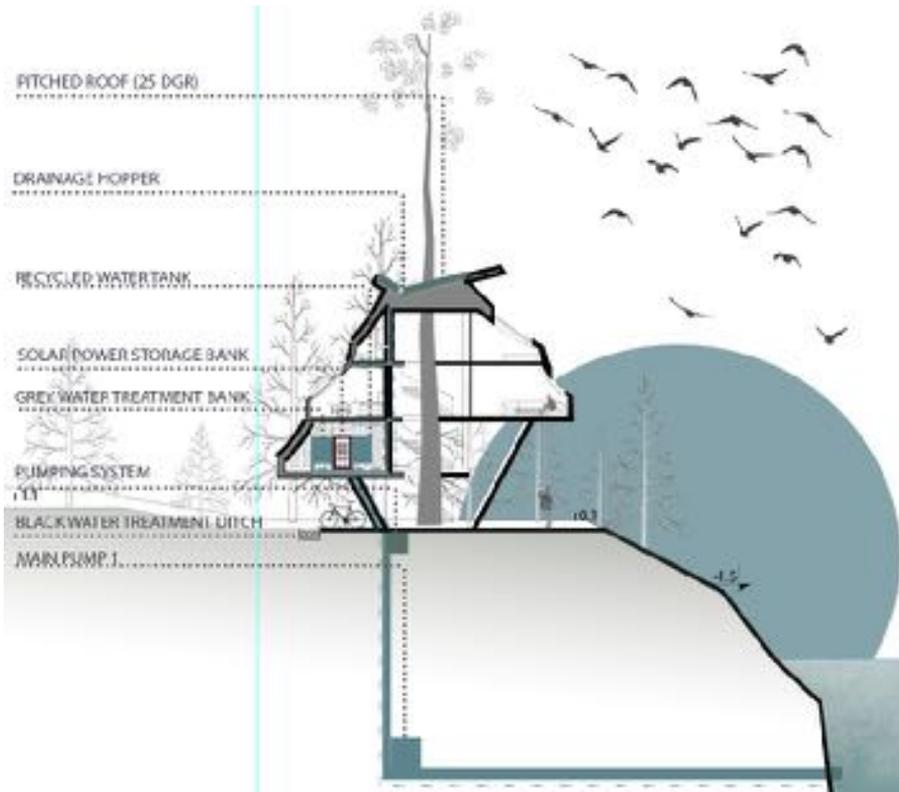


Figure 9- section drawing of water-treatment systems (By the author, 2020)

**Conclusion:**

The topic of ecological housing in today's post-industrial world is more relevant than ever. Man's aspiration to nature is manifested in different directions - architecture is one of them. It is the imitation of forms in nature - bionics in architecture, and the use of environmentally friendly materials, the desire to integrate life with nature. For comfortable living, it is enough to use a number of basic architectural and planning features.

Ecological and energy requirements for residential buildings of the quarter:

- refusal to use technological processes and energy sources that pollute the environment;
- reduction in the use of natural fuel;
- use of local materials;
- increased use of renewable energy sources;
- improving the quality of the indoor climate;
- heat recovery and reuse of water resources.

When designing a region, local climatic peculiarities are taken into account, which contribute to improvement of comfort in construction and reduction of energy load on heat and power supply of buildings. At present, measures are being taken in Russia as well to introduce eco-materials on a large scale during construction works. For this purpose, a "green" standard dated 01.03.2013 on

“environmental requirements for real estate objects” was published. In particular, it states that all real estate objects should be environmentally friendly, resource-saving and energy efficient. (Skachedub A.V., 2015.) For the design of housing in regions such as Russia and Europe, it is necessary to provide certain measures for factors that may affect the development, its complicity with the environment and the ability of the construction to coexist with the climatic conditions of a country.

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# THE ROLE OF GREEN SYSTEMS IN THE DESIGNING AND DEVELOPMENT OF THE CITY – A CASE STUDY OF ŁÓDŹ

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## **Abstract**

The article describes the role of green areas in the city. The author presents the history of the development of green areas in the city in the context of Łódź. The growth of Łódź, a city in central Poland, began in 1821 and only after around a hundred years the city was flourishing. During that time the number of inhabitants had increase from eight hundred to six hundred thousand. The development of this city is intensely connected with the industrialization process – mostly with textile industry development (Olejniczak, 2017).

The article shows the influence of historical green areas on the contemporary city and the opportunities for its development based on the post-industrial heritage in the future. The research takes into account urban parks located in Łódź, along with current activities of the local city authorities.

The goal of the research is to draw attention to the importance of green areas in cities, their relationship with the environment, and their impact on the entire city over the years. Principal results of this research is that greenery in the city has timeless role of the city's development. In the 19th century, as well as today, public parks are a very important place for the inhabitants of Łódź. Designing with nature is still not appreciated.

## **Introduction**

Currently, it is observed that life conditions in cities are worsen. Year by year air pollution is more intensive, which is caused by still increasing a number of cars and local emitters (amount of detached house on the suborns) (Wycichowska, 2017).

Europeans have dealing with terrible air conditions from a long time. The first, significant factor was an industrial revolution. It changed an image of lodz's voivodeship on the beginning of 19th century. People have been moved from small villages to the developing city, from full of green places to polluted space, where was no greenery. For better economic situation people sacrificed their health environment.

The growth of Łódź, a city in central Poland, began in 1821 and only after around a hundred years the city was flourishing. During that time the number of inhabitants had increase from eight hundred to six hundred thousand. The development of



Jewish population started arriving to the city. They had a huge impact on trading with raw materials and finished goods. After some time, they were able to open their own powerful industrial plants. However, the city's greatest development began in the 1850s and 1860s, It was connected with several factors. Firstly, large eastern markets opened for product from these region (the customs duty has been abolished). Secondly, the increased demand met with the development of technology and improved solutions from the western countries, which stay popular on these area. The last very important factor is the enfranchisement of the peasants in 1864, which contributed to the large migration of people to the villages, which surrounding Łódź.

All European and American cities at the beginning of the industrial era were already developed with formed city centers, developed trade and craft. On the other hand, Łódź entered the era of industry as a small settlement poorly connected to the rest of the country, located in a highland covered with forest. The first buildings in Łódź were compacted, creating a frontage arrangement, and gardens were created inside the quarters. However, in next years the buildings consumed nearby gardens and plots were filled with buildings. The local authorities tried to respond to the disappearance of greenery in the city by creating small parks to improve the living conditions of the inhabitants. Also the rich owners of factories founded villas and palaces with gardens, which was very often near their factories creating factory-residential complex. After the introduction of the steam engine, the location of industrial plants was separated from the river valleys, which leads to the creation of factories throughout the city.

Taking into account the fluctuations of the business cycle, the period of dynamic development lasted until the beginning the First World War. During the war many factories were closed and the machines were taken over by the occupiers. After the war, the owners tried to rebuild their market position, but cutting off from previous buyers on the eastern market hindered this process. During World War II, the plants were taken over by the Nazi-Germans and their production was directed to military needs, e.g. to supply the army with uniforms. After 1945, the plant was nationalized. Communist government wanted to keep large plants in particular, allowing small factories to go bankrupt.

The importance of industrial heritage has been underestimated worldwide for a long time. Many nineteenth-century factories were demolished due to the end of the current use and the lack of idea of using industrial buildings. Some of them have been converted into warehouses. However, these facilities were not seen as valuable historical buildings. In the western Europe, the beginning of the 1970s was associated with a change in approach to this problem. In that time an industrial heritage were appreciated and very often it was linked to the program of revitalization many post-industrial districts. This process lead to economic and social changes. Currently, Łódź is facing a similar challenge of revitalizing large post-industrial areas. It is good moment to think about question: What about the role of greenery in these changes.

### **Problem characteristic**

The importance of gardens has changed for centuries. The types of garden arrangements has been changing from ancient times to modern times. The gardens

have different physiognomy in every historical period, and it leads to development of garden over the years (Majdecki, 1972).

Each historical period is characterized by the characteristic types of gardens. Over the years the number of task has increased and also the area has changed, as a results gardens evolved So, the role of garden composition is growing. "Already at the turn of the century, new tendencies emerged in the relation between man and park, garden (...) a large-scale change was initiated, the transition from the garden and park to the great composed green assumptions" (Ciołek, 1978). For years, garden art was mostly associated with the rural landscape, but in the nineteenth century, as a result of the rapid development of industry and the formation of large settlement centers, new forms of gardens appeared. Designing public areas with greenery connects garden art with urban planning (Zachariasz 2006). Public parks and their relations with the environment are becoming important elements in the modern urban structures.

### **The role of green systems in the city**

Currently in Łódź, urban planners designing public spaces refers to the history and previous impact of each areas. Project activities focus mostly on degraded areas and by extracting their value they are restored to the local community. Its strengthens the importance of this places in the structure of the city. One of the currently implemented projects is the "New Center of Łódź". The main goals of this project s is to create an attractive space, which will encourage inhabitants and investors to arrive to Łódź and in consequence become the new "heart" of the city. At the center of this assumption is the renovated first power plant in Łódź, which is currently adopted to a new functions. Next to this building it is planned to create the "Kobro Market" equipped with new plantings of greenery. It is proved that green areas have a city-forming functions and they can consolidate space (Zchariasz, 2006). Considering the importance of this place in the urban structure, there is a chance that the city will gain an attractive public space that will be a catalyst for all kinds of inhabitants activities.

Another project connected with greenery implemented in Lodz is the idea of creating "pocket parks" and special green-street (mostly for pedestrian, which has been called woonerf. They use the ideas of reducing car traffic). Its goals is to improve the attractiveness of space in these places and, as a result, encourages people to stay there. The "Zielone Polesie" project covered the city center district The main idea is to transform several streets into green passages and the creation of new green areas (squares) in undeveloped areas of the quarters.

All this practices are responding to the role of greenery in cities. Very often people don't realize that green areas are important for them. The most obvioust role of green systems is:

a) recreation and education – spending time in surrounding of trees or other greenery have a positive influence on humans nervous system and psychic form. Our ancestors spend more time with nature. A lot of areas were not urbanized. The industry revolution caused that people moved from vilages to cities, where was no greenery. Creating a green areas in cities is a good solution for inviting inhabitants for spending their time in city than on the suburbs.

b) fresh air supply - green systems in cities very often are a great corridor for

ventilation. A riverside boulevard, public parks, streets with trees, give a chance to deliver a fresh air from surrounding areas.

c) urban composition - public parks had an influence for a form of developing cities. The localisation of parks in city structure is not accidental.

d) decorative – this areas are mostly in a spring or autumn very attractive for walking or spending time there

e) accomaning building - Adding a greenery in our nearest surrounding have not only a good impact for aour psyhic form. For example an ivy on facade of building improve a resistance for rain, reduce a heat loss, protect from noise.

f) health barrier - a trees and bush are great barrier for dust or noise. They reduce a negative impact of street onerousness or other city inconvenience.

All examples of this roles are shown below on figure 2

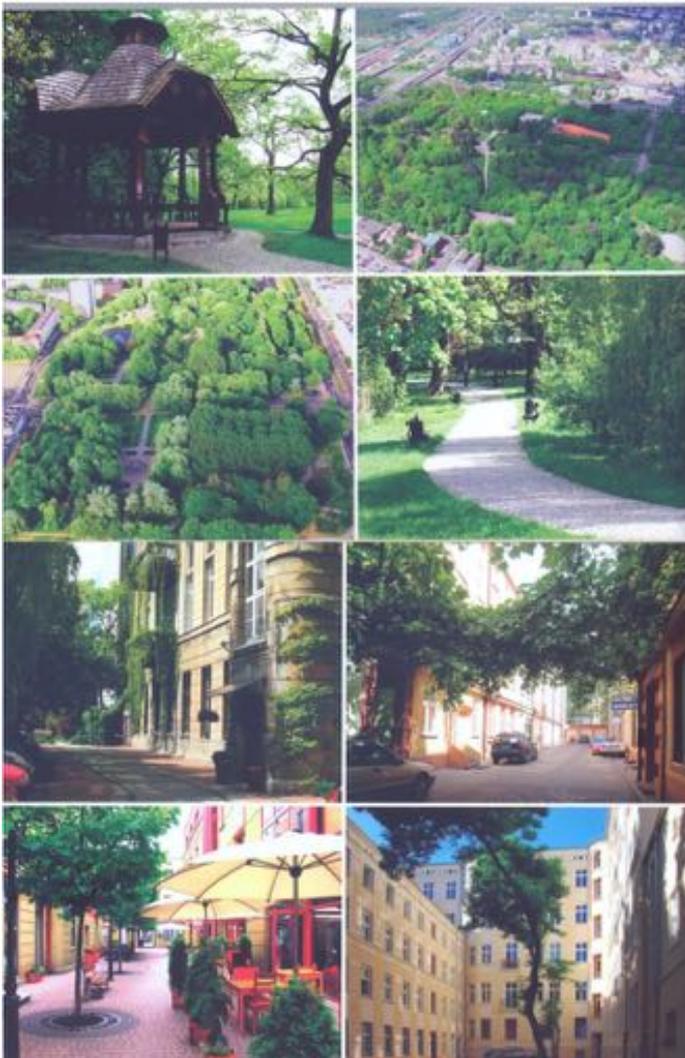


Figure 2. The role of greenery in cities, the most comon examples.

Improving the quality of the environment in which people live in cities is one aspect. Nowadays people change their lifestyle. There is also a visible tendency to spend time actively. The development of cycling infrastructure is visible in the central Poland. It is observed that the number of bicycle paths, free street service points, and other bicycle's infrastructure is still improving. Furthermore, the creation of the Lodz's "City Bike" was very well received by the inhabitants. The system is still growing – on the beginning it covered only the city center, in next years it also extended to the suburbs. Currently a network of the related system is being implemented in the entire voivodship, integrating, among others, bicycle and public transport (mostly train). Unfortunately this development is still not used properly. City has a chance to arrange green areas (both existing and undeveloped) for the needs of sport and recreation. In the majority housing district neighbourhood, there is no place for daily activities. This should be assessed negatively, because while in the center of Łódź we can observe the effort to implement greenery. In this district should be also created green areas, because in this place people spend a huge part of their life. It is worth to emphasize how important role is played by green areas in the human environment. Green areas have been proven to contribute to: improving air quality (they are a barrier for dust- its stay for example on trees leaves), regulating humidity and temperature (temperature change by 2-3°, humidity up to 20 percentage points), reducing an urban noise. Moreover, green areas give the opportunity to rest and soothe the nervous system.

Another case is the center with a high level of urbanization, where it is practically impossible to establish new parks, but the need to implementation of greenery also exists. The most economical and low space-consuming is the idea of using green walls and green roofs. This solutions have a good chance to be used by many investors and private people in cities.. It is worth to mention the advantages of using this type of greenery. It effectively reduce noise, provides protection against overheating of buildings in summer and heat loss in winter, increases fire protection, has aesthetic values. The implementation of greenery in city centers encourage people to stay in them and for variety of attractiveness in these areas. It is therefore a chance to stop the negative processes taking place in many modern city centers. These processes are related to the development of suburbs (urban sprawl phenomenon) leading to increasing urbanization near roads, which leading to cities, occupying agricultural areas causing natural and landscape changes

### **Summary**

The article shows the influence of historical green areas on the contemporary city and the opportunities for its development based on the post-industrial heritage in the future. The research takes into account urban parks located in Łódź, along with current activities of the local city authorities. The goal of the research is to draw attention to the importance of green areas in cities, their relationship with the environment, and their impact on the entire city over the years. Principal results of this research is that greenery in the city has timeless role of the city's development. In the 19th century, as well as today, public parks are a very important place for the inhabitants of Łódź.

Analysing the development of Polish cities in central Poland in the 18th century, provides that the intensification of negative environmental factors was met with

the reaction and many public parks and other green areas has been. Over the years, greenery have significant role in the urban structure. They positively influencing for the quality of life thiers residents, especially in large cities. It is worth to remember when we thinking about the city of tomorrow. Nowadays, we can also observe at deteriorating urban conditions and climate changes. However, the form of solutions in implementing greenery has been changed. The use of traditional forms of green areas in city centers such as: pocket parks, planting trees along communication routes is a common practice. Currently, it is fashionable to develop old post-industrial areas for new purpose. This idea is also popular among private investors. However, exists areas with a high level of urbanization, where the implementation greenery is not possible. In this way it is recommended to pay attention to alternative solutions such as green walls, vertical gardens or green roofs. Developing a greenery system in cities will perhaps make them more attractive to inhabitants and, as a result, will stop the current processes of city depopulation and suburban growth.

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# STRUCTURE, MATERIAL, AND FORM: A DIFFICULT RELATIONSHIP. AN ANALYSIS OF BRICK IN MODERN ARCHITECTURE

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## **Abstract**

This paper explores the relationship of structure, material, and architectural form, using brick as an example. Brick is a traditional building material that dates back several millennia and, originally made by hand, represents craft as well as imprecision. With the introduction of mass production and new technologies, brick has assumed a new identity, often at odds with prevailing aesthetic sensibilities. Further, with the introduction of the multi-layered wall, brick's structural responsibilities have been assumed by more efficient construction elements, diminishing its role to that of representation. The paper investigates the use of brick of several architects of the Modern Movement, at a time that was on the threshold of tradition and modernity, and their redefinition of the language of brick, as well as current approaches to brick construction.

## **Introduction**

The purpose of this paper is to undertake a theoretical discourse on the relationship of structure, material, and architectural form. The center of this analysis is a building's exterior wall, often associated with the role of load bearing and, as its outer boundary, responsible for a building's form. The second aspect of the study is how the choice of materials affects the formal language of a building – its reading as a unified figure or space, the perception of its weight and permanence, or as an illustration of the design process.

As a tool for this analysis, brick will be used as exemplary material to explore the premise. Brick, over the past century, has proved to be an ambiguous material whose character oscillates between traditional and modern, heavy and light. Despite its inherent compressive properties, it has overcome its 'heavy' image, and new readings and interpretations of brick continue to emerge as technology and material science advance.

The study will examine the use of brick in the work of five modern architects and compare their attitudes towards this ambiguous material during a time in architectural history that was in itself ambiguous. While the ideas of the *Modern Movement* dominated the thinking and practice of architects worldwide, it also produced counter movements that advocated a return to the local and vernacular. Simultaneously, versions of Modernism emerged that were both universal and rooted in a particular place – a tendency coined *Critical Regionalism* by Alexander Tzonis and Liane Lefaivre. These approaches embraced the innovations of modern construction while also incorporating local traditions.

These various architectural positions were also reflected in an attitude towards materials, in particular toward brick – a material that was traditionally handmade and is now industrially produced. On the subject of structure, there were also diverging positions. On one hand, exterior monolithic brick walls expressed the nostalgia for brick as a heavy and load bearing material. On the other, modern construction methods, in particular reinforced concrete and structural steel, were expressed in the form of exposed frames, and brick used as infill, clearly expressing its non-structural designation.

The architects whose work is examined in this study include Alvar Aalto and Sigurd Lewerentz, who embraced the imperfect and stereotomic qualities of brick but not without reference to modern construction, as well as Ludwig Mies van der Rohe and Louis Kahn, who, in their buildings, aimed to clarify the relationship of structure and envelope. Le Corbusier's use of brick is further examined as a moment in his career where he begins to embrace raw materiality, and the term *Brutalism* emerged from this period of his work.

### **The relationship between structure, material, and architectural form**

The relationship between structure, material, and architectural form is a problem that has been at the core of architectural thinking since its beginning. It touches upon the question of structure's and construction's role in architecture: should structure and construction methods be legible in a building? Or is structure only a means to an end, and architectural language is developed independently from it? Is architectural form specific to a material or can a material be shaped into any possible form? And, how much do considerations of material and structure determine not only the form but also the layout and organization of a building?

That this problem is not only an ideological and theoretical one but inseparable from construction technique is evidenced by the evolution of the wall section. Historically, exterior walls consisted of a single monolithic layer, often brick or stone, that fulfilled its load bearing, insulation, and cladding requirements. Since structure and skin were the same, the question of legibility of structure did not exist. The modern wall section, however, forces us to confront this issue. Consisting of multiple layers that each takes on a distinct responsibility, it conceals the structural elements behind insulation, cladding, as well as various waterproofing membranes. While the modern wall is more sophisticated from a technical perspective, offering advanced thermal properties, it removes the direct relationship between structure, form, and material and thus obscures the legibility of a building's construction.

On one hand, the independence of architectural form and space from structure allows for its free expression. This was evident during the Modern Movement,

where an emphasis on volumetric forms and pure geometries often meant that the underlying structure was suppressed, enabled by the use of reinforced concrete and in line with the development of the free façade. This was a common direction for architects during the modern period with the exception of Ludwig Mies van der Rohe, an admirer of Karl Friedrich Schinkel (1781 – 1841). Schinkel advocated for the clear expression of construction, which he believed was the basis of architectural language. According to Schinkel, an expressed structure does not only provide intellectual satisfaction but also offers pleasure on a visceral level, because the structural path can be intuitively understood.

Modern means of construction, then, introduce a conflict between the expression of structure and the actual structure. If the structural components are left exposed on the exterior to reveal the load bearing system, the building, exposed to thermal bridging, is subjected to problems with temperature and moisture. Only industrial or temporary buildings, where insulation is less critical, can maintain such purity. In most other cases (with the exception of lightweight insulated concrete, for instance), because of the challenges of construction, a less 'honest' method has to be utilized – that of representation. In this case, the structural scheme is expressed symbolically through a system of structural gestures, while the actual load-bearing system remains concealed.

The idea of *structural symbolism* has been widely employed across the centuries and can be found in Gothic architecture (where some *structural* elements were purely representative or even decorative), as well as in the work of Mies van der Rohe, who, according to Robin Evans, was never interested in structure - only in the *appearance* of structure. Examples of Mies' structural symbolism can be found in his project at 860-880 Lake Shore Drive in Chicago (1951), where purely decorative elements were employed to give the building an appearance of structural rigor. In other projects, Mies defies structural expectations and allows large openings in brick walls through the use of hidden steel beams that span the opening.



Figure 1. Ludwig Mies van der Rohe: 860-880 Lake Shore Drive, Chicago (1951)

Structure can also represent values. For instance, it could symbolize the importance of the building and employ *symbolic* structure, even if structural support is not required. The *AEG Turbine Factory* in Berlin (1909) by Peter Behrens uses what appears to be massive pillars that emphasize the representative character of the building but that are, in reality, not made of the large cut stones but of a hollow concrete shell. Symbolic structure here is used to convey the civic importance of the building. In Gunnar Asplund's *Woodland Chapel* in Stockholm (1920), twelve columns represent the twelve disciples, although less columns would have been required for the structural support.

However, architectural form can be viewed as independent from the structural system. In Romanesque architecture, for instance, structure was regarded as only a means to an end and remained concealed behind murals. In contemporary architecture with digitally designed geometries, structure often serves as scaffolding only but remains hidden behind the complex surfaces.

The development of form independent of structure and materiality has been a widespread direction throughout history. An example is Henry van de Velde's furniture that assumes any form, regardless of its material and the material's natural behavior, in tune with Gottfried Semper's *Stoffwechseltheorie* that promoted the application of artistic form independent of materiality.

These examples illustrate that there has been no agreement in architectural history on the role of structure in architectural form and expression. The technical realities of construction, which make direct exposure of structure difficult, further complicates the problem. One can assume that this problem will remain at the center of discourse, as we continue to inhabit a world that is ruled by gravity and where we intuitively understand structural forces. Structure and material innovation will change but never completely eliminate this innate desire to understand structural forces.

### **Material as an agent in the design language**

The choice of material has a profound impact of the reading of a building, both of its exterior form, as well as of the interior spaces. Materials have the ability to act as unifiers and can group otherwise disparate objects together. Materials help understand which components of a building are meant to be understood as part of one system and which should be read separately.

Traditionally, a building is understood as a system made of planes: horizontal surfaces - the floors, vertical surfaces - walls, and slanted surfaces – the roof. Each of these components have different functional requirements, and material assemblies are designed for this purpose. Floors need durable compressive materials, roofs need materials that withstand and easily shed moisture and are resistant to the sun, while exterior wall materials have less stringent requirements and only form an envelope that protects the elements beyond. Some materials that are suitable for exterior walls, such as stucco, are unsuitable for floors and roofs.

However, from the perspective of establishing a design language, it may be desirable to remove the distinction between the building parts in order to create a unified whole. This requires using the same, or similar, surfaces for all components. When wall and roof are of the same material, the building will be experienced as a whole; the mass or volume of the building will read as one volume, one geometry.

Because of the more stringent technical requirements for the roof, it is the roofing materials that needs to be adopted by both walls and roof. This constraint reduces the choice of materials: one option is metal (such as standing seam metal) – a superior choice for roofing as it allows water to shed and likewise ideal for exterior walls. Other materials suitable for both roof and wall include wood shingles, asphalt shingles, and elastomeric surfaces. Very few other materials are possible and if they are used, they require a workaround through proper detailing: concrete and brick roofs do not easily shed water because of their porosity. In roofing applications, they are typically detailed as a top layer that directs water to an underlying membrane.

Creating a sense of oneness is simpler on interior spaces, as they are not exposed to the natural elements (rain, sun, wind). Here, materials for floor, walls, and ceiling, as well as furniture, can be made from a variety of materials: wood, concrete, stone, masonry.

Using one material directs the focus to the most important quality of a building, such as its character – heavy or light – and its space and form while removing distractions that are inessential.

Traditionally, buildings were made of one material only, such as stone basilica and wooden buildings. Examples of modern one-material buildings and spaces are Sigurd Lewerentz' two churches in Sweden, which will be discussed below. The buildings are completely (and relentlessly) made of brick – exterior and interior wall finishes, floor, and ceiling, as well as altars and benches, and this produces an immersive interior space that gives gravitas to the function of the building and produces a unified interior space.

Today, multiple materials are often used to address the myriad technical and code requirements but there are many examples of contemporary buildings that, at least on the surface, use one material only. An example of an almost all-brick space is Caruso St. John's sunken *Brick House* that employs brick for floors, walls, and built-in elements such as bathtubs. Swiss architect Valerio Olgiati uses concrete extensively on all surfaces, and American architects JOHNSTONMARKLEE, in their *Hill House*, employ an elastomeric cementitious membrane that extends over roof and walls and allows for the elimination of waterproofing details such as metal flashing, further advancing the reading of a singular volume.

Materials, on the other hand, may also be used to clarify functions – not only to distinguish between roof and wall but also to differentiate between structure and infill and to establish a hierarchy. An example is the use of an exposed structural frame – concrete or steel – with another material as infill. An example for functional distinction is Louis Kahn's *Richards Medical Research Laboratories*, in which the *servant spaces* and the non-structural elements are articulated in brick, while precast concrete is used for the *served spaces* and the structure.

The creation of one-ness, using one material only, on the other hand, dissolves the clear distinction between structure and infill. The focus here is not on performance but on surface, in that sense, material can act like a unifying coat of paint.

Finally, materials can be used to illustrate the formal operations used during the design process. Most importantly, it serves to distinguish between an additive and subtractive design process. In an additive process, elements remain intact, and their outer envelope is visible. In a subtractive process, elements are compromised

– cut and sliced, and what remains is a partial envelope and an expressed interior. This interior, if the process of subtraction is to be articulated, must be rendered in a different material, otherwise the operation of subtraction will be obscured. The logic is that of an apple that has been bitten into, leaving a lighter interior, while maintaining the darker skin.

### **Brick as symbol of traditional values**

Brick is a building material that is suspended between tradition and modernity. It has been used since the beginning of civilization and has, after its invention around 10,000 – 8,000 B.C. and the introduction of fired bricks in 3,500 B.C., continuously evolved over the next millennia. Brick was first used in Neolithic Jericho, soon used in all of Europe and became the construction material of choice during the Roman Empire. Brick is a local and low-tech material: it can be made by hand, using only local ingredients and without the help of machinery. Many cultures throughout the world have developed their unique brick building tradition and syntax. In short, brick is a universal construction material with local variations, and it is easily available in all parts of the world.

Yet, throughout the last centuries, brick has experienced an evolution from its low-tech origins: it transformed from a local, imprecise, and handmade building block to one that is machine-made and precise. During the Nineteenth Century, brick manufacturing, with the introduction of machinery for brick production, experienced a break through and today, brick is mainly mass produced.

While the efficiency and speed that come with mass production is beneficial in many ways, it is precisely the consistency and regularity of the individual brick, its perfection, that is often seen as its flaw. Instead of an appreciation for this precision, there is often a desire for the return of the original character of brick, its organic and handmade quality with irregularities and variation in shape and color. But making bricks by hand, in the developed world where cost of labor is high, can only be achieved at a higher cost of production.

This disconnect between means of production and aesthetic sensibilities is one of the contradictions in the contemporary use of modern brick. Another conflict arises out of a broader question in architecture: the relationship between structure, material, and architectural form.

With the emergence of modern construction and mass production techniques, brick's low-tech, hand-made, and heavy qualities have evolved and become more ambiguous. Even though brick is an inherently compressive material, it has lost its role as load bearing element to the lighter and larger concrete blocks that mostly remain concealed within the multi-layered wall. Brick, however, has preserved its role as structural element on a symbolic level: as cladding in the form of a thin brick veneer, it represents solidity and weight – the very characteristics of the traditional brickwork. It also represents a value that, with the advancement of technology, has often been lost: craft. Brick, with its dimensions made to fit inside the human hand, is intrinsically linked to hand labor and bears the trace of human effort. Brickwork, as a craft used across the world, also reflects specific cultural conditions, as shown in the myriad of brick bonds and adorned structural elements that correspond directly to sensibilities in other artistic production. Brick bonds not only fulfill the structural purpose of bonding individual pieces into a unified whole but also serve

as ornament, expressing an architectural and cultural mood: sometimes sober and unadorned, at other times lavish and textured. Brick walls are built up from small pieces row by row, similar to fabric making - weaving, knitting, knotting - creating their distinct patterns.

These two paradoxes, result of a disconnect between modern means of construction and our aesthetic sensibilities, reveal a nostalgia for traditional construction, where walls are heavy and built by skilled craftsmen. Simultaneously, our collective knowledge of construction has kept pace with the evolution of construction, and even as laymen, we intuitively understand structural relationships. A familiarity with structures that were previously unknown to us then make us comfortable with new structural expressions.

Major structural changes have been achieved with the introduction of structural steel and reinforced concrete, and this has had a profound impact on the *Modern Movement*. We will therefore examine how the architects of the *Modern Movement* used a traditionally low-tech, load bearing material as brick in the context of these structural innovations and in their mission to overcome tradition.

What follows is an analysis of the use of brick in the work of five modern architects, followed by a brief discussion of the contemporary use of brick.

### **Brick and the Modern Movement**

Brick stands for values that are in conflict with the ideas of a *New Architecture*. The *International Style* promoted an independence of structure and enclosure. The wall, freed from its load, was to be expressed freely, and the structural elements were independent from the building enclosure - a strong departure from the traditional thick load-bearing wall that provided support and enclosure at once. This allowed walls to be thinner, and this lightness was furthermore foregrounded by its color, white – a de-materialization that emphasized form and geometry over construction and material and further promoted the *machine aesthetics*; the language of mass production.

Despite its association with craft and weight and even though its image was in conflict with the movement's main aesthetic ideals, brick was central to the *Modern Movement*. During this time, two main positions toward brick can be observed: on one hand, the embrace of and sometimes the exaggerated emphasis on its **natural** and organic character, and, on the other hand, the promotion of brick as an industrialized, mass produced material that may have lost its primary function as structural load bearing element.

None of these directions, however, were that clear cut and the advocates of the **organic** character of brick were neither nostalgic or backward-looking nor creators of mere historic replica but instead promoted new readings of brick while introducing new architectural forms. It can certainly be said, however, that the use of brick in some instances was in tune with a reaction against the placeless *International Style* and an agenda to create more local architecture, sensitive to its physical and cultural context.

### **Alvar Aalto and Sigurd Lewerentz: Embracing the imperfection of brick**

Alvar Aalto (1898 – 1976) and Sigurd Lewerentz (1885 – 1975), from Finland and Sweden respectively, countries that both have a long tradition in the use of brick,

both embraced craft and the organic quality of brick. Aalto expressed his interest in the textural qualities of brick in numerous projects, including the *Säynätsalo Town Hall* (1949-52), as well as *Baker House* in Cambridge, Massachusetts (1946-49), where he used locally produced, handmade bricks and included burnt, mis-shapen bricks to emphasize the organic and hand-made quality. But despite his rejection of the machine aesthetics and the promotion of a **humane** architecture, his buildings speak a clearly modern language in their use of new and abstracted form. His *Muuratsalo Experimental House* in Säynätsalo, Finland, (1953) foregrounds color and shape in brick. In addition, Aalto also challenges our reading of the material by juxtaposing heavy brick with the light tectonics of wood construction. In his town hall, he contrasts between the all brick walls and the lightweight ceiling structure.

Sigurd Lewerentz introduces a unique syntax in the brickwork for the exterior walls of his two churches, *St Peter's Church* in Klippan (1966) and *St Mark's Church* in Bjorkhagen (1960), both Sweden. Set in between mortar joints of exaggerated size, the bricks resemble aggregate within a homogenous cast rather than distinct modules and therefore reverse the reading of *figure* and *ground*.

The irregularity of the wall, however, is deceptive: the brickwork is executed with upmost precision and under the premise to never cut a brick.

Dimensional adjustments, necessitated by the floor plan, are absorbed by the mortar joints of varying sizes. This is in contrast to the work of Mies, as we will see below, who achieves an apparent precision through irregularities, imperceptible local adjustments of brick sizes to accommodate the dimensional irregularities of the floor plan.



Figure 2. Sigurd Lewerentz: St Mark's Church, Bjorkhagen, Sweden (1960)

Lewerentz' churches are almost entirely built of brick – walls, ceilings, floors, and altar, creating an intense and immersive atmosphere in the interior spaces. However, in his choice of structure in the church in Klippan, Lewerentz introduces a foreign element that is counter to the established language within the space: rather than developing the support out of the predominant material of the project, brick,

he uses a steel structure, inserted into the interior space like a found object and that, because of its ill fit, appears like a temporary crutch.



Figure 3. Sigurd Lewerentz: St Peter's Church, Klippan, Sweden (1960)

With this gesture, Lewerentz declares that his view of brick is not rooted in nostalgia but that he accepts discontinuity in material and structure. The inserted steel structure within the roughly constructed church seem almost comical - as if structure was an afterthought, added when the vaulted ceilings were found to be structurally insufficient.

Aalto's and Lewerentz' buildings look like they grow out of the ground (from which the brick is made) and crafted by hand. However, both embrace ambiguity – structurally and formally.

### **Ludwig Mies van der Rohe and Louis Kahn: Brick and Structural Logic**

Ludwig Mies van der Rohe's and Louis Kahn's work expresses a different position toward brick. Clarity of structure is present in both architects' work, and both also embrace the advancement of brick production aesthetically, in their perfected shape as a result of machine production. Ludwig Mies van der Rohe (1886 – 1969) used brick extensively until steel and glass became his main material. Mies came from a tradition of brick construction in Germany and had a deep understanding of the construction technique and the modular logic of brick. Brick and brick construction, in his mind, are directly linked to architecture: *"Architecture starts when you carefully lay two bricks together. There it begins."* (Ludwig Mies van der Rohe, 1959).

Yet, Mies transforms the language of brick by combining it with modern construction techniques. His two villas, the *Villa Esters and Lange* in Krefeld, Germany (1928 – 30), feature large window openings – too large for traditional brick construction to span, even with the use of brick headers, which are also absent - the brick course above these openings continues in a straight course, unfit for the structural support of the wall above. In the context of traditional brick construction,

one intuitively notices the structural impossibility and realizes that there must be another structural system at play: a hidden steel beam inside the brick wall. Mies, here, uses brick as a texture, leaving unclear what the structural system is. Looking at the large opening creates an unease in the observer.

Furthermore, the exterior walls at the Krefeld villas look precisely calibrated to the brick module – yet, bricks are cut to fit the dimensions of the floor plan, they only have the **appearance** of uniformity, in contrast to Lewerentz' churches, where all brick modules have a uniform size.



Figure 4. Ludwig Mies van der Rohe: Villa Esters and Lange, Krefeld, Germany (1928 – 30)

In one of Mies' later projects, the buildings on the *IIT (Illinois Institute of Technology) Campus* in Chicago (Masterplan by Mies, completed mid-1940s), the relationship of structure and envelope is made visible with the use of exposed steel frames, using brick as infill. This didactic gesture is a direct translation of the structural diagram into the aesthetics of the building and anticipates the later development of Mies' work to an even clearer emphasis of the frame construction - in his use of steel structure with glass infill. However, despite the structural clarity, there are ambiguities: the steel columns end short of the ground and rest on a few rows of brick wall. Here, the brick is no longer "infill" but becomes the footing. One example is the *Alumni Memorial Hall* from 1946.



Figure 5. Ludwig Mies van der Rohe: Alumni Memorial Hall, Chicago (1946)

This detail was coined the *IIT corner* and defies the clear syntax of the building. It finds a predecessor in a detail at Peter Behrens' building for the AEG in Berlin, on which Mies worked as Behrens' employee, where the steel hinge is supported by a stone base.



Figure 6. Peter Behrens: AEG Turbine Factory, Berlin (1909)

Despite leaving room for misreading, both examples are an illustration of Mies' intention to clarify that the brick used is non-structural – either in an obvious fashion, as in the IIT buildings, or in more subtle ways, as in the Krefeld villas. These two projects are a departure from Mies' earlier projects, where he embraced the typical characteristics of brick: the *Memorial to Rosa Luxemburg and Karl Liebknecht* (Berlin, 1926, demolished), a project that completely grows out of the brick module, and the *Brick Country House* (1924, unbuilt), which is based on the module of the

brick, and where each individual brick has been drawn in the floor plan. In his later work brick, for Mies, assumes the role of cladding or infill and, in its structural role, belongs to the same family as glass.

Louis Kahn (1901- 1974) was interested in establishing a structural theme in his buildings, making the load bearing and construction logic visible on the exterior. He used various materials – concrete, brick, wood – to illustrate the respective roles each building component had, both structurally and in relationship to its use. At *Richards Medical Research Laboratories* in Philadelphia (1965), the structure is made of exposed precast concrete elements, while brick serves as infill or cladding but does not have a structural role. Brick, in the narrow towers containing shafts for mechanical equipment and vertical circulation, furthermore demarcates the *servant spaces*, in opposition to the main *served spaces*, articulated using exposed precast concrete structure with brick infill.

In contrast, other projects by Kahn, such as the *Phillips Exeter Academy Library* in Exeter, New Hampshire (1972), and the *Indian Institute of Management* in *Ahmedabad*, India (1974), employ brick structurally and, furthermore, illustrate clearly how forces act on it. Louis Kahn's famous conversation with brick ("You say to a brick, 'What do you want, brick?' And brick says to you, 'I like an arch.'") is played out at Ahmedabad, where the arch and the circle are reoccurring motifs. At Exeter, the exterior brick walls are load bearing, and to emphasize this, the pillars are tapered, illustrating the increase in load toward the base of the building. Despite the structural clarity, there are ambiguous moments: the corners of the building volume are open, rendering the exterior brick walls like thin sheets that are placed in front of a supporting structure.



Figure 7. Louis Kahn: Phillips Exeter Academy Library, Exeter, New Hampshire (1972)

Mies and Kahn represent a position in which structure and construction technique are the driving forces in the design of the building. Kahn's buildings clearly illustrate the structural diagram through the separation of structure and infill, Mies places less importance on the expression of structure itself but uses representation in lieu of actual structure in order to communicate the structural diagram more clearly.

### **Le Corbusier's anachronistic use of brick**

Le Corbusier (1887 – 1965) is regarded as one of the key figures of modern architecture (as well as the most unpredictable and changing), and he was the strongest advocate for the use of reinforced concrete structures. As author of the manifesto *Five Points of Architecture* (1927), he advocated to free the exterior walls from their structural responsibilities, as already anticipated in his *Maison Dom-ino* (1914), a skeleton structure of concrete slabs and columns.

*Maison Dom-ino* is an illustration of the idea that structure and enclosure are independent. Structure serves as neutral framework; the walls themselves are free and placed as infill or as curtain walls hung from the structural frame. Within this context, Le Corbusier's return to a heavy and load-bearing structure seems anachronistic but speak of his ability to reinvent his work and the intellectual liberty to reassess his own principles. *Villa Savoye* (1928-31) illustrates these principles and further possesses an immaterial quality while defying both weight and materiality.

The *Maisons Jaoul* in Paris (1954-56) were built 25 years after the release of the *Five Points* and represent a fierce departure from these principles. In these two projects, the wall once again assumes agency – not just as enclosure but as structural support. Structure and enclosure are one singular element, manifested in coarse brick wedged between exposed concrete floor slabs. As an expression of the raw materiality, the brickwork is purposefully irregular and inconsistent. This is a dramatic departure from the type of wall from preceding decades, where structure was the generic framework of the building and walls expressed as thin membranes that defined the spaces. This new direction is in line with Le Corbusier's interest in expressed and raw materiality, which he already articulated in the *Unité d'habitation* (1952) and *Ronchamp* (1954) and later in *La Tourette* (1961). In response to this new material sensibility, architecture critic Rayner Banham coined the term *New Brutalism* - from the French *brut*, raw. Subsequent decades were influenced by this new direction, and buildings expressed raw materiality, imperfection, and the traces of labor.

Soon associated with the emergent and often faceless post-war social housing projects that adopted this aesthetic, *Brutalism* was mostly rejected by the general public and literally regarded as *brutal*. But decades later, after high-tech architecture, which aestheticized technology, lightness, and had an air of optimism for the future, became a mainstream trend in architecture, the embrace of an *honest* materiality found a renaissance. This was particularly evident in the work of Swiss architects such as Peter Maerkli, where rough materiality was foregrounded, as well as Peter Zumthor, Herzog & de Meuron, and Valerio Olgiati, who elevated a more refined material purism.

The *Modern Movement* emphasized the aesthetics of mass production, and brick played an important role in this. Yet, brick adopted many different languages, either

emphasizing its character of *infill* (analogous to Gottfried Semper's description of the lightweight fabric within the framework, or the *tectonic*), through emphasis on the inherent structural language of arches and pilasters, or by an overemphasis on its qualities as a handmade low-tech material. The architects of this period used their ambivalent relationship with brick to establish a new language that is suspended between tradition and modernity. Technical advancement – the invention of reinforced concrete and structural steel – made these new expressions and readings possible.

#### **After Modernism: Brick as a light material, brick as a cloth**

In analyzing the use of brick among modern architects, we encountered three types of exterior walls: the bearing wall, the infill wall, and the cavity wall. In the bearing wall, structure and enclosure are one. This wall type was used by Aalto and Lewerentz. The infill wall is the type of wall where structure and enclosure are separated. The structural frame is visible and on the same plain as the non-bearing cladding. We have seen examples of the infill wall in Mies' work at the *IIT* and Kahn's *Richards Medical Research Laboratories*. In another type of wall, which has also been used by Mies, the cavity wall, the structure is concealed behind layers of waterproofing and cladding.

A fourth typology, the rainscreen wall, emerged in the Mid Twentieth Century and became more widespread in the 1960s. The rainscreen wall operates in a similar fashion as the cavity wall in that structure and cladding are separated and structure is concealed. They differ in two ways: the rainscreen wall is permeable and comprises of an additional drainage layer behind the outer screen. And secondly, the rainscreen wall is hung from the structure beyond and forms a continuous plain, similar to a hanging cloth. This means that the rainscreen is typically comprised of lightweight elements, often metal. But even materials that are typically associated with weight can be used. This became commonplace in the 1990s, when terracotta became widely used as a lightweight masonry material for rainscreen facades. Especially Italian architect Renzo Piano (b. 1937) used terracotta - in notable projects such as *IRCAM* in Paris (1990) and at *Potsdamer Platz* in Berlin (1997) - and developed a language that made brick appear light. The bricks at *IRCAM* are contained within steel grid panels and arranged in a stack bond, emphasizing the lightweight and non-bearing nature of the brickwork. The brickwork at *Potsdamer Platz* resembles delicate wood strips, alternating its spacing to filter the light.

Swiss architects Herzog & de Meuron have been innovators in their re-definition of the building façade and their development of *skin typologies*, as shown in their projects for *Ricola*, such as the *Production and Storage Building* in Mulhouse-Brunstatt, France (1993), which uses silkscreen printed translucent polycarbonate façade panels, or the *Signal Box* in Basel, Switzerland (1994), which is wrapped in twisted copper strips that form a screen in front of the building.

Herzog & de Meuron's more recent work continues to employ materials in new ways, now with a focus on brick. At the *Tate Modern Switch House* in London (2016), a perforated brickwork lattice stretches over a precast concrete frame and acts as a rain screen. The brick's pattern is based on a Flemish bond, connected together using elastomeric joints, stainless steel pins, and a resin joint.



Figure 8. Herzog & de Meuron: Tate Modern, London (2016)

This notion of the building skin as a stretched piece of fabric is a departure from one of the firm's early projects, the *Stone House* in Tavole, Italy (1988), in which traditional dry stone is used as infill within a reinforced concrete frame, rendering the small structure both traditional and modern. But in their most recent work, brick has gained elasticity and, rather than belonging to the realm of the wall, has become a drape that stretches in all directions.

This becomes evident in Herzog & de Meuron's *Museum der Moderne* in Berlin (in planning stage), an extension to Mies van der Rohe's *Neue Nationalgalerie* (1968). It will be located between Mies' museum and Hans Scharoun's *Berlin Philharmony* (1963), two buildings that could not be more different: Scharoun's concert hall is an expression of organic form, in tune with the possibilities of its plastic structure, concrete. It is clad in golden metal panels, emphasizing its plasticity and playfulness. Mies' museum, in contrast, is an expression of rationality and consists of the tectonic elements, frame and infill, as proclaimed by Semper: black steel and glass.

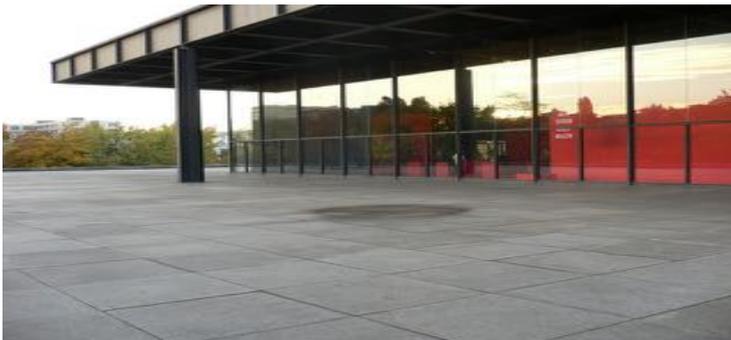


Figure 9. Ludwig Mies van der Rohe: Neue Nationalgalerie, Berlin (1968)



Figure 10. Hans Scharoun: Berlin Philharmony, Berlin (1963)

Herzog & de Meuron's material response to Mies' and Scharoun's materials is brick, rendered as a rainscreen that stretches over the roof and walls of a barn structure. This application of brick is contrary to what one would ordinarily expect of brick. Similar to the project in London, it expresses lightness, as opposed to the traditional heavy brick wall, and acts as filter of the natural light. Unlike Renzo Piano's gridded brick bonds, however, the brickwork in both the London and Berlin projects adopts a traditional language, using brick bonds and thus embracing its textural qualities and alluding to brick's traditional structural role, while using it new ways.

In more recent decades, even further technological advancements, paired with a renewed interest in tectonics, have brought forth new readings. Whereas brick was always associated with knitted or woven fabric and reflected the heavy character of knitwork, it is now often used as a lightweight element. Rather than representing the heaviness of a massive wall, brick applications have transformed into lighter sheets and drapes, often used as curtain walls that are hung from the structure beyond.

### Conclusion

The development of a material language and aesthetic is closely linked to building technology. Even as a layman, one intuitively understands the coherence of structure and materials. This shapes what is perceived as **normal** or comfortable. Thus, with the advancement of technology, expectations of material and structure also advance, and with this, our aesthetic sensibilities. The development of the wall section to a multi-layered assembly has removed the possibility of being **truthful** in the use of materials. Rather, symbolic gestures were used to represent, but not show, the underlying structural system. Simultaneously, there are examples where our structural expectations are challenged. This development is moved forward by technological advancement – the introduction of structural steel, reinforced

concrete, advanced adhesives, thermally insulated bricks, and so forth – will all push material aesthetics into new directions. Using brick as an example, we have seen that one and the same material can render different readings and perceptions. Advancements in construction and material technology will further generate new expressions and applications in brick construction in the future.

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### **Credits**

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# REDEFINING THE CONCEPT OF TIMELESS IN ARCHITECTURE: CENOTAPH FOR NEWTON

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## **Abstract**

Time is a versatile concept with intellectual and dimensional principles. The concept of timeless is closely related to architecture since it contains meanings such as eternity, continuity and glory. This study aimed to redefine the concept of timeless with the cenotaph for Newton of Étienne-Louis Boullée, a design that goes beyond its time and transcends its magnificence. For this purpose, the concept of timeless has been explored through various principles in the architecture of cenotaph as an example of a monument.

Timeless in architecture can be explained as a concept that can be defined formally and semantically through various principles. These principles can be related to the shape, details, fictional and semantic structure of the design, the separation of interior and exterior space, its surroundings, and even its energy. The cenotaph for Newton as an original and pioneering design among monumental building types; the form, the size, its solid and space-free appearance, its heavy impression, and its fictionalization express its formal infinity. The semantic features that emphasize its infinity become timeless in its holiness.

Consequently, in the evaluation of cenotaph for Newton according to the principles of timeless architecture, its unchangeability and complementarity, monumentality, historical, cultural or artistic value, holiness, continuity, and formal features of the building have allowed the redefinition of timeless. The cenotaph will continue to live as an example of timeless architecture.

**Keywords:** Architecture, Monument, Timeless, Étienne-Louis Boullée, Cenotaph for Newton.

## **Introduction**

The discipline of architecture, which can be defined as a creative art, has to deal with the time aspect of the design action. The concept of time, which can be evaluated subjectively and objectively, can be described mentally. In historical period, time is a concept that many philosophers, artists and designers figures it into their own view; but today it is a hot topic to discuss.

Within the scope of the study, the concept of time is considered as an

expression of a process, more broadly than expressing time, moment, and a clear representation. On the other hand, the concept of timeless represents a beginning and an infinite situation that allows actions, can contain sensory and physical creations, and include moments of existence. While the timeless aspect of the architecture may include imaging a certain period and style, it also contains the meanings of continuity and infinity. With this aspect, the concept of timeless also needs different semantic expansions for architectural terminology, besides its known definitions as eternal, steady, not belonging to a certain era.

As important examples of the concept of timeless in the abstract and concrete level, monumental architecture can also be applied to a work elevated in idea and simple in conception and execution, and having something of the timeless nature of great architecture. With specific perspective, the relationship between architecture and timeless can be discussed with examples of cenotaphs. The cenotaph, defined as an empty tomb, consists of a combination of the Greek words *kenos*, which means empty and *taphos* which means tomb. Cenotaph has been a type of building that can also be monumental as well as a symbolic meaning. In this context, cenotaph for Newton that is designed by Étienne-Louis Boullée is an important example for making new definitions on the concept of timeless in architecture.

By reason of reminding the Newton as a monument, the timeless of cenotaph for Newton which describes with the definitions of eternity and infinity, it has represented with pure and basic geometric forms and it is as a crucial architectural idea since it unbuilt. In conclusion, Étienne-Louis Boullée's cenotaph for Newton with its surreal aspect is still an important subject of utopian expansions and definitions in architecture. Its poetic narrative qualities such as creating the perfect form, magnificence and being mysterious suggest a timeless aspect that is hidden in the cenotaph design.

### **Time and Timeless**

Time is a concept that is constantly considered as a mental image or reality. Time has been the subject of different studies with its aspects of being mathematical and abstract. The concept of time in TDK is defined as 'process that an occupation or existence is going, will going or going through, and a certain part of this period, the specified moment and season' (URL-1, 2020). According to the Oxford Dictionary, time is defined as 'the part of existence that is measured in minutes, days, years, etc., or this process considered as a whole' (URL-2, 2020). There are two different definitions of time in Ancient Greek, *chronos* and *kairos*. While *chronos* defines chronological or sequential time, *kairos* represents the uncertain moment when an important and meaningful event takes place. *Chronos* is about counting, while *kairos* is more about the moment (Çağlar, 2014). According to these definitions, the concept of time varies when no measurement is made. It can be defined as a broad period expressing an event or it can be used as an expression of instantaneous occurrences. Due to this diversity, time has found responses in different philosophical ideas and gained different ways. In the history of philosophy, time as a phenomenon that is questioned is one of the common topics that can represent reality, beginning and ending, progression, being subjective and objective (Çoştu, 2015).

Time, which is a subject of evaluation and interpretation, changes as it is a living phenomenon. In order to express certain situations, connotations are derived by

expanding or narrowing the meaning of time. There are two types of philosophical approach related to time: timeless and temporality. The timeless either rejects the reality of time or locates true being in something that is timeless, such as Plato's forms, Aristotelian essences, God, or the Absolute of the idealists, temporality gets the truth about time (Gale, 2002). In this context, the concept of time is related to the temporal aspect of various and different facts. The issues of synchronizing certain aspects of specific concrete events or events with potential to be concrete, or setting a date for them, are related to their temporalization (Elias, 2000).

Temporalization refers to the determination of time. The concept of timeless has a very different meaning to this definition and expression. Timeless has a meaning such as not belonging to a time period, but it can also be perceived as a continuation of the validity of these periodic principles.

According to Soykan, there are two types of time: infinite time and measurable time. The time expressed as infinite is quite outside the measured time definition (Gözcü, 2018). Besides according to McTaggart (1909), infinite time is more uncertain than the type of time being experienced. It is used in at least three distinct senses: to denote unending time, to denote the timeless of truths, and to denote the timeless of existences. In the infinite time, the first definition, the relation of infinity with time is quite simple. Time, which is limited, is part of infinity. The timeless of truth refers to the validity of all laws, scientific or historical information in general. The infinity of the existing, which is the third time definition, exists as long as the principles and relationships of matter or substances are in reality. As long as cases are real, they exist (McTaggart, 1909). As a result, the concepts of timeless and temporality are created by interpreting the perception of time differently. These concepts have different principles and are imaged in many ways.

### **Timeless Architecture**

Architecture is a discipline that is both theoretical and practical. Architecture, which is considered only as a formal production, is actually supported by different disciplines due to its structure and nature. In the context of the discipline of philosophy, architecture, which essentially represents space and deals with all its details, contains different parameters. One of the most important of these parameters is time.

Space-time relation was first used by cubist painters in the early 20th century. They resisted the use of only one perspective to represent the truth in space. In order to give a more realistic impression to the time of the space, they added the time to the three dimensions of the traditional perspective as the fourth dimension. In this fourth dimension of a painting there is the idea of merging and overlapping different images of the same object or the same people. In the 1980s according to Hermann Minkowski 'space and time are doomed to disappear like shadows when they taken separately.' To perceive an architectural space, time is required and in this context, since time varies from person to person it is a concept produced by human perceptions. However, every element of a built environment, a space, exists as a reflection of time (past and future) as well as architectural products (Altan, 1992).

Space is related to time in concrete and abstract ways. While this relationship expresses a process as a real measure, it can also be perceptually imaged. In other

words, space production requires a process and time but beyond that, it also has the feature of reflecting the time it was produced and belonging to the age. Exactly at this point, there are examples of spaces and buildings that can cross the boundaries of the time it was produced, affecting different periods and may even be valid in these periods.

For Aristotele, *kairos*, one of the definitions of time in Ancient Greek, was the time and space context for his proof to be delivered. The Ancient Incas regarded time and space as a single concept. Similarly, there is the concept of 'ma' in Japanese, which defines time and space together. Ma is defined as place and regards as the product of the space lived and the time lived. The concept of 'time-place' can also mean the 'space in flow' with the characters in Japanese. All experience of space is a time-structured process, and all experience of time is a space-structured process (URL-3, 2020). Space, which is the base of architecture, has been associated with the concept of time since ancient times. The fact that space and time are not separated from each other shows that they have partnerships both in real and semantic contexts. Based on this context, it can be stated that time is a component of architecture.

Time began to be handled differently with Einstein's Special Theory of Relativity. Time has been described as the fourth dimension of space. As architecture is considered as a finite, quantifiable and static area since the first space production, it took a long time after the discovery of the theory to settle the time in this discipline. Sigfried Gideon introduced this idea in his book 'Space Time and Architecture', and then Juhani Pallasmaa described the relationship between time and space as 'as time loses its duration, and its echo in the primordial past, man loses his sense of self as a historical being. Architecture emancipates us from the embrace of the present and allows us to experience the slow, healing flow of time. The time of architecture is a detained time; in the greatest of buildings time stands firmly still. Time and space are eternally locked into each other in the silent spaces. Matter, space and time fuse into one singular elemental experience, the sense of being' in 'The Eyes of the Skin' (Pallasmaa, 2005). Detained time can be redefined as timeless when it expresses the continuity of a state of the building in certain period. Time and space which are interconnected exist as a whole. Since detained time expresses an infinity, it is valid in all periods and makes the space timeless.

In the historical process, with various thinking styles and principles that emerged in different periods. These styles have a starting and ending time and show their effects within a certain period of time. Stylistic differences reveal the process of change, historicity about a product, thus temporality occurs. As a result, the art is a historical and temporal phenomenon, and the artistic products such as painting, music, and architecture also come into being in temporality. Buildings, which are products of art because of historical and cultural entity, have also a different temporality principle as it contains a living and lived space as well as its abstract temporality. In this context, temporality has two different principles in architecture, which are directly related to buildings. The first temporality principle is related to the fact that buildings are living beings. The building in the life cycle is constantly changing and transforming. Buildings live or die and this situation which is the life of the building is one of the definitions of temporality in architecture. The other definition of temporality is related to the product of entity that is the existence

of the building. It expresses the existence of the building without physical reality, and defines the essence of the building away from the substance-form relationship. It represents the unchangeable and immortality quality and artistic stance of the building as a cultural entity. Buildings in architecture coexist within these two different temporal principles (Tunali, 1984). In this context, the temporality of the building is evaluated concretely on its physical property and abstractly on its artistic value and immortality. At this point, the expression of timeless architecture occurs.

Wittmann summarizes the relationship of architecture with time in three ways. First of all is the influence of space on the experience of the flow of time, the second is perceived duration of the age of a building, the third is the aspect of timeless of the design principles of architecture. In this context, time and space in architecture are designed and constructed together. There are underlying design principles for successful architecture which are timeless, i.e. enduring, and which can also be found in successful contemporary buildings. Every era has a different culture and this is reflected in art history. The crucial thing is to identify and use these principles that can express timeless (URL-4, 2020).

Christopher Alexander (1979) explains the concept of timeless with the principles of alive, whole, comfortable, free, definite, egoless, and eternal. He acknowledges that the principles of timeless exists, although it states that it cannot be fully named or expressed in words, and that there is a timeless architectural essence that goes beyond time. The purpose is to contribute to the timeless by identifying different principles, beyond making an ancient definition of timeless (Essawy, 2017). Alexander (1979) states that the person should get rid of artificial images that distort the nature and learn a discipline that teaches the relationship between the environments. He expresses that timeless is hidden in learning this discipline and then keeping it. He regards timeless as the basic quality of life and soul in the building or space. He creates the expression of timeless architecture that relates infinity to architecture. He defined timeless as “places, which are comfortable because they have no inner contradictions, because there is no little restlessness disturbing them” (Essawy et al., 2014: 135). For example sacred buildings, where the person feels comfortable, in harmony and stressless, are described as timeless (Essawy et al., 2014).

Timeless architecture can be defined in several ways. Timeless can mean durability and energy based on the physicality of a building. Timeless architecture does not have a lifetime, it is not outdated because it maintains its validity with different functions as it was designed. The most difficult way of making timeless design is that it can take a long time to reach this timeless (Gawronski, 2004). According to Alexander (2002) “sacred architecture is usually defined as a building or monument that has a religious function or uses the vocabulary of forms consistent with religious practices, and often qualified to being ‘timeless’” (Essawy et al., 2014: 133). Different meanings can be attributed to the architectural design with the timeless way. For example, sacred structures have been associated with a rigid geometric form, measurement and proportion that transmits, transfers and symbolizes their sacredness. Similar to this approach, some basic principles have been discussed and developed in order to access the divinity (Essawy, 2017).

Timeless architecture is associated with tombs and monuments throughout history and even today. There are examples of contemporary architecture designed

to be timeless and ancient architecture that has become timeless. The common feature of the timeless of these examples is their environment which connected with their location. A tomb built with a material in its area can define timeless architecture, contrary to this, a different timeless can be defined by not completing the construction of the tomb created with a different material from outside where it is located. In order to express divinity in monuments or tombs, the features of the place are emphasized and timeless is associated with the context of the place. These buildings can evoke infinity perceptually and sensuously, but the important thing is that the cycle of nature creates timeless. In this context, timeless architecture comes up with physical building and place and it is hidden in the integration of these two principles (Gawronski, 2004).

Timeless architecture is described in various principles in different sources. In this context, general principles are as follows: darkness and light, signs of wear, traces of workmanship, haptic intimacy, sense of the whole, monumentality, human scale and water. Depending on these principles, the definition of timeless architecture is an integrity with the physical environment conformably and establishing connection between the past and the future while integrating with the architectural environment. According to Essawy (2017), other principles related to timeless created by some architects by examining in detail beyond general definitions are determined as in Table-1.

Table 1. Architect’s principles of concept of timeless

Vitruvius’s Approach	Brill’s Approach	Tabb’s Approach	Alexander’s Approach	Karim’s Approach
order	making a location and center	center	levels of scale	earth energy design principles
arrangement	making orientation and direction	bounding	strong centers	sky linked design (verticality)
eurhythmy	spatial order	direction	boundaries	qualitative harmonics
symmetry	celestial order	descent	alternate repetition	design principles
propriety	differentiating boundaries	ascent	positive space	motion in design
economy	reaching upwards	passage	good shape (form)	qualitative system scaling
	triumph over the underworld	numeric order	local symmetries	archetypal codes design
	bounding	geometric order	deep interlock and ambiguity	material balancing energy
	passage	spatial order	contrast	biosignature
	ordered views	anthropomorphic order	gradients	
	light	ordered nature	roughness (texture)	
	materials	celestial order	echoes	
	nature in our places	materiality	the void	
	finishing a place	elementals	simplicity and inner calm	
		ceremonial order	non-separateness	

The concept of timeless can be expressed with different principles depending on various thoughts in architecture. One of them is the state of going beyond the period with its meanings such as eternity, continuity, validity and not belonging. Another principle is that the context and the building form a whole. In the light of these principles, the concept of timeless in architecture is exemplified with monuments and cenotaphs commonly. This types of buildings can become timeless by expressing divinity with its principles of being sacred, magnificent, eternal, and forming a whole with its surroundings in its context.

### **A Timeless Monument: Cenotaph for Newton**

The concept of timeless which is derived from the concept of time can be interpreted in various ways in architecture. In parallel with this diversity, the types of buildings are monuments, tombs and mausoleums. In this context, it can be said that the value of monumentality stands out in expressing timeless in architecture. The reason why timeless in architecture is dealt with these types of buildings is that it can be expressed as the symbolic dimension of monumental architecture and the representation of infinity in parallel.

Étienne-Louis Boullée, one of the designers whose structures and designs are considered as an example of monumental architecture, was born in Paris in 1786. He started his architectural career at the school of Jacques-Francois Blondel. He learned 17th and 18th century French architecture, called Baroque and Rococo, and Neoclassicism that developed after centuries. Boullée is both a visionary designer and writer and an artist of transcendent quality during his time.

Neoclassical design in France emerged in 1772, the year when Boullée was admitted to the Academie Royale d'Architecture. As of this date, in the buildings and theories of Boullée, it can be seen that it proceeds more clearly than symmetrical, geometric Neoclassic forms than asymmetric, highly decorative Baroque and Rococo styles. His buildings are very symmetrical and use familiar Neoclassical elements, including columns, triangular pediments and fringes. To summarize the architecture of Boullée, by synthesizing painting and architecture, he created new structural forms by applying the effects of light and shadow, and is beyond the research and imitation of Neoclassicism's pure geometry (Eriksen, 1974). Boullée, based on the understanding of architecture in line with the needs, which is the essence of Classical Greek architecture, which is the basis of Neoclassicism, avoided the excess of the elements than the need, and wanted to give the form a beauty (Tuncer, 2018). According to Boullée, nature is activated, bounded and surrounded by architecture. He combines the concept of "pure space" defined by Locke and Voltaire with architecture and displays an utopian approach. He proposes architectural space as a relative, boundary, absolute, pure and public space (Terzoglou, 2012).

In this context, one of the works of Boullée that reflects the design concept in the best way is cenotaph for Newton which is the most symbolic project of Boullée. Drawn by Boullée in 1784, the cenotaph is described as a giant monument attributed to Newton (URL-5,2020). Despite the fact that the building, which states that the architect should aim at glory, was never built, its design was spread and settled in a professional environment (URL-6, 2020). The cenotaph for Newton, which is an important example in the consideration of timeless in architecture, is neither Newton's number of movements nor duration of objects; is the amount of movement and objects. Time is also a valuable example in that it is a reflection of the Newton's viewpoint that it has its own nature regardless of the existence or absence of the world created.

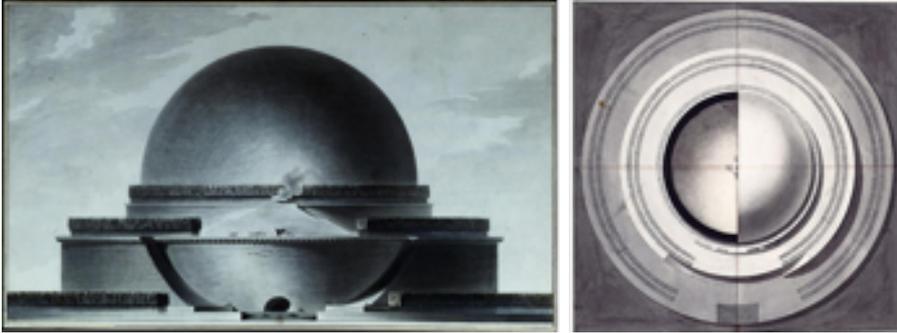


Figure 1. The illustrations of the cenotaph for Newton (URL-7, 2020)

Combining the emotional effects of Romanticism, the intense rationality of Neoclassicism and the splendor of Antiquity, Etienne-Louis Boullée's Newton cenotaph is an artistic achievement that highlights both modern architecture design and the symbol of certain historical breakings. The cenotaph is a poetic respect to scientist Newton, who became a respected symbol of Enlightenment ideals 150 years after his death. Beyond representing his individual creative genius, Boullée's approach to design has shown architecture as a pure art from building science. The purpose of the design is to predict and inspire a conceptual idea in spatial forms. Boullée's quest is unchanged and for an integrative architecture (URL-7, 2020). In this invariance and integrity, the feature of the cenotaph being supreme strengthens the quality of timeless. The cenotaph is glorified both semantically and formally. With its dimensions and proportions, the cenotaph, which is considerably larger than the human scale, is glorified with this feature, and it is glorified due to being sacred because it symbolizes the human and holds his grave. In this framework, the cenotaph reflects the semantic importance of being sacred along with its formal quest.

Boullée looked again at the historical monumental forms of Greek culture in search of pure forms derived from nature. Beyond praising these historical examples, he overcame them and reasserted the classical elements on a scale and level that had not previously been achieved. According to his drawings, the first step towards the cenotaph for Newton begins with the monumental staircases at the base of the much higher global monument. While the daylight illuminates a very small part of the sphere, it leaves the entrance open and most of the mass in the shadow. For Boullée, the sphere in design represents excellence and grandeur. It creates infinite domination over the senses by creating smooth light transitions on its curved surface. The sphere with a diameter of 500 feet is embedded in a three-layer cylindrical base. Although the volume seems embedded, Boullée completes the sphere figure by adding two curved ramps to it. The cylindrical base is reached with a single large staircase.

The drawings of cenotaph differentiate them by affecting the legibility, impact and atmosphere. For example, showing a small door on the second level plaster but not showing the means of how to get here is related to this effect and atmosphere. Narrow side stairs provide an external connection between the second and top terraces. Cypress trees, which are associated with mourning in Greek and Roman

culture, are closely spaced on each floor and limit these floors. The lower level global entrance portal opens into a dark and long tunnel that lies below the central volume. As the stairs rising as you approach the center ends, it brings the visitors into a porous space. Here, in the middle of the center of gravity, there is a sarcophagus belonging to Newton as the only indicator of human scale. Boullée creates an inner world that reverses external lighting conditions. The light is emitted from a large lamp hanging at the center point of the sphere at night. While outside, a black night illuminated by stars covers the interior. Light penetrates through the narrow holes into the thick crust, whose assembly corresponds to the positions of the planets and constellations. The inaccessible corridor in the shape of a quarter circle that appears in the section wraps around the sphere. As can be seen in the cross section of the cenotaph, the dome of the sphere is in sections that thicken from the top to the supports. The sections is suggested as a statement of power. The nudity and unadornedness of the walls creates a gloomy impression. Changes in air and fog-like elements strengthen the sense of mystery (URL-7, 2020).



Figure 2. Interiors illustrations from the cenotaph for Newton (URL-7, 2020)

The cenotaph is a design that bilaterally suggests the unity of time and space when both designer Boullée and the person he is attributed to are considered in parallel with Newton. The design, which is constructed quite differently from the period that it belongs functionally, has symbolic meanings in very wide expansions. Considering these aspects, it can be said that the cenotaph has turned into a timeless architectural product by exceeding the time period designed.

### **Timeless in Cenotaph for Newton**

The cenotaph can be described as one of the timeless designs in architecture with its many features and qualities. Since the architectural styles combine the characteristics of sensory, rational and magnificent, the cenotaph is an expression of an eternity, in which relations are sustained. Cenotaph design, which is attributed to artistic success as a common expression of various styles, is also considered as a work of art when it is evaluated within the scope of universality and continuous validity of art. The cenotaph, which is stated to have a poetic aspect, becomes timeless in the eternity of art by reinforcing its artistic identity with this aspect. The cenotaph cannot be limited to a time frame, it cannot be represented as a style. The design has created a general set of valid qualities in its own right, and these rules have become valid not only in one period but in every period.

The memorial as Newton's symbol will exist forever. Because the cenotaph is attributed to Newton, it becomes timeless as an expression of its existence. According to Newton's definition of time, time is about existence, so it corresponds to the concept of timelessness in architecture, which expresses eternal existence.

Since Kenotaf takes Newton's existence from the past to the future, it becomes infinite as a transcendent being.

In cenotaph design, there is more anxiety to put forward a conceptual idea and inspire, than to create place and space. In fact, the produced space stands out with the meaning it carries more than its function. Meaning and concept continue the same expression since the first process created due to the dominant symbolic effect of form. A function for space may change or its meaning may change, but for a more monumental space, this change is more difficult to occur. The monument is a form of representation and if this representation is variable, it loses the first necessity of the design and becomes meaningless. In such a situation, a monument that has lost its meaning does not actually represent or represent anything. Considering from this point of view, the cenotaph is infinite, continuous and timeless because it is both semantic and conceptual.

The cenotaph can be described as timeless when it is considered formally beyond what it symbolizes. Formation of the form with a pure sphere is an indication of the pursuit of perfection and magnificence. Although this search is also present in the semantic and functional content of the memorial, it brings a formal completion with its spherical form. The fixing of the sphere by placing it on cylindrical platforms has added a stronger appearance to the sphere, which actually expresses a greatness, with its feet on the ground. The strong appearance is complemented by monumental references from the Greek and has enormous dimensions. Looking at all these formal features, the cenotaph has a purpose to rule against Newton over time. That is why the cenotaph for Newton is semantically as well as semantically timeless. The same timeless expressions exist when looking at the design from the interior. The huge sphere create different perceptual effects in day and night environments. While a dark indoor atmosphere prevails in the daytime environment in the cenotaph sections, a bright indoor atmosphere comes to the fore in the night environment. In addition, the indoor and outdoor spaces do not have a common time and they experience different moments at the same time, reflecting the concept of timeless.

The cenotaph for Newton expresses eternity and continuity in different contexts, resisting to belong to a period by becoming timeless. Continuing its existence within the same meaning from the time it was first designed to present, the cenotaph has become one of the reasons for its timeless, perhaps as a utopia, as it is an idea project that has never been realized.

In questioning the timeless dimension of the cenotaph for Newton, the principles of architects put forward by Essawy can be used as important tools (see Table 1). The approaches of architects for the concept of timeless are important in terms of evaluating the principles according to five different architects, as well as being important features in the study of the timeless of the cenotaph.

- According to the Vitruvius approach, the cenotaph for Newton is completely symmetrical in terms of structure, so it has an order and arrangement. Looking at the design in section and plane, it is seen that it contains eurhythmy. As it is an idea project, the principles of propriety and economy are unquestionable.
- According to the Brill approach, the cenotaph for Newton does not meet the criteria of making a location and center, nature in our places, finishing

a place because it is an idea project. Since the building does not make direction definitions such as right-left, forward-backward, up-down, there is no making orientation and direction principle. The large opening with the tomb symbolically claims that the spatial order principle exists. It can be said that there is a celestial order due to the night and day conflict created both indoors and outdoors. Light is very important in the appearance and effect of the form, and the materials that give heavy and hard appearance are very important in shaping the form. Since the boundaries of the building are symmetrical, it is equidistant from the center, so it has differentiating boundaries. The form creates a frame with the image of the envelope, it shows the bounding principle. It is observed that the passage and door principles that provide the relationship between the interior and the exterior, the window layout and the ordered views, which have a meaning that distinguishes the holy from the outside world, are also present in the cenotaph.

- According to Tabb's approach, though the cenotaf does not physically meet the center principle, it is also available semantically, as expressed in the center principle, celestial order and materiality principles, and the Brill approach. The principle of direction started from a central point and created a symmetry axis, largely shaping the volumetric effect. Descent principle, which expresses the bond of cenotaph with the ground, emphasizes numeric order and geometric order principles because it expresses the numerical and formal balance. It is not correct to mention the anthropomorphic order principle, the ascent principle due to the lack of vertical orientation, and the order nature principle, since its relationship with the environment cannot be determined precisely.
- According to the Alexander approach, the principle of boundaries shows that alternate repetition and good shape principles exist because it creates a rhythm based on symmetry. While the gradients principle can be observed due to the ongoing fragmentation in the ceiling section of the sphere, the contrast between day and night is revealed with the contrast principle. It can be said that the simplicity and inner calm principles, which express simple and pure geometry, define the sphere with the void principle, which has a heavy and full appearance. Since the cenotaph expresses a clear whole, it can be said that the positive space principle is not available, and because it is an idea project, non-separateness principles are not available. Texture details such as roughness (texture) and echoes are not qualified to be determined from existing documents of cenotaph. In addition, since principles such as levels of scale, strong centers, local symmetries, deep interlock and ambiguity, roughness are aimed at evaluating environmental data, they could not be detected in the cenotaph.
- Finally, when Karim's approach is examined, earth energy design principles, qualitative harmonics, design principles, motion in design, qualitative scaling system, archetypal design codes, material energy balancing, biosignature principles for the cenotaph, which is an idea project, could not be detected. The sphere form does not contain verticality makes the evaluation of the sky linked design principle insignificant. The fact that the

timeless principles in Karim’s approach are energy-oriented showed that there are no suitable tools for questioning the concept of timeless on the scale of cenotaph.

Table 2. The concept of timeless principles of the cenotaph for Newton

Vitruvius’s Approach	Brill’s Approach	Tabb’s Approach	Alexander’s Approach	Karim’s Approach
order	spatial order	center	boundaries	
arrangement	celestial order	bounding	alternate repetition	
eurhythmy	differentiating boundaries	direction	good shape (form)	
symmetry	bounding	descent	contrast	
	passage	passage	gradients	
	ordered views	numeric order	the void	
	light	spatial order	simplicity and inner calm	
	materials	celestial order		
		materiality		

In conclusion, according to the five approaches put forward by Essawy (2017), when the cenotaph for Newton is evaluated, it shows that some of the principles that stand out are in the potential to serve the formal and semantic expansions of the cenotaph (Table 2). The cenotaph for Newton’s prominent titles such as order, form, void, material and light; it was also observed that the timeless principles took place in four of the five approaches. It can be argued that the principles in the following table are important in evaluating the cenotaph as a timeless architectural product and redefining the concept of timeless in the context of architectural knowledge. Therefore, the possible principles of the concept of timeless in architecture have been redefined in the example of the cenotaph.

**Conclusion**

Although timelessness is a discussed topic frequently, its limits and principles are not defined by clear rules. The concept of timeless, which includes the meanings of infinity and continuity, emphasizes glory as an expression of a sacred approach. Timeless in architecture can be explained as a concept that can be defined formally and semantically through various principles. These principles can be related to the shape, details, fictional and semantic structure of the design, the separation of interior and exterior space, its surroundings, and even its energy. This study opens the timeless principles up for discussion in architecture for the example of Étienne-Louis Boullée’s cenotaph for Newton.

The timeless principle is closely related to the facts of history, art and environment. The cenotaphs are sacred and infinite as a divine meaning of these principles in architecture. Cenotaph for Newton, a special example of the cenotaphs,

is beyond time with its dominant strong posture formally. It has no human scale, it is transcendental. It is timeless with the historical and cultural values attributed to it. It is not belong to a certain time, because of continuing to live as an idea project instead of being built as a reality. Thus, the cenotaph becomes infinitely timeless.

Consequently, in the evaluation of cenotaph for Newton according to the principles of timeless architecture, its unchangeability and complementarity, monumentality, historical, cultural or artistic value, holiness, continuity, and formal features of the building have allowed the redefinition of timeless. However, it should not be forgotten that this definition is not an absolute definition and it can be diversified and enriched in different types of structures.

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## ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS

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# RE-SHAPING THE URBAN IDENTITY OF FORMER INDUSTRIAL TOWNS - PABIANICE AND TOMASZÓW MAZOWIECKI IN POLAND

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## Abstract

Urban identity, being a rather objective feature, is defined by rather objective qualities such as urban texture, historical development, traditions, memory of a place, society. In order for any of these characteristics to change, a catalyst is required such as dramatic events like revolutions, wars, natural disasters, etc, which in turn lead to re-shaping of the urban identity. The industrial revolution, considered such an impetus, has left its mark on many towns and cities, branding them "industrial", shifting their identity from small agricultural villages to large production centres. Consequently, the process of deindustrialisation has left the aforementioned settlements with the label of "former" or "post-" industrial, which brings the need for a new definition of their identity - its re-shaping of sorts.

Globalisation, with the ever-growing phenomenon of the "global man", could be considered the biggest factor in the search for a new urban identity. Contemporary architecture, being a product of standardised building technologies and materials, in most cases lacks local character and unifies the city-scapes. In the past decade, the go-to solution for the aforementioned problems has been the process of revitalisation, which has proven quite effective in both redefining the urban identity and improving the urban image. With time, the memory of a place is romanticised, and nowadays people are fascinated by the old, even nostalgic, especially by the former factories. Their potential is more and more recognised, and utilised, not solely for their adaptation capacity, but also for their historical value and architectural qualities. The vast industrial districts, after the seizing of the production activity, have left traces of monumental buildings in the urban centres.

Those structures play a major role in the redefinition of the urban texture and the overall re-shaping of the cities and their identity, simultaneously preserving the memory of the past, providing the needed continuity.

The current article case-studies the towns of Pabianice and Tomaszów Mazowiecki, located in central Poland - both former textile industry centres, with the aim to examine the role of the revitalisation process of old industrial buildings in the re-shaping of the urban identity.

**Keywords:** Urban Identity, Revitalisation, Post-industrial, Architecture, Globalisation, Poland

### **Introduction**

For the purpose of this paper, the terms Urban Identity, Globalisation and Revitalisation have to be defined.

**Urban Identity** - most commonly defined as having a direct correlation with the users' intuition about the place/city, and their perception of its unique appearance, including "environmental, historical, socio-cultural, functional, and spatial values" (Arbak (Erdem), 2005). A number of studies supports the direct correlation between place identity and the identity of its citizens (Verhaar, 2012; Arbak (Erdem), 2005; Lynch, 1984; Proshansky, 1995; Eldemery, 2009; Kaymaz, 2013). The sense of "belongingness" is emphasised as a key component, involved in building the character of a place, alongside socio-economic and political factors. Those statements lead to a conclusion that when the inhabitants and their identity change, the cities they live in change as well. But, as it requires major historical events, technological advancements, and/or natural phenomena, this process could oftentimes take generations to fully occur and have a visible impact. Overall, it could be said that urban identity has a rather static nature, changing only ever-so-slightly. Additionally, it is rather objective, as its set characteristics are objective - urban texture, inhabitants, historical development, etc.

**Globalisation** - a variety of definitions could be found, but those relevant to this paper are:

- a multi-dimensional process characterised by the acceptance of a set of economic rules for the entire world designed to maximise profits and productivity by universalising markets and production, and to obtain the support of the state with a view to making the national economy more productive and competitive (UNESCO Glossary);
- refers to all those processes by which the peoples of the world are incorporated into a single world society, global society. (Martin Albrow, 1990);
- a phenomenon by which the experience of everyday life, as influenced by the diffusion of commodities and ideas, reflects a standardization of cultural expressions around the world. Propelled by the efficiency or appeal of wireless communications, electronic commerce, popular culture, and international travel, globalization has been seen as a trend toward homogeneity that will eventually make human experience everywhere essentially the same. (Encyclopedia Britannica, 2019) on "Cultural Globalisation").

**Revitalisation** - from the latin word *vitalis* - life-giving, lively, and the prefix *re-* - again:

- the process of making something grow, develop, or become successful again (Cambridge Dictionary, 2019);
- The action of imbuing something with new life and vitality (Oxford Dictionary, 2019);
- the process of bringing degraded areas out of crisis, carried out in a comprehensive manner through integrated activities for the benefit of the local community, space and economy” (Polish Revitalisation Act (*Ustawa Rewitalizacji*), 2015).

In summary, the process of globalisation aims at unification, standardisation, while the urban identity is supposed to be unique. Nowadays globalisation plays a major role in the shaping of our cities, which leads to the need of a tool in order to preserve the one-of-a-kind identity of a place. Revitalisation has been such a go-to instrument in the past several decades, mainly because it deals with the preservation of historical urban texture.

The focus of this paper falls on the revitalisation of former industrial areas in the vicinity of the cities’ centres, as they provide some of the biggest challenges when it comes to their adaptation and reintegration into the life of the contemporary city. The aim is to outline the influence of both processes - globalisation and revitalisation, on the re-shaping of the urban identity of post-industrial towns, based on the examples of Pabianice and Tomaszów Mazowiecki in Poland.

### **Urban Identity - from Industrial to Post-Industrial**

The industrial revolution played a key-role in the historical and urban development of many towns and cities around the world, even causing the establishment of a number of them. The vast factory complexes have left a physical mark on the urban texture, as well as an intangible one on the society and its memory. All of this combined shaped the identity of those cities, which started to identify themselves as **industrial**.

At the time, industrialisation was a global trend. This meant that technologies were exchanged between countries, which lead to similar production processes for which the buildings had to be adapted (Stearns, 2007). And even though there is a resemblance in the outlook of the factories, they were still built according to the environment they stood in, using local materials and accommodated to withstand the regional climate. Those particularities stimulated the local character of the cities, providing their unique urban identity - the industrial city of England was not the same as the one of Poland or of Spain.

The next major shift in identity came because of the process of deindustrialisation of the cities. The relocation of the production to the outskirts left vast brownfields in the vicinity of the urban centres (Berens, 2010). The factory buildings stood empty, unused and in a state of decay for years, sometimes even decades. These areas became voids in the urban texture, neglected, avoided and disliked. They served as a reminder of “the every-day hustle and bustle of a dull industrial city”, which in the memory of the collective was associated with the oppression of the every-day factory life (Walczak, 2015).

As it was already mentioned, there is a direct correlation between place identity and its inhabitants - and in this case, as the production was relocating, most of the citizens were losing their jobs and were no longer identified as “factory workers”, the cities were experiencing a shift in their identity, too - from **industrial** to **former industrial**. However, is being “former” really an identity? The need for a proper re-shaping of the urban character has emerged.

### **Factors influencing the Re-shaping the Urban Identity**

There are several major factors that should be taken into account when talking about the re-shaping of the urban identity of the post-industrial cities.

First, it is the fact that the value of former industrial buildings as cultural heritage has been more and more recognised, not only by professionals, but also by the public. Practices for the preservation of such areas have been initiated in the 1960s in the UK and the USA, and since then has become rather popular and even trendy all over the world. In Poland, such practices were rarely executed until the late 1990s (mainly due to the socio-economic and political past of the country), but gaining momentum in the 2000s, and currently becoming the norm. Many factory complexes have been declared as heritage sites. The inhabitants of former industrial cities have grown more interested and involved in the matters regarding such areas, as they are identifying themselves with their industrial past once again (Mastalerz, 2017). And even without official heritage status, there is a newly found appreciation for post-production sites, as they hold a large variety of possibilities for adaptation and redevelopment. The root of this rediscovered potential is most likely to be found in the tendency for society to romanticise the past - *“only people who do not know the steam and sweat of a real factory can find industrial space romantic or interesting”* (Zukin, 1989). Nowadays, the exposed brick walls, the high ceilings, the vast spaces of the former factories evoke the same sentiments we hold for gothic cathedrals or renaissance palazzos.

The next factor is the rapid process of globalisation, which, as already mentioned, tends to bring unification in almost any aspect of contemporary everyday life - everywhere the same shopping chains, restaurants, cafes, hotels, etc. The import-export of materials and the development of the construction and HVAC technologies allow for any building to be built anywhere, regardless of the local pre-conditions, such as topography and climate. Local authorities usually grant permits for any building project as long as it is compliant with the overall requirements set in the masterplan - density, height, percentage of greenery, etc. Contextuality is no longer of importance, which leads to the unification of the cities themselves, and the loss of the unique urban identity. (Svetoslavova, 2019) (fig.1)



Figure 1. . Malmö Live /Skanska and schmidt/hammer/lassen k/s/, Malmö, Sweden (left) and Nowa Fabryczna Office Building /Skanska/, Łódź, Poland (right)  
sources: Wikipedia (left) and <https://www.skanska.pl> (right)

Which brings us to the last, but not least, important factor - revitalisation. The positive influence of the globalisation process could be observed in the spreading tendency to value the already-built environment and the urge to preserve and utilise it as much as possible, hence the growing number of revitalisation projects, worldwide. The adaptation of pre-existing buildings could be considered in correlation with the process of globalisation, as trivial functions, such as housing, offices or shopping, become exciting and interesting when they are located in former industrial buildings. The loft apartments, which in their origins were considered one of the cheapest housing options, currently are some of the most expensive and luxurious ones - not only they preserve the building substance in the urban texture, but also help re-shape the urban identity while keeping the local character. The very same applies for the adaptation of such buildings for hotel purposes - as for example hotel Andel's in Łódź (fig.2), located in one of the spinning mills of the former I.K.Poznanski factory.

Another example that comes to mind is the "mall" phenomenon. Shopping centres usually require a huge area, hence why their usual allocation in the outskirts, where plots of the necessary size are available. However, by revitalising former industrial sites, which more often than not are located in the vicinity of the urban centres, the "malls" gain a more attractive location, easier access, and most importantly regenerate a previously undesirable area. The success of such projects could be observed in "Manufaktura" in Łódź (fig.3), "Stary Browar" in Poznań (fig.4), as well as "Centrum Silesia" in Katowice.

All these examples prove that revitalisation process, especially in times of rapid globalisation, is a key-factor to preserving the urban identity of a place. Such areas, after their restoration, become popular places for the locals, who once again are beginning to associate with their industrial past. The revitalisation of former factory areas help cities in more than one way - it regenerates a previously inaccessible degraded area, making it available to the public, reintegrates it into the urban texture, while at the same time preserves the contextuality and the identity of the place by not adding yet another soulless "concrete-and-glass" cube.



Figure 2. Hotel Andel's, Łódź, Poland; *foto. M.Svetoslavova*



Figure 3. "Manufaktura" Shopping Centre - former I.K.Poznanski factory complex in Łódź, Poland;  
photo: M.Svetoslavova



Figure 4. “Stary Browar” shopping centre in Poznań, Poland; *photo: M.Svetoslavova*

In bigger cities, such as province capitals, the process of revitalisation has proven without doubt to be quite successful, as most of the study cases and examples come from there and are known globally. However, smaller cities and towns have not been studied so extensively. It is of interest to take a look at how the processes of globalisation and revitalisation have influenced (if at all) towns of a smaller scale. The towns of Pabianice and Tomaszów Mazowiecki have been chosen for the purpose of this paper, as both have once been major textile-production centres and have undergone revitalisation projects of former industrial areas in the vicinity of their urban centres.

### Case Studies

Pabianice is a town of about 65 000 inhabitants, located in Central Poland, on the south border of the city of Łódź. Not too many traces are left from its pre-industrial past - a small renaissance palace with attached gardens, and a brick church, built at the end of the XVI century. The settlement was mostly agricultural, until the early XIX century, when the industrial revolution reached Pabianice and its true uplift began. The town grew and flourished during the industrial era, and even after the nationalisation of the production after 1945, its economic prosperity was still mostly dependent on the industry. The three most important factories established here were the ones of Rudolf Kindler, Krusche&Ender, and the Baruch Brothers, considering their location on the main street of the town (Mastalerz, 2018). The fall of the industrial era had a catastrophic impact on the town, which was facing depopulation, high rate of unemployment and general degradation of its urban centre. The first actions toward revitalisation of the town were focused on the “true” heritage, meaning the renaissance palace, together with the church. The industrial heritage was not yet recognised as such, which caused its deterioration,

as well as the destruction of parts of the former factory buildings.

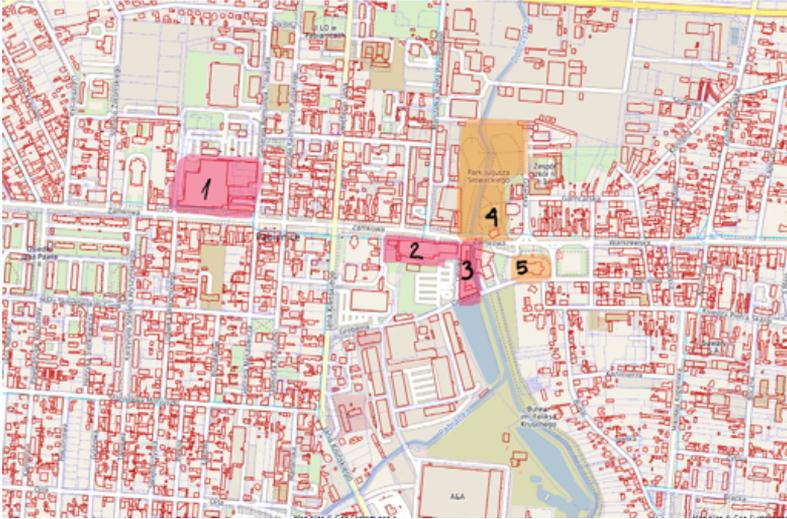


Figure 5. Pabianice town centre; *draft by the author*;

1) Former Kindler Factory – currently Mall “Echo”, 2) Former Krusche&Ender factory, 3) Former Baruch Brothers factory – currently hotel “Fabryka Wełny”, 4) Renaissance palace with gardens, 5) Brick church from XVI century

The first industrial site to be recognised for its potential was the former factory complex of Rudolf Kindler (no.1 on fig.5). It was established in 1879, prospered until the WWI, after which it bankrupted. In 1927 the English company “F.Willey & Co. Ltd.”, together with the Polish government created a co-owned factory establishment and managed to save parts of Kindler’s former empire. After WWII it was nationalised, but still operational. In the 1960s some of the buildings of the complex began to be demolished, and until the 1990s when the factory was sold, only three buildings were left standing from the initial assemble - the office and technical buildings and the pressure tower. In 2002, these buildings were incorporated in the newly built shopping centre “Echo”. The new structure takes the exact space as the former factory did, which preserves the integrity of the urban texture (fig.6). It provided a new place for the inhabitants to meet, businesses to be developed, and most importantly - workplaces. The aesthetics of the new construction is questionable, but it is not entirely non contextual. It was the first step towards the city accepting and embracing its industrial past.

The second industrial complex, located right across from the renaissance palace, is the one of the Baruch Brothers (no.3 on fig.5). This was one of the most important factories in Pabianice, established in 1862. Officially it was operational until 2006, but some of the buildings were in a state of decay from earlier times. In 2014, the buildings underwent a huge transformation and in November 2014, hotel “Fabryka Wełny” (“Wool Factory”) opened (fig.7). This high-end hotel and SPA is probably the best example of revitalisation in such small cities, attracting visitors and tourists with its history and very skillfully-executed adaptation. It is an example of how one such investment could rebuild the city’s image, preserving its identity, and at the

same time intrigue new investors to continue the revitalisation works in the town.



Figure 6. Former J.Kindler factory – currently shopping centre “Echo”– then and now

sources: <https://um.pabianice.pl/artykul/347/1868/historia-miasta> (left), <https://maps.google.com> (right)



Figure 7. The former factory of Baruch brothers, currently a high-end Hotel&SPA  
source: <https://www.fabrykawelny.pl/galeria>

The third former industrial area, currently consists only of one building - the former weaving mill of Krusche&Ender (no.2 on fig.5). This factory, founded in 1825, served as the beginning of Pabianice’s industrial history. It had similar fate as the rest of the complexes - prosperity until the 1990s, later bankruptcy, and many of the factory buildings demolished in the early 2000s, as they were not considered valuable. The surviving weaving mill is under protection as a heritage site, hence its existence to this day. The building underwent conservation works in the early 2010s, but stood mostly empty, with the exception of some local services on the ground floor. Currently, revitalisation works are in progress for the full re-integration of the building in the urban life, as an additional part to hotel “Fabryka Bawelny”. It is supposed to provide a place for leisure activities, cafes, restaurants for the locals and the visitors of the city. The project so far involves the full preservation of the historic building, which is in sync with the preservation and enhancement of the

urban character.

The town of Pabianice is an example of how the local urban character is only enhanced by the preservation and utilisation of the remnants of the industrial past. Even though the presence of older heritage sites, such as the renaissance palace and gardens, the former factory buildings and their revitalisation seems to be the key to bringing new investments into the town, as well as creating new workplaces, and increasing the attractiveness to tourists and inhabitants alike.

A similar case provides the town of Tomaszów Mazowiecki, only with some years of delay. Located around 60km south-east from the city of Łódź, it was established in the late XVIII century. For the most part of the XIX century it was a manufacturing town, consisting of small production workshops. The established railway connection with Łódź and Warsaw in the 1890s played a key role for the industrialisation of the town, which then started developing exponentially (Badziak, 2008). Tomaszów Mazowiecki was most famous for the production of wool and silk goods, as well as carpets. Those of the factories which survived until the 1990s declared bankruptcy, and the process of deindustrialisation began. Currently none of the original industrial complexes are operational, and most of their buildings are demolished or in state of decay. However, the industrial past still lives in the memories of the inhabitants.



Figure 8. Tomaszów Mazowiecki town centre; *draft by the author*;

1) Town square, 2) Former location of Mazovia factory – currently shopping centre Galeria Tomaszów, 3) Hypermarket, incorporating elements of post-industrial buildings facades

Near the city centre, on the banks of the river Wolbórka, the remains of the former Mazovia factory could be found. It was established by the merging of two former industrial establishments - the one of Jakub Halpern, which in 1853 started as a trading company, but around 1900 was already a production factory, and the one of Moritz Piesch, established in 1878, and by early 1900s considered to be the biggest textile finishing company in continental Europe (ibid.). Both factories

were nationalised after WWII, and merged into one concern. After the political transition in the 1990s the production rates decreased, and the factory declared bankruptcy in 2008. The former industrial buildings along the river slowly started to disappear. Only in 2015 projects for the adaptation of the remaining buildings were initiated. However, after consultations with the local conservation officer, the investors decided on demolition instead of renovation, even though the buildings were included in the regional registers as heritage sites (Mastalerz, 2017). The new shopping centre - Galeria Tomaszów (opened in late 2016; no.2 on fig.8), currently in the place of the former industrial site, incorporates the original chimney and the reconstructed-as-it-was spinning mill, attached to it (fig.9). The case is similar to the Pabianice's shopping centre "Echo", which leads one to believe that this is only the beginning of the revitalisation of former industrial sites in Tomaszów, and their reintegration as active parts of the urban texture.

Even though it is not a good example for building revitalisation, a positive side of this project is the revitalisation of the green area next to the river, which is currently a pleasant park by the water, accessible to the general public at all times - the urban identity shifting towards inclusiveness and sustainability (fig.10). Moreover, Tomaszów Mazowiecki is located near the Sulejów dam, which attracts a lot of nature enthusiasts. Further incorporating nature and especially making the river accessible, could help increase the tourist flow, and the general attractiveness of the town.

Another interesting link towards the industrial past of Tomaszów could be observed right across the street from the new mall - very well preserved parts of the facades of former industrial buildings and semi-realistic division of the facade of the located there hypermarket as if to imitate the industrial character (fig.11). Even though it is obviously a mimicry, it is still a clear reference to the historical past of the town and the willingness of the investors and architects to acknowledge it.



Figure 9. Galeria Tomaszów – the only surviving elements of the industrial past,  
*photo: M.Svetoslavova*



Figure 10. Public park next to the new shopping centre, *photo: M.Svetoslavova*

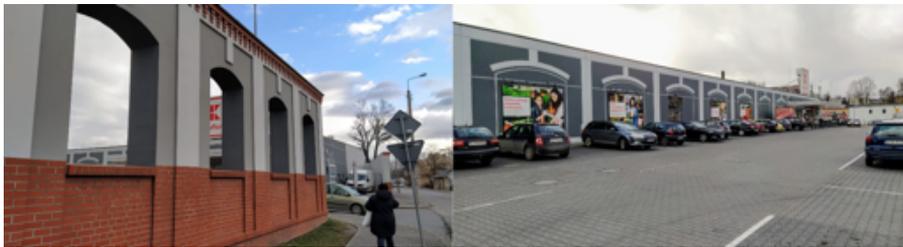


Figure 11. Hypermarket across the street from Galeria Tomaszów, *photo: M.Svetoslavova*

From these study cases, it is becoming clear that post-industrial sites play a key role in the revitalisation of mid-sized towns, especially when they are located in the vicinity of the urban centres. Even one proper adaptation of such buildings and areas is capable of raising the attractiveness of the town and attracting further investments, thus positively influencing the socio-economic local development, as seen from “Fabryka Wełny” in Pabianice. The inhabitants are finally embracing their industrial past and utilising it as good as they can in order to rebuild their towns from the degradation brought by the deindustrialisation process. It is natural that mistakes could happen and were made, especially regarding the demolition of some of the structures, but the newer cases are evidence that architects and investors alike are paying more attention to the already-built environment and trying their best to adapt to it. Both towns might still be considered as post-industrial, but their identity is slowly being re-shaped one project at a time.

### **Conclusion**

The shaping of the urban identity is a constant long-term process, happening more often than not unconsciously. Major events, such as the industrial revolution once branded towns as industrial, while the following deindustrialisation left them

in search of a new identity. The revitalisation of degraded parts of the urban texture is a natural occurrence, as cities are competing to raise their attractiveness to potential and current inhabitants, tourists, investors.

The process of globalisation, even though aiming at unification, provides tools and “recipes”, which when adapted to the local conditions, prove successful in the reshaping and enhancing the local character of a place. Former industrial buildings and areas hold some of the greatest potential for re-use and their proper revitalisation results in intriguing places, with unique spirit. In summary, the re-shaping of the urban identity of cities, no matter post-industrial or not, is closely connected to the revitalisation of already-existing areas with the aim of, in the words of Thomas Heatherwick, “*making something that doesn't feel like somewhere else we've already been*”.

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# EXPERIENCE OF PUBLICNESS IN HOUSING DESIGN FROM 20TH CENTURY TO TODAY: THREE EXAMPLES FROM TURKEY

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## **Abstract**

The transition areas between public and private spaces, the social contacts proposed by these spaces, are the most important elements that ensure the continuity of urban life. Architecture, urban design and social life, that are differentiated as a result of developments such as industrial revolution, world wars, technological advances and rapid urbanization, evolved into a new environment where boundaries between housing and the city have created and the meaning of transition spaces have lost. This urbanization process, which weakened the people-house-built environment relations and possibility of socialization improved by semi-public and semi-private spaces, has continued from 20th century to the present day; thus, the way of designing spaces became one of the main issues of the housing discussions in the last century. During this period, in accordance with these criticisms, many housing design approaches that could be called experimentally developed and it was tried to design buildings with innovative space patterns that allows public interaction both in the world and Turkey.

In this context, to examine the public-private relations suggested by housing projects and to read spatial resolution developed by selecting qualified examples of public housing projects from Turkey that have a design concern was aimed. In the study, Yeşilköy Mass Housing (Istanbul, 1973, Design: Haluk Baysal and Melih Birsal), Sürücüler Terasevler Housing (Ankara, 1989, Design: Nuran Ünsal, Merih Karaaslan and Mürşit Günday) and Asma Bahçeler Housing Complex (Izmir, 2015, Design: M+D Architecture) has been determined as three cases from different time periods. For the purpose of the study, the selected building groups were compared the proposed social life opportunities in the context of semi-private, semi-public, public space relationships. According to the research, it was aimed both to analyze

the spatial necessities that help encounter opportunities offered of the housing complexes to the users and to show the way of create spatial organization with the same concern at different time periods.

**Keywords:** housing design, modern housing in Turkey, modern architecture, public-private space, ublicness in housing

### **Introduction**

In the urban environment, the spaces are organized gradually from private to public according to their spatial boundaries and permissions. Houses are the most confidential building groups in this system of relations and offer a living environment to the citizens with the interaction opportunities in their private zones. For this reason, examining the degree of publicity of the housing groups and the semi-public/semi-private spaces offered becomes important in analyzing social life of urban environment for theoreticians.

The spatial relations in the built environment have evolved according to the unique social, economic and technological conditions of each period from past to present, and aspect new meanings to the housing concept. Therefore, the urban environment provided by people-house-built environment interaction has found different responses throughout history. As a result of the urban and social model formed after the industrial revolution, one of the spatial organizations that meet the need for dwelling has been mass housing. These housing groups are restricted residential areas that offered a public-private life within their borders (Blakely and Snyder, 1997) and have been developed as a solution to cities that become overcrowded and unhealthy as a result of a rapid industrialization. However, these settlements have evolved into a model where public life has lost its quality, unlike the relationships in traditional urban texture (Trancik, 1986). At the end of this period, which damaged the urban environment and the life of society in public space, the elements to be considered in the design of residential settlements have been one of the main discussion topics of the designers. Thus, in the last century, many projects with this concern have been built, and approaches that consider public-private space relations from public housing designs have been developed.

The purpose of the study is to reveal the design decisions that should be considered for the working of the space hierarchy while designing the housing groups, and to examine the actualization forms of these decisions through case projects. In this respect, it was aimed that to read spatial resolution developed for housing groups by analyzing the proposed public-private space relations selecting examples from Turkey designed in 20th century. In the study, first of all, the points that should be taken into consideration for mass housing design are determined as a result of the literature review and a list of design principles is created based on the spatial requirements that should be provided. In the second phase of the study, the housing productions in Turkey, from the 20th century to today, examined and three projects which offer authentic and diversified public life were selected to examine. While deciding projects, attention was paid in order to choose buildings that differentiate from their compeers according to design qualities and innovative spatial relationships. Then, a publicness study was realized by reading the site plans of the projects and analyzing public, semi-public and semi-private space organizations which allowed active and passive contact possibilities for dwellers.

**Housing Design and Public Relations in 20<sup>th</sup> Century**

The development experienced in mechanization with the effect of industrial revolution has fundamentally shaped the traditional social life since the 19<sup>th</sup> century and has been the beginning of the process of differentiation, change and development of urban space and housing concept in the world. Because of new job opportunities, population had increased with migrations and this created a housing problem in the city centers. This process, which supported the way for rapid urbanization and construction, caused the differentiation of spatial organization in the urban environment to be established, so new housing opportunities were needed for the growing population. As one of these solutions, mass housing applications in the urban environment have begun to be applied by creating their own social facilities in the regions outside the city.

The basic examples of this idea are given firstly as garden city settlements which were interpreted as an escape from the city center. Then, worker houses developed to offer healthier living standards to factory workers and low density building groups constructed in the suburbs of the city in the first half of the 20<sup>th</sup> century. After the World War II, large-scale mass housing projects and vertical dwelling blocks continued to design in order to answer the housing needs. Over time, this understanding has evolved to a new urban system that grow and rise by accommodating more functions in residential buildings, and mechanical environments where the houses do not have a horizontal relationship with the city and do not recommend public relations (Bilgin, 1999) have been produced. The public open spaces arranged according to the human scale have been replaced by a system where the settlements are built on the private space and where the balance of the private space-public space is damaged with the rapid urbanization (Sinmaz, 2018). Therefore, urban life had weakened in time, semi-public spaces had lost their value of use, and public open spaces had become desolate. Moreover, these mass housing groups, which do not respond to the needs of the citizens and residential users, had become one of the most important problems of the period. (Tab. 1)

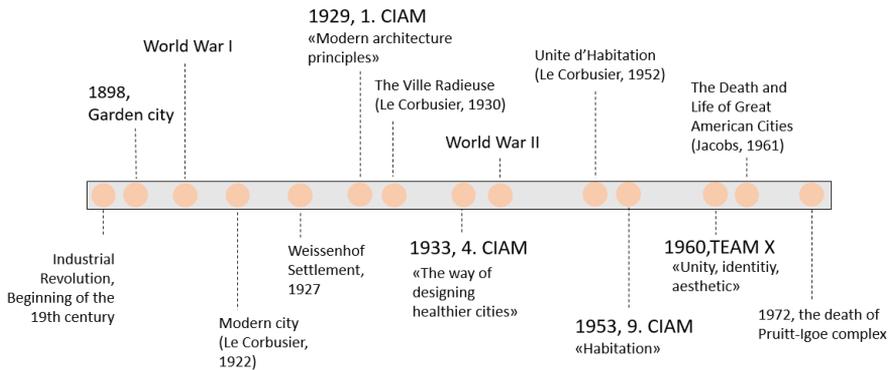


Table 1: The timeline of 20<sup>th</sup> century and important points for design principles

Therefore, this design way of urban environment and housing began to resolve after the 1960s. Many theorists had criticized this understanding to gain the quality

lost in public life. One of these theorists, Jacobs (1992) defines the spatial problems result from this process as the loss of control around the massive construction, the collapse of public life, incompetence and rootlessness. Like Jacobs (1992), Jacobs and Appleyard (1987) summarized the problems of modern urban design as creating poor living environments, loss of control, large-scale privatization and the loss of public life, centrifugal fragmentation, destruction of valued places, placelessness, injustice and rootless professionalism. In line with these similar problems, architects and urban designers tried to find solutions for publicness of the settlements. Therefore, new residential groups were designed to include more private-public space interaction, and experimental concepts were developed on this design method.

### **Spatial Necessities of Public Housing Design**

According to Bouma, Poelman and Voorbij (2015) a cohousing community is a social ecological system where people share their daily life activities. This system consists of multiple dwellings oriented around public spaces and having dynamic interaction opportunities. In accordance with this definition of housing groups with high communication facilities, this projects should be developed around certain design principles and spatial necessities. In other words, in order to prevent the problems experienced in the past, public interaction opportunities should be taken to make decisions that will be prioritized. About this subject, Jacobs and Appleyard (1987) indicates the goals of urban life as livability, identity and control, access to opportunity, imagination, joy, authenticity and meaning, community and public life, urban self-reliance and an environment for all.

Thereby, the importance of social relations to be considered while designing housing groups had become the main topic for architects and structural relations, layout schemes and urban models have been proposed for livable environments. Publicness, semi-publicness and semi-privateness were redefined for these housing groups by determining public spaces as “environment for users to come together within the housing group and strangers’ encounter”, semi-public spaces as “spatially and psychologically divided into a certain group of users allowing controlled communication”, semi-private spaces as “areas that allow interaction with public life, despite of being part of the private space” (Cihan and Erdönmez Dinçer, 2018). For the production of dense housing groups, design principles have been determined, different approaches that will offer new alternatives to the user have been developed and the quality of the publicity has been reconsidered with these principles.

In this regard, Abu Ghazze (1999) argues that active and passive communication opportunities are the requirements that determine the quality of urban life by focusing the encounters in daily life in semi-public spaces. Especially, it reveals that this contact established with auditory and visual communication in public space will enable social interaction (Abu Ghazze, 1999). Likewise, Kuper (1953) also mentions that passive contact between residents is enabling unplanned meetings is an important contribution that will increase public life quality. Therefore, it can be said that random passive communications in semi-private spaces and active communications in semi-public and public spaces are the basis of urban life.

On the other hand, as a result of their work, Cihan and Erdönmez Dinçer (2018)

determined the points to be considered in mass housing design as accessibility, observation opportunities, spatial organization and quality of public space. Accordingly, criteria such as organization of observable building entrances, streets and common areas, creation of semi-public spaces that will create a gradual spatial model by allowing different activities, and the organization of pedestrian roads that support passive contact (Cihan and Erdönmez Dinçer, 2018) were determined. In the light of these criteria, importance of spatial hierarchy also was emphasized.

In addition to these studies, Bouma, Poelman and Voorbij (2015) determined the points that should be taken into consideration in order not to lose the quality of public life in housing settlements as a result of a literature review. According to the research, the closeness and orientation of the buildings, the location and quality of the common areas and the walkway design within the site are determined as the criteria to be considered (Fleming, Baum et al. 1985; Cooper Marcus 1986; Gehl 1987; McCamant 1994; Abu-Gazze 1999; Williams 2005, quoted by Bouma, Poelman and Voorbij (2015). First of all, the orientation of the buildings stands out as it determines the volume of the outdoor space; therefore, the undefined spaces should not be created in the settlement by determining the proximity of the buildings to create defined open spaces. Secondly, the location and quality of common areas has been taken another subject. Common areas that provide active contact possibilities to the user should be shaped by defining the public and semi-public identity as well as transition areas and suggesting different interaction alternatives in the semi-private identity. The last criterion was the quality of the pedestrian routes within the site. These roads, which connect the buildings to each other and the settlement to the city, should be privatized at different levels and offer diversity to the user, also should become a sharing space for the residents rather than the transportation function.

Briefly, as the result of the literature review, balancing active and passive contacts with the help of composition of public, semi-public and semi-private spaces, and the relationship between these spaces determined as the most important need for character of the public life. Therefore, within the scope of the study, creating buffer zones that will balance the private and public spaces, creating sharing areas that will allow common activities and supporting the circulation with different functions were considered as the features to be search on the building examples and the principles were determined within the scope of these titles (Fig. 1).



Figure 1. Active-passive contacts in spatial hierarchy

Sharing areas consist of common-use spaces within the housing group, have meeting, intersection and encounter opportunities offered by the settlement to the user. As Jacobs (1992) emphasizes that open spaces with many alternatives create different experience spaces for user and affect the degree of interaction, sharing areas form the basis of communication in public space. Meeting points as

playgrounds, pools, gardens; common rooms as activity areas; also courtyards and green space arrangements increase the degree of use in the sharing areas and give people various opportunities, thus directing the person to the outside world with active contact chances.

Circulation areas include walking paths that will increase the daily encounters while walking, standing or running for reaching somewhere. Jacobs (1992) defines these ways as areas where people who do not know each other come together comfortably and sees it as the most important part of public life. In order for these circulation elements to provide these meeting possibilities, the roads should be gradually designed from outdoor to interior. The pedestrian paths used outside the building compares the residents with all users, create spontaneous meetings. Secondary roads in the building are semi-public spaces and socialize the user in a more controlled way by providing communication with other dwellers. On the other hand, corridors appear as areas used only for transportation, but also have a possibility for passive contact. Therefore, this circulation network offers the user a controlled socialization opportunity.

The buffer zones, as a key point between public-private and internal-external (Von Meiss, 1990), are transition spaces that facilitate users' participation in the outside life without damaging their own privacy. It creates a passive communication environment by removing the borders created by the walls and supporting the auidal and visual relations that contribute the public life (Gehl, 2011). The inner gardens at the building entrances where the user meets with public life for the last time before entering private space, and the balconies and terraces opening from the private space to the outside world constitute the buffer zones. The inner gardens are conversation spaces the neighbors while planting or helps dialogue with other dwellers crossing the pedestrian path. Balconies and terraces (Walton, et al., 2007), which allow private and public space activities to be combined, are also transition areas that allow residents to communicate as much as they want. The dweller, who is visually, audibly and physically located in the outside world, also protects his privacy limits, so that he can safely join the outside world.

Briefly, the spatial qualities of sharing areas, circulation areas and buffer zones, where contribute the social life by supporting the active and passive contacts within the housing settlement, have been determined. It is seen that the sharing areas was classified as meeting points, common areas, gardens and courtyards; circulation areas were classified as pedestrian paths, secondary streets and corridors, and buffer zones was classified as interior gardens, balconies and terraces (Tab. 2). This classification will be used to analyze the public use possibilities proposed by the housing examples to be examined within the scope of the study, and each case will be discussed over its spatial organization and active-passive contact chances.

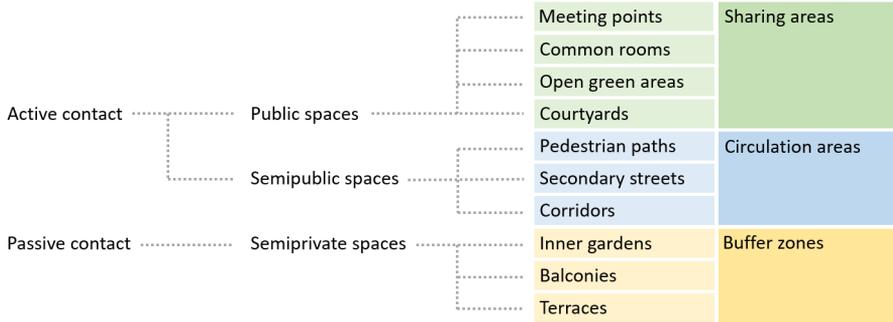


Table 2. Classification of public, semi-public and semi-private spaces as sharing areas, circulation areas and buffer zones

**Housing Design in Turkey from 20<sup>th</sup> Century to Today**

Republic of Turkey founded after World War I in the first quarter of 20<sup>th</sup> century entered in the process of access to modern living standards with the help of new form of government. According to Bilgin (1998), it was thought that the change experienced by the newly established state could be demonstrated through urbanization studies, and this would also modernize the citizen. In other words, it was seen that the basis of this process could be founded with the modernization of the cities and the housing. Therefore, it was densely worked in the field of urbanization and residential architecture in order to catch up with contemporary living standards of the western movements.

From the 1920s to the 1940s, when redevelopment was prominence, low density singular apartments and single houses designed according to user requests and provided spatial quality, formed the housing texture in the cities. In addition, it is observed that there are low-density cooperative settlements especially for workers and government employee in Anatolia (Koca, 2015). These examples were building groups inspired by the understanding of garden-city, in accordance with the standards of mass housing settlement of the period, economically appropriate, rational, easily produced (Cihan and Erdönmez Dinçer, 2018). By the 1950s, it was entered into a period which international style and Western movements were followed and this understanding was more reflected in the building design. It is observed that although single houses still were preferred, cooperative settlements and apartment sites are also becoming widespread, and alternative housing groups are beginning to be designed (Koca, 2015). These building groups, which contain common-use organizations equipped with different functions, and where the concept of neighborhood is still important, suggested a new urban environment where the public space-private space relations gained value. This period, which experienced rapid urbanization and urban congestion in city centers, caused a new construction model in the 1980s, the housing stock deficit in the city center was tried to be eliminated by applying public housing projects with the help of the government. These closed settlements consisting of multi-storey houses leaking into the urban fringe offered a different social and spatial proposal differ from traditional urban texture. This urban production continued by repeating large-scale mass housing projects until 1990s, which mostly do not relate to the

context of the city, have begun to offer unusable public spaces and unqualified environments to the residents. After 2000s, these spatial production forms, which became widespread, continued to designed fast, and mass housing and mixed-use residences began to be preferred by citizens. Due to economic concerns, housing had become an object produced exclusively for profit concern regardless of user needs (Koca, 2015), so multi-storey buildings not allow public life and socialization continued to be produced in a way that repeats each other.

When looking at the changes in the ways of housing production in the country, it is seen that the projects developed by considering the design value first have been replaced by economic concerns over time. The process, which started by applying universal solutions in the urban settlements, resulted in developing spatial productions that do not propose any use value other than shelter. On the other hand, as discussed of unqualified environments for public life in the world since 1960s, there were criticisms about mass housing projects in Turkey. Therefore, it was possible to find studies that apply their own design decisions and offer unique living environments during this period and to find alternative spatial production and innovative housing projects in order to defend importance of public relations in the housing groups.

In this study, it was examined housing designs constructed in Turkey during the aforesaid period and three examples, Yeşilköy Mass Housing designed in 1973, Sürücüler Terasevler Housing designed 1989 and Asma Bahçeler Housing Complex designed in 2015 supporting social life reflected in different design concepts, was selected in order to analyze the new approaches for semi-public space design proposals according to the breaking points in housing production. (Tab. 3)

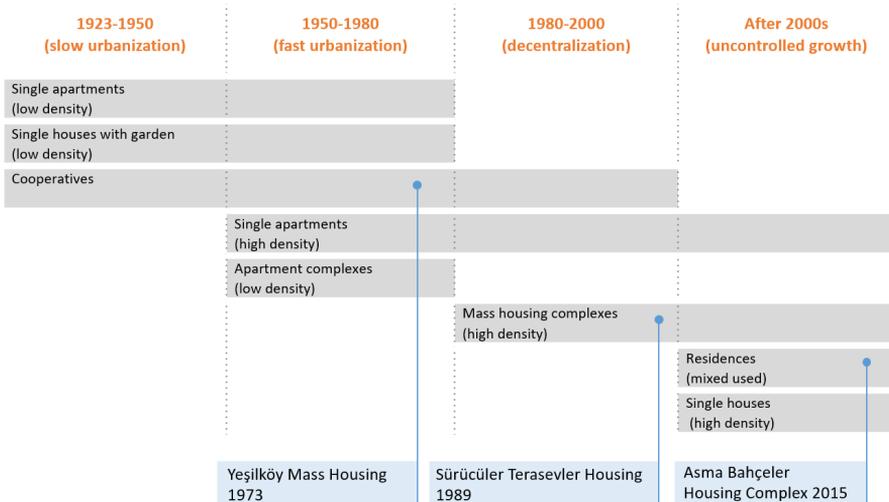


Table 3. Timeline of housing design in Turkey

**Case studies and results**

Built environment can be livable with the help of active and passive contact opportunities in the housing complexes; however, when looking at the housing design background of Turkey, it was seen that there were limited experimental

designs that offers public life. Therefore, these 3 cases mentioned previous chapter, Yeşilköy Mass Housing, Sürücüler Terasevler Housing and Asma Bahçeler Housing Complex (Tab. 4) seen valuable to search their publicness and proposed experience because of reflected their own design principles according to the period their built. In this context, three cases will be evaluated on the spatial necessities determined as a result of the literature review, then their proposed functions for semi-private, semi-public and public spaces will be compared to each other to see changes over the years.

	Yeşilköy Mass Housing	Sürücüler Terasevler Housing	Asma Bahçeler Housing Complex
Architect	Haluk Baysal, Melih Birsel	Merih Karaaslan, Nuran Ünsal, Mürşit Günday	Dürriin Süer, Metin Kılıç
Year	1973	1989	2015
Location	Istanbul	Ankara	Izmir
Photo			

Table 4. Case Studies

Yeşilköy Mass Housing is a housing project that includes spatial relationships built on a grid plan inspired by the concept of mat-building (Akkuzu, 2019). Designed by Haluk Baysal and Melih Birsel, the project is one of the most authentic examples of its period with various interactions offers to dweller. When looking at the spatial organization, the most crucial point in the project is the multi-layered pedestrian roads and semi-private spaces connected by these roads. The residential complex, which creates different levels of publicity, supports spontaneous encounters for people and encourages them to use the outdoors with its semi-public streets. At the same time, the fact that the created mini-neighborhood is open to the entire city on the ground level by not closing to the outside world shows that it supports a livable urban environment (Mollaahmetoğlu Falay and Yürekli, 2017 quoted by Akkuzu, 2019). In short, in this project where semi-private, semi-public and public space relations are provided by diversifying the pedestrian paths in different elevations, it is easier to establish dialogue with the courtyards and inner gardens, and thus, a strong life mechanism is established by associating with the context.

Sürücüler Terasevler Housing is a building group that has differentiated from its era with its new collective living model and has achieved great commercial success. Designed by Merih Karaaslan, Nuran Ünsal and Mürşit Günday, the project has a mass organization that enriches visual and audial communication by having terraces at different levels, unlike ordinary apartment buildings. Each terrace overlooks the green space and activity areas, which are the public part of the complex, and the terraces are connected each other both protecting privacy and supporting leisureliness. Thus, a new life is proposed in the building group that consists active and passive interaction. In addition, the garden, which is open to public use, has many functions that creates meeting areas for the user. With all these important alternatives, the architect of the project, Merih Karaaslan, defines the site as a

landmark in the city (Uçak, 2018). Briefly, thanks to the mass organization of the building group, the inner gardens or terraces of each residence are designed in different openings in order to strengthen the interaction with the other dwellers. Thus, semi-private and semi-public space relations have been established, and this system, which provides passive interaction, has supported the public life within the settlement. Therefore, semi-private and semi-public space relations have been organized, and this system, which provides passive interaction, has supported the public life within the structure group.

Asma Bahçeler Housing Complex proposes an extravert life model outside of the usual concepts of mass housing understanding by evaluating the conditions of the project site. Designed by Dürrin Süer and Metin Kılıç (M+D Architecture), the project consists of a combination of residential units in different sizes parallel with the slope lines. Thus, different terraces and green areas of them suggested different sharing areas to the users. In addition, supporting the pedestrian paths on their terraces apart from the common areas recommended at ground level has benefited the development of neighborhood relations of residents. Opening to semi-public terraces from balconies, which are semi-private spaces, strengthened passive and active contacts outside. In short, the building group has created a living organism by creating different degrees of publicness at different levels by using conditions of the site, in contrast to the standardized production patterns of today.

To conclude, both cases have various space relations that provide publicness in the project site differ from other mass housing examples designed in the same era (Fig. 2).



Figure 2. Public/semi-public/semi-private space relations in the case studies

After the introduction of design features of the case projects and the semi-private, semi-public and public space relationships proposed, a detailed spatial analysis was made on the site plans for the next step of the study. The analysis made was evaluated not with the change and usage value of the projects over time, but with the design decisions taken and the life model they represent, therefore, the original layout plans were used. Accordingly, as a result of the literature review, meeting points, common rooms, courtyards, public gardens which are accepted as public sharing areas, pedestrian paths, secondary streets, corridors which are determined as semi-public circulation areas and inner gardens, balconies, terraces which are selected as semi-private buffer zones have been checked through the housing designs. (Figure 3-4-5)



Figure 3. Analysis of Yeşilköy Mass Housing a. secondary streets of the complex, b. balconies of the units, c. inner gardens opening to the pedestrian path



Figure 4. Analysis of Sürücüler Terasevler Housing a. public garden and pedestrian path of the complex (Url-1), b. terraces and inner gardens of the units (Url-1), c. secondary street connecting to the meeting point (Url-1)



Figure 5. Analysis of Asma Bahçeler Housing Complex a. layout plan of the site (Url-2), b. terraces and public green spaces (Url-3), c. terraces of the units (Url-3)

According to the design features read from the site plans, each project has been found to have public-private space relations that would allow active and passive contacts (Tab. 5). Firstly, it was observed that the sharing areas became prominent for architects while designing mass housing concept. Meeting points were organized as different activities in all three projects, sports fields, planted areas in Yeşilköy Mass Housing, playgrounds, seating areas in Sürücüler Terasevler Housing and outdoor pool, gardens in Asma Bahçeler Housing Complex. The common areas used only as closed interiors in Asma Bahçeler Housing Complex. The courtyards were preferred in a single project, in a block of the Yeşilköy Mass Housing. When looking at the characteristics of the circulation areas, it was found that the pedestrian roads were supported by secondary streets in Yeşilköy Mass Housing by raising from the ground to add a new dimension, and Sürücüler Terasevler Housing by leaving in the same level of the ground. Corridors helps the circulation in the Asma Bahçeler Housing Complex and Sürücüler Terasevler Housing at the interiors only purpose of access. In addition to that, buffer zones were created with inner gardens and balconies placed different levels in Yeşilköy Mass Housing, while various terraces and interior gardens on the ground floor helped user communication in Sürücüler Terasevler Housing. Also, terraces and balconies supported by public gardens in Asma Bahçeler Housing Complex were considered as buffer zones.

		CASE STUDIES			
		Yeşilköy Mass Housing	Sürücüler Terasevler Housing	Asma Bahçeler Housing Complex	
ACTIVE CONTACT	Sharing areas	meeting points	+	+	+
		common rooms	-	-	+
		courtyards	+	-	-
		public gardens	+	+	+
	Circulation areas	pedestrian paths	+	+	+
		secondary streets	+	+	-
		corridors	-	+	+
PASSIVE CONTACT	Buffer zones	inner gardens	+	+	-
		balconies	+	-	+
		terraces	-	+	+

Table 5. Comparison of each case

### Conclusion

Housing settlements should include spatial organizations that support the publicness for the continuity of social life. In this way, these settlements, which base a strong balance of public, semi-public and semi-private spaces, can find a solution to one of the biggest problem of past century, “the loss of the quality of public life” (Trancik, 1986) by the help of new perspectives of collective living. Therefore, the main purpose of the study was determined as the examination of the spatial organization in the residential settlements, and it was aimed to study the design principles to be considered when establishing a public-private space balance in public housing settlements and to determine the qualities of the spatial formations in this balance. To this end, three experimental cases of different eras from Turkey selected and design of these projects in the criteria determined by examining the space hierarchy decisions were analyzed. While analyzing, not the present usage value of the houses, their qualities at the time they were designed and their innovative approaches were discussed.

As a completion of the comparison, some results were reached about the lifestyle that it represented in the three selected examples. While designing a residential group in the first quarter after 1950s, it was observed that universal movements were still followed and different perspectives were tried to be brought to the house. In addition, it has been examined that the project could be designed with strong open space organizations since the cities is not intensified yet. In the analyzed example, the spatial organization integrated with the city was created by increasing the degree of publicness on the ground and the interaction possibilities at different levels were maintained without damaging the privacy of the users in the semi-public and semi-private areas at the upper elevations. In the 1980s, it was observed that the urban growth narrowed the boundaries of the residential areas and the practices of mass housing became widespread. In the analyzed example, a new apartment block type was created to try increase interaction and more introverted settlement was designed in narrower area, so public relations tried to be provided with alternatives within the inside of housing group. Also, it was seen that this settlement, which sets boundaries between urban life, include activity areas that allow socialization within themselves, passive contacts in these activities

with semi-private spaces is supported, that is, micro-neighborhoods were being created. At the present time, it has been observed that the residential settlements have started to be produced in the urban fringe as the result of density in the city centers. In the analyzed example, it was determined that the difficult site conditions were resolved by a horizontally organized settlement decision, and the design strategy strengthened dwellers relationships. Although public open spaces are few because of smallness of the site, semi-public and semi-private space texture has been designed densely to make stronger the neighborhood feeling and a highly interactive life model has been proposed.

To conclude, the result of these analyses show that the projects, which were represents similar design approaches from different times offered an experimental social living environment to the user with the proposed publicness. In the study, after the discussion of the active-passive contact relations, it is concluded that semi-public and semi-private spaces are crucial spatial inputs to support public life. As a result, it can be said that the spatial formations that will provide publicness experience in the housing design are sharing areas, circulation areas and buffer zones where the residential user can freely spend time and that settlement will live according to the communication allowed by these experimental spatial perspectives.

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# BUILT UTOPIA OR INTEGRAL PART OF URBAN REALITY: READING BATIKENT THROUGH THE EYES OF TAFURI

MELIKE ATICI

## Abstract

The housing problem, which started to be experienced by European cities at the end of the 19th century, made its presence felt in the mid-20th century for the cities in Turkey as a concomitant of the global proliferation of the industrialization. At that time, Turkey, as a young republic, dealt with the problem of housing as a part of the modernization process and had trouble generating social policies for urban housing inadequacy. This deficiency in housing policy was filled by left-wing municipalities in the 1970s. Municipality of Ankara and its social democrat, architect mayor developed a new approach to cooperative housing as a third way of housing provision besides the ones developed by the state and market. Through organizing lower and middle-income groups under the association of Kent-Koop (cooperative union) and mediating between different actors -such as central government, construction companies, architects, planners and cooperatives, Municipality of Ankara conducted the largest housing project of its time, Batkent. The organizational model developed for Batkent indicates a critical point in the housing history of Turkey. This collective planning and design process was adopted by various cities in Turkey throughout the 1980s.

A closer examination of Batkent housing settlement reveals its organizational, spatial and ideological similarities with the inter-war and post-war European housing experiences that emerged as the embodiment of social democratic values. For those housing examples, Manfredo Tafuri opened up new ways of consideration in terms of the tension between architectural objects and its social, political and historical context. This paper argues that it is possible to develop an alternative reading on Batkent through imitating Tafuri's studies on European housing examples. Through this reading, it is aimed to depict the peculiar position of Batkent as a field of collective planning and design, confronting visions and contradicting implementations.



# GENDER AND URBANISM: CASE STUDY OF THE REPUBLIC OF MOLDOVA

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## **1. Introduction**

Trends of fast urbanization at global level have resulted in the fact that more than half of humanity lives in cities today and 5 billion people are projected to live in cities by 2030 (UN, 2015, SDG 11).

Urbanization is, in general, associated with different positive trends and many challenges. As positive trends, urbanism is associated with increased prosperity (Chant & Datu, 2015; UN HABITAT, 2013), enhanced social, economic, and political opportunities for women and men (Chant & McIlwaine, 2013; UN HABITAT, 2013), better access to social services and health care (UN DESA, 2014; World Bank, 2013), and a reduction in overall poverty (Ravillion, Chen, & Sangraula, 2007).

At present, rapid urbanization is challenging both national and local governments in their role to develop compact, inclusive, connected and integrated cities. In order to improve the well-being of all persons in the city, it is paramount to work toward promoting inclusive cities with spaces that welcome and engage different groups of women and men. Gender issues should be mainstream into human settlements development. Urbanization and city life have a different impact on men and women

due to the fact that they benefit differently from the opportunities offered by the urbanization process. The structural interlinkages between gender equality and urban sustainable development have been recognized in the 2030 Agenda for Sustainable Development which emphasizes the role of efficient urbanization as the right path towards sustainable development (UNWomen, 2016).

We would like to mention the efforts of some specialists to critically revisiting cities through gender lenses (e.g. Moss & Al-Hindi 2008; Raju & Lahiri-Dutt, 2011; Chant, 2013). The general critique presented by geographers concerned with gender is that both the field of geography and the practice of urban governance – the latter being the methods of governing and the way of developing and implementing policies at the local level – are too masculinist and gender-blind (cf. Doan 2010, (apud Zebracki, Martin 2014). Their argument runs that women’s presence in space is highly constrained by gender roles, and that urban governance in every sphere is oriented towards the needs and routines of especially male city users (Watson & Gibson, 1995; Walby, 2005; Lavena & Riccucci 2012). In that respect, a good while ago, Monk and Hanson (1982: 44) made a plea for “a more [gender-] fully human geography” (apud Zebracki, Martin, 2014). At the same time, West and Zimmermann (1987) posited that the social construction of gender affects all aspects of life and hence the culture of urban governance.

## **2. Research approach and methodology**

In the first section of our research, reflected in the article, we analyze the importance of gender as variable in the urban dynamics. In the second section we explore the youth’ vision on urbanism through gender lens.

### **Thus, as hypothesis we supposed:**

1. Women and men experience urbanization differently.
2. Despite of general recognition of gender as important variable in the social life, urban planning is gender blind.
3. There are girls’ and boys’ specific vision on city/urbanism (similarities and differences).

### **Research questions:**

1. What is gender perspective of city/urban development?
2. What are the challenges of urbanization for young people?
3. What is a gender friendly city?
4. Is the concept of security in the city for women and men the same?
5. What are the opportunity for women and men to contribute to decision making process in urban life?
6. How to engendering urban dynamics?

As Methodology, we used gender analysis of some areas of urban development: statistics and legal documents, transportation and road infrastructure, safe public space, access to public/private services, balanced development of jobs and housing, formal / informal economy (jobs), urban governance, etc., based on international standards and approaches (UN Habitat, 2013; THEMATIC BRIEF, EU, 2015).

Also, two focus group with students (16 girls and 16 boys) were organized in

order to explore the youth' vision on urbanism. The students were selected from different universities in Chisinau, aged 18-19. Half the students are permanent residents in Chisinau, half came from rural communities.

### 3. Main findings of research

According to international documents, to mainstream gender equality into urban planning, legislation and economic development can contribute to full integration of women and girls in the economic, social, political and cultural life of cities (UNWomen, 2016; UN Habitat, 2013). Thus, adoption of gender sensitive documents is important indicator of urban development.

In the Republic of Moldova, we note the adoption of comprehensive legal framework on gender equality: Law No. 5 from 09.02.2006 on ensuring equal opportunities for women and men, Strategy for ensuring equality between women and men in the Republic of Moldova for the years 2017 -2021 and Action Plan on its implementation, National Program for implementation of the UNSCR Resolution 1325 on Women, Peace and Security for 2018-2021, Law no. 71 from 14.04.2016 for the modification and completion of some legislative acts, which provides for the introduction of the 40% gender quota, of parental leave, non-sexist advertising etc.

Gender equality perspective is included in some sectorial documents, such: National Strategy on Employment for 2017-2021, Education Code (2014) etc.

In relation with urban development, Strategies of local development incorporated some demographic and health indicators disaggregated by sex. But the majority of documents are gender 'gender-neutral', that means that something is not associated with either women or men. However, what is often perceived to be gender-neutral, including in areas of statistics or dissemination of data collected in reference to a population, often reflects gender blindness in practice (a failure to recognize gender specificities) (EIGE, 2020a). We should note that gender-blind policies, programmes and attitudes do not take into account the different roles and diverse needs of women and men. They therefore maintain status quo and will not help transform the unequal structure of gender relations (EIGE, 2020b). The analysis of public expenditures shows that social standards and financial norms considered by gender equality are not implemented in the budget process (Moldova Report Habitat III, 2016).

At the same time, beyond the mentioned progresses, the major challenge is the implementation of the specified documents, but also the persistence of traditional stereotypes, which affect the lives of women and men alike, limiting the opportunities for personal and professional development. "Moldova is still a patriarchal society, in which men dominate at home, at work and in the public sphere," are the findings of the OSCE study (OSCE, 2019).

In the context of Moldova, urbanization is mainly conditioned by internal migration and results mainly in the people orientation to living in the capital, which offers greater employment opportunities compared to other localities. Thus, in the last years a stable tendency of growth of the urban population is observed, with a special emphasis towards the capital, the city of Chisinau, which concentrates almost 20% of the total population and 45% of the urban population of the country (UNDP, 2016).

De facto, Internal migration also represents a challenge and an opportunity for

urban development.

Thus, the better living conditions offered by the capital's facilities, including cultural, educational and medical services, as well as greater opportunities for employment, are among the factors that attract the population, especially the youth to Chisinau.

On the other hand, the concentration of the population in the cities leads to the deepening of the socio-economic problems in general, it leads to the increasing inequality of access to facilities and services, both between cities and villages and within them between different groups of the population (UNDP, 2016).

Similarly, as a challenge, we find the need to adapt public services and infrastructure to the flow of population outside cities. For example, the flow of personal cars, used especially by men who come to work in Chisinau, raises the problem of parking.

Given the connection of women's needs with the family, but also the security problems, as a solution for reconciling professional and family life for women, who commute from villages to work in cities, it would be to improve the infrastructure of roads and intercity transport.

Based on international documents and studies, we analyzed different challenges related to urban development through gender lens.

Urban space, as a human product, reflects the needs, norms, models, traditions and values of a society. Women and men have a common and also different visions on urban life; often, they use urban space in different ways, due to the traditional division of roles in the family and in the society. Traditionally, men are focused more on 'productive' (paid work) in the public space; women are dedicated more to care and domestic activities in the private space. The data analysis confirms that in Moldova, as in many countries, "the gendered use of space remains influenced by those traditional gender roles" (Jaeckel and van Geldermalsen, 2006).

Thus, according to research, in Moldova mothers give more time to children than to fathers: 2.4 hours vs. 1.3 hours, but mothers' participation rate for such activities is 21.4% and fathers - only 10.4% (NBS, 2012a).

At the same time, taking into consideration the adoption of paternal leave in Moldova, and increased the number of men who spend more time with children, often the tasks remain different: women are more responsible for childcare, and men - for agreement. Relative to men, women tend towards a more mixed use of urban space than men. Thus, women typically take three types of roles in terms of the paid and unpaid work. For example, the priorities of women in the cities (Chisinau, Balti, Cahul and others) may include different types of employment (paid work / income earners), household management and childcare (unpaid work), social activities at school / kindergarten, housing associations, etc. (largely unpaid work).

According to NBS data, in Moldova, most of the unpaid works are performed by women: about 66% of the total working time constitutes unpaid work (4.9 hours a day). While men allocate twice less time for this activity (2.8 hours a day or 46% of the time used for various forms of work practiced by men). Women are only paid for three out of ten minutes for work and men for five minutes (NBS, 2012b).

Cities and urban spaces have become increasingly feminized in the past 20 years, as a result of women's integration into paid work outside of the domestic

sphere. As highlighted by UN Habitat (2013), in the near future, cities of developing countries will comprise a majority of women, and this trend will be even more observable among older people (over 60 years old) and 'older old' (over 80 years old) (UN Habitat, 2013).

Moldova is a country with visible aging process. Ageing coefficient has substantially increased from 17.5% in 2014 to 20,8% in 2019 (at the beginning of year), meaning that number of persons aged 60 years and over per 100 inhabitants has substantially increased, being more prevalent among women (60%) than men (NBS, 2018).

Considering the external migration of the population through the strong exodus of the labor force, the problem of creating friendly jobs for the elderly is required. At the same time, the creation of 'elderly- friendly' jobs and related services must also include the gender dimension, given the fact that women are numerically prevalent among the elderly.

One of the important indicator of urban development is access to and control of urban resources. Often, in many countries, there are differences in women and men access to and control over the same amount and types of urban resources. Globally, only 30% of women have access to the use of a car during the daytime. In contrast, women tend to use public transport in greater proportion than men: in developed countries, 75% of bus journeys are undertaken by women (Lambrick and Rainero, 2010, apud THEMATIC BRIEF, EU, 2015).

According to national research, in Moldova: Eight out of ten women and nine out of ten men travel daily for a specific purpose, a trip of about 1.4 hours. Two thirds of her travel time, women walk on foot and a quarter of that time spent in public transport. Men devote three times more time to car travel compared to women. Taxi services are more used by women and city dwellers. Men and villagers use the train more often (NBS, 2014).

The state register of drivers also shows that, as of January 1, 2018, in the Republic of Moldova there were 972 thousand drivers, of which 217 thousand are women (22.32%) (Registru, 2018). There are 524,703 drivers in category B in the State Register of Vehicle Drivers, of whom 308,332 are men and 216,371 are women (Agora, 2019). At the same time, despite of increasing number of women car drivers, informally, many people do not agree this transformation. Thus, the society has an effect on this based on how people view gender roles/ impact of gender stereotypes.

Urban development means existence of adequate, accessible and affordable services and infrastructures. Their lack/ insufficiency has a negative impact on women. For example: the lack of services and infrastructure – such as care institutions, sanitation, transport or accommodation – increases the amount of time that women spend on unpaid work, which in turn affects their socio-economic participation.

From a social and gender perspective, increased attention requires access to educational services, especially preschool services. Statistical data indicate the insufficiency of places in the preschool institutions in cities, especially in the municipality of Chisinau. According to statistical data, at Chisinau level there are some problems with access to kindergartens since 103 children refer to 100 places (NBS, 2019a). Considering, the lack of places at the preschool institutions, but also

that traditional childcare is the responsibility of women, this situation affects the possibilities of women in the labor market.

Thus, among those who face difficulties in employment, we mentioned especially mothers with young children, who are affected on the one hand by the insufficient development of child care services, the insufficiency of places in kindergartens, especially in the nursery groups, and on the other hand, the persistence of stereotypes (the concern of employers that mothers may be frequently absent from work due to children's illness).

Thus, for women aged 25-49 with at least 1 child (aged 16 and under) the employment rate is 49.2%, while for women without children the employment rate reaches 54.1 % (NBS, 2019b). Thus, education service deficiencies and associated time burdens can limit income generation among women.

As was mentioned, in Moldova urbanization is mainly conditioned by internal migration due to the fact that cities offer more opportunities at labour market. At the same time, despite of the positive trends, we note gender inequality at Chisinau level.

Women mainly work in education and the services sector. With regard to the number of employees distributed on some economic activities and by sex, we find a significant gender discrepancy: women, accounting for 50.8% (51.0% -2018) of the total workforce, predominates in education (73.8%) and services (52.0%), the other domains being dominated by men (table 1).

At the national level, women earn on average 13% less than men (NBS, 2019b), in Chisinau - 15.4%. Reiterating that Chisinau offers more employment opportunities (in the vision of more women and men), we conclude visible gender discrepancies in the average monthly earnings in the economy (NBS, 2019a). Thus, in 2018 the average wage of women constituted 84.6% (85.3% / 2017) compared to men, in industry and construction - 81.5% (82.9% / 2017), in education - 85, 9% (81.5% / 2017), in service activities - 83.8% (86.2% / 2017). In agriculture, forestry and fisheries and public administration and defense; compulsory social insurance - the discrepancies were smaller, respectively 91.5% (95.6% / 2017) and 98.0% (93.0% / 2017).

	Total	Including:		% out of the Total:	
		Women	Men	Women	Men
Employees – total	359 491	182 686	176 805	50,8	49,2
Agriculture, forestry and fishing	3 751	1 302	2 448	34,7	65,3
Industry and constructions	72 955	28 621	44 328	39,2	60,8
Public administration and defense; compulsory social insurance	21 188	9 847	11 342	46,5	53,5
Education	32 999	24 299	8 701	73,6	26,4
Other services	228 597	118 617	109 986	51,9	48,1

Table 1. The number of employees distributed on some economic activities and sexes on 01.01.2019, persons (NBS, 2019a).

Overall, the results suggest that although gender role attitudes are becoming less traditional for men and for women, traditional gender role orientation continues to exacerbate the gender wage gap.

Informal employment in cities persists both among men and women, with more pronounced weights of men with informal jobs. Thus, 52.9% of the total men working in the sector and 20.8% of women, in commerce - 14.0% men and 10.3% women, in transport and communications - 12.6% activate informally men and 1.1% women. It is worth mentioning that agriculture sector remains the most affected by informal employment, with 73% men and 84% women working in this sector being employed informally (UNDP Moldova, 2020).

Women’s involvement in decision-making and participation in urban development activities are considered as important issue of urban development. Despite of some progress compared to the national level, women continue to be under-represented in the decision-making process at the municipal level (table 2).

Position	2007	2011	2015	2019
Women in mayoral positions	18.0%	18.0%	20.6%	21.8%
Women in local councils	26.5%	26.6%	30.0%	36.5%
Women in district and municipal councils	13.2%	17.4%	18.5%	27.1%
Women in Chisinau municipal council		15.6%	27.4%	31.37%

Table 2. Women’s rate in decision-making, as result of local elections (CEC, 2011; CEC, 2015; CEC, 2019).

Unfortunately, women have lower rate of participation in urban development activities than men. For example, in Moldova out of 227 members of the Union of Architects only 37 are women (16.29%).

Taking into consideration the concentration of young people in cities and in the capital, the vision of young women and young men on urban development was explored.

Both young women and young men have acknowledged that the city offers more opportunities for studies and employment in the field of work compared to the rural area.

Both groups mentioned some common problems of urban development in Chisinau: bed roads that affect its mobility, crowded transport, insufficient space to combine studies with the agreement, lack of pedestrian areas, polluted environment. Interesting that more opportunities were noticed by young women and men from rural areas compared to residents of Chisinau. Chisinau residents are more critical of the city’s image and development.

At the same time, young women identified more social issues such: improving the accessibility of public transportation, widening sidewalks, increasing the number of street lamps, and designing housing to facilitate women’s care needs – for students with small children, create more green and agreements space etc. The young men and young women specified some technical issues such: roads rehabilitation, more safe parking places, more Wi-Fi zone.

As the biggest challenge in relation to life in the capital, young people mentioned the small scholarships and reduced opportunities to combine studies with part-time

work for a decent life. In this regard, it was recommended to establish partnerships between universities and the private sector - to create spaces that combine the theoretical knowledge and practical skills of the students.

International researches shown that rapid urbanization and large women migration into cities have increased women's vulnerability to sexual violence in public spaces. As result, women's feelings of insecurity in the street limit their access to economic and social opportunities, and prevent them from accessing and enjoying their rights (to education, justice, leisure, etc.) (THEMATIC BRIEF, EU, 2015).

Thus, the safety of public space remains a challenge in relation to urban development. Referring to public spaces, young women and young men (respondents in our research) have shown common visions as well as some differences. Thus, both groups indicated that the streets should offer them safety. At the same time, the girls mentioned more often the importance of the safety of the spaces in the public transport, on the street (of sexual harassment), and the boys of physical aggression from other boys / men.

As important recommendations, youths mentioned the following:

- Engage young men and women in the design, implementation, monitoring and evaluation of local development projects.
- Build youth-led and youth-focused components into infrastructure projects, such as participation, research, information and communication technology (ICT), communications, and employment.
- Improve habitat through street art and youth initiatives to improve the image and architecture of the city.
- Offer more opportunities for young women and men to combine studies and part-time jobs.
- Create more space in the frame of universities for students - young mothers with small children to combine studies and child care.

## **5. Conclusions:**

Based on results of our research, we can conclude some challenges related to nexus between urban development and gender equality:

- Urbanization in Moldova is strongly conditioned by internal migration, which offers both women and men more opportunities for development and also challenges. At the same time, urbanization and cities offer different conditions and have different impact on women and men, girls and boys, which benefit differently from the opportunities available therein.
- Women and men use urban space in different ways, due to the traditional gender roles. Women tend to have a more mixed use of urban space than men. Women and men have different access to and control over the same amount and types of urban resources. Women have lower rates of decision-making and participation in urban development activities than men.
- Gender stereotypes and education services deficiencies and associated time burdens can limit income generation among women, thus urbanization should take into consideration gender needs.
- Creation of 'youth- friendly' and 'elderly-friendly' jobs and services must also include the gender dimension.

- Mainstream gender equality into urban planning, legislation, finance and economic development can contribute to integration of women and men specific needs in the economic, social, political and cultural life of cities.
- Collection of data disaggregated by gender and space, collected at national and cities level, is essential for gender mainstreaming and for developing strategies to ensure that urban prosperity becomes more gender equitable.

Despite of general recognition gender as important variable in the social life (with special provisions in national legislation), urban development documents remains gender-neutral, a fact that can result in gender blind. At the same time, some statistical data confirms existence of gender differences in the process. Also, we state the similarities and differences in girls' and boys' vision on city/urbanism. Thus, our hypotheses were confirmed.

#### **Thesis for reflection:**

Taking into consideration the controversial discussions about *New Urbanism* (Bodrug-Lungu, 2017), we would like to mention that New Urbanism is an urban design movement which promotes environmentally friendly habits by creating walkable neighborhoods containing a wide range of housing and job types New Urbanists support: regional planning for open space; context-appropriate architecture and planning; adequate provision of infrastructure such as sporting facilities, libraries and community centres; and the balanced development of jobs and housing

We consider that ***Gender Friendly Urbanism*** - refers to an urban public space / conditions with a safe environment where women and men, girls and boys, have equal access to all facilities/services and have opportunities to exercise their fundamental rights for a better life.

In order to strengthening of urban development' potential, the Urban development programmes need to be gender-sensitive. This gendered response should develop two parallel strategies: actions to reduce gender and social vulnerabilities, and actions to improve urban planning and budgeting (engendered) and ensure its better implementation. Urban Development as process should take into consideration the theory of change and new transformative approach: addressing women not only as victims but also as agents of change.

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**CPUD '20**

**V. INTERNATIONAL CITY PLANNING AND URBAN DESIGN  
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# ENHANCING THE QUALITY OF PUBLIC OPEN SPACES IN TRIPOLI

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## **Abstract**

This study aims to examine the quality of urban public space that contributes to creating successful public open spaces in Tripoli. Specifically, this study focuses on defining the physical qualities of streetscapes that enhance socio-cultural qualities of urban spaces. In order to do so, how residents perceive the physical quality that supports their socio-cultural desire is examined. A review of relevant literature shows that sixteen attributes can be identified with respect to the previous query. This study will utilize a mixed method approach for data collection and analysis. The literature review, questionnaire surveys, and semi-structured interviews were adopted in order to answer the research questions. The findings of this study suggest that there are five key features of public space that play a significant role in enhancing the cultural values of the Libyan society. This study adds to the knowledge of the potential of the physical qualities in supporting cultural values of public spaces.

**Keywords—** physical quality, Social Activities, urban design, public spaces, cultural values.

## **1. Introduction.**

Using the case Tripoli, the capital of Libya, this paper seeks to conduct an in-depth study of “quality of public open space”, the dimensions of urban space, and its effects on public squares. Additionally, using the case of Libyan cities, the paper assesses the concept of qualities of public open spaces. Renowned scholars have been studying the quality of public open space and city design. Some of the notable works include *The Life and Death of Great American Cities*, (1961); the *Cook*, (1980); Gehl, (1989); (Mohamed et al. 2016); and Salama and Azzali, (2015). Importantly,

their studies regarding urban design of communities were not only limited to the architecture of public space but also provided insight into the activities that occur within the public open space. Arguably, the studies affirm that social activities and other physical activities tend to positively relate to the architectural standards of public open spaces. Therefore, as an architect, one needs to understand user needs before designing an open space, which in the long-run will attract the locals, facilitate their needs, and encourage users to spend more time within the facility (Francis 2003).

A crucial role is played by public spaces in creating a different feel about Tripoli. As stated by Madanipour (2010), it is essential to provide effective public spaces in all cities, but there are considerable differences in the particular social and spatial designs of cities all over the world. For that matter, the literature on public spaces has aimed to gain further insights into the most important and well-developed aspects of urban design (Francis, 2009). A number of scholars (e.g. Whyte, 1980; Gehl, 1987; Carr et al., 1992; Cooper Francis and Marcus, 1997; Wooley, 2003; Shaftoe, 2008) number of factors that can underpin the construction of good public spaces, such as flexibility of use, diversity of building type, and accessibility. There are also certain perceptual, social, functional and physical criteria that must be met to achieve successful public open spaces.

Public open spaces allow people to engage in social interactions, including all types of personal, cultural and economic exchanges, and provides such places an identity in order to play a significant role in their respective civic and national communities (Carmona et al., 2003). Explaining this notion, Gehl (1987) suggested that new developments should consider issues like the type of life people want and the type of spaces required for such life (i.e. activities), as well as the way in which the urban fabric should be planned, placed, and created, to maintain these spaces and the life of such areas.

Although there has been some extensive research on public spaces, a gap in the understanding of the public space of cities appears to be the major issue at present. One of the key problems identified by Francis (2009) is the need to determine “why some public spaces are memorable while others are easily forgotten and how understandings of cultural diversity and publicness guide the design of public open spaces. It is also important to understand which physical forms are the most effective and how designers, planners, and managers best apply the lessons learned from the now extensive number of published case studies” (Francis, 2009). There appears to be a gap in how people understand the meanings attached to public spaces and the growing typology of spaces developing at the present times. According to Francis (2009), it is possible that understanding cultural diversity and publicness would impact on the design of public spaces.

## **2. The aim of this paper.**

Using the research question “How can the quality of public open spaces in Tripoli be enhanced?” this paper aims to fill in the gaps with respect to the suggested attributes of quality urban space in the context of Libyan cities and the design policies and guidelines for the design, management, and perception of urban spaces in Libya. To achieve this objective, measurements of attributes of squares are taken as quality indicators of public areas within the city center of Tripoli. Additionally,

the relationship between urban forms and quality is explored, in addition to the structural environment's impact on quality and physical activity relative to the research question.

### **3. Background and literature review.**

#### **3.1 Public open spaces: definition and concepts.**

According to Francis (1992, p. 1), the public realm can be defined as "all the parts of the urban fabric to which the public have physical and visual access. Thus, it extends from the streets, parks and squares of a town or city into the buildings which enclose and line them." While defining the public sphere, Tibbalds (1992, p. 1) highlighted the social dimensions linked to such spaces as being "the most important part of our towns and cities. It is where the greatest amount of human contact and interaction takes place". From another perspective, according to Carmona et al. (2010, p. 137), there are two aspects associated with the 'public realm'; namely the 'social' and the 'physical' one, with the latter linked to space and the former to activities. In other words, "The physical public realm means the series of spaces and settings – which may be publicly or privately owned – that support or facilitate public life and social interaction. The activities and events occurring there can be termed the socio-cultural public realm." In adopting the term 'public realm', the purpose of Carmona is to combine both the physical space with the social events taking place in such a space.

As shown in aforementioned definition in the Dictionary of Urbanism (2005) and according to several architects and urban designers, the concepts of 'public realm' and 'public space' tend to be conflated and the attention seems to be paid mainly to the physical features of the 'public realm' instead of the social aspects. Similarly, more accuracy has been adopted by other scholars when differentiating between these two concepts, with the sociological features being highlighted by several practitioners, such as sociologists, builders, urban architects and designers, and developers. It should be pointed out that some authors even go as far as placing more significance on the social aspect at the expense of the physical one. Defining the term 'realm', Lofland (1998, p. 11) looked at it as being "not geographically or physically rooted pieces of spaces". In so doing, there is a clear reference to the social element when attempting to define the public realm. In addition, while referring to a public realm as "the locus of a complex web of relationships" (ibid. p. 51), Lofland argues for the presence of three kinds of realms in her approach; namely the private, parochial and public types. Similarly, Lofland distinguishes between 'private' and 'public' in respect to accessibility, with 'public' spaces being used by virtually everyone as opposed to the 'private' ones. Moreover, as contested in Lofland's approach, upon exiting their private space, people engage with others who are strangers to them, but they do not necessarily have to reveal their opinions, cultural beliefs or past activities or actions.

#### **3.2 Urban public open space.**

The design and the creation of open public spaces have witnessed a noticeable consideration in recent years, attracting interests of designers, planners and policy makers. The term "public space" has different definition depending on the context in which it operates. The simplest definition is that public spaces refer to spaces

that are public; accessible, available and free-to-use by citizens. Chen et al. (2016) point that public spaces are essential part within the civic built environment, serving urban-life activities and needs on daily basis.

At the policy level, the Scottish Executive (2008) defines “public open space” as a space that comprise natural elements such as greenery, parks and gardens, water surface, water fronts, trails and pathways, lands and structures for vegetation hill and any other geological element within a human settlement or at its boundaries. These public open spaces serve as recreational and comfort zones for local communities which seek relaxation and refreshing besides contributing towards other social, economic and environmental benefits. On the other hand, all paved spaces, squares, plazas that serve for civic purposes are defined as “urban spaces” (Taylor, 2007 and Kim & Nicholls, 2016). For instance, Taylor et al. (2007) and Kim and Nicholls (2016) assert that public open space, which includes squares, parks, playgrounds, and waterfronts tends to act as recreation facilities that boost society’s social and physical activities such as sports and socializing. To boost society’s social and physical activities, Abbasi et al. (2016) assert that effective use of public open place calls for the quality of the physical features, meeting user needs, and spatial structure of the place.

### **3.3 The square as a public space.**

In urban design discourse, there has always been a recognition of squares as social spaces. In fact, the role of square as an important social space in the city has been championed by several scholars, including Whyte (1981), Jacobs (1961), Appleyard 1981), Gehl (1987), Jacobs (1993), and Mehta (2013). It is important to note that communal places, especially squares, are generally open to the public; thus, they serve as a space for social interaction, with people from various backgrounds engaging in diverse public and social activities, whether individually or collectively. As a political space, there is public awareness of the role of the square as a place where personal and political life flows together. As stated by Jacobs (1993), a square can be referred to as ‘a meeting ground for the development and exchange of ideas and hopes or a stage for demonstration and mass expression’. Rapoport (1987) confirmed that pedestrians’ use of squares is in the first place culturally motivated. In certain cases, a square can be turned into a platform for parading, or for performing arts and playing. It is generally held that when people want to celebrate their achievement, identity, or any festive occasions along the square space, they do this via square parades and processions. For example, a square can be utilised both for funerals and weddings of high-profile personalities or celebrities or sometimes the local residents. Architectural work plays a significant role in determining the city’s image. Lakheder and Dugeny (2010) argue that any project with poor design creates architectural elements that negatively impact the city’s image. Tripoli is a Libyan millennium city with vast advantages and disadvantages regarding the public open place. Focusing on the disadvantages, Tripoli’s urban space is under degradation which negatively affects the green spaces from the year 2000s to date (University of Wisconsin Transportation Analysis Team 2011). Furthermore, the city infrastructure, which includes the roads, sidewalks, and public open space facilities are under poor condition. Consequently, Libya’s ongoing conflict since 2011 led to the stoppage of all projects that requires the

services of architecture.

### 3.4 Qualities of public open space.

Physical attributes are constituents of urban form which include furniture, natural elements, shape, size and material. More so, the constituents determine its appearance. Thus, it is hard to determine the appropriate size for public spaces because it is associated with location and context that differs between places. Therefore, it is claimed that layouts with smaller places and breath out surroundings are valuable (Shaftoe, 2008). To arouse curiosity, Shaftoe (2008) explained that curves and bends used in designing the public space are ideas, leave alone intriguing. Shaftoe claims that Gordon Cullen's *Townscape* (1961) based his idea to explain successful designing of different areas of the town in a particular sequence rather than at the same time. In addition, Gehl (1987), Madanipour (1996) and others argued that height as a third dimension is appropriate to avoid overshadowing and overlooking the surrounding buildings. Good quality material has been pointed out by Shaftoe (2008) to be a preferable material when it comes to public space. This is because a well-used space undergoes a lot of wear and tear, thus, good quality material is ideal for durability and economical over time. Moreover, Shaftoe suggests the use of assorted materials that have intriguing attractive colours and layouts on vertical surfaces. Whyte (1980) argued that sitting places in public spaces are essential and requires careful planning in order to be used by people. Good quality sitting places are required in any public space rather than formally fixed benches as argued by Shaftoe (2008). In support of this, Whyte (1980) suggests the use of movable chairs that aids flexibility in movement. Natural elements such as trees, plants and water incorporated in the public spaces help to work well (Shaftoe, 2008). Woody vegetation, trees and water features are among the important natural elements (Schroeder and Anderson, 1984). Moreover, greenery and trees are aesthetically pleasing as much as psychologically significant in public spaces (Kaplan and Kaplan, 1989). Whyte (1990) pointed out that water features occupy a prominent status as it is attractive and tempting enough to convince people to spend more time in public spaces.



Fig. 1 Before and after the cost relocation in the city centre of Tripoli.

#### 3.3.1 Social dimension.

In various recent research studies of the built environment and human conduct, the importance of social factors in terms of identifying and forecasting the forms of human interaction with the environment has been highlighted. According to

Carmona et al. (2010b), the key aspect of urban design lies in recognising the link between the social construct (people) and their spatial setting. Further, one way of describing the association between individuals and their setting is that of “a continuous two-way process in which people create and modify spaces while at the same time being influenced in various ways by those spaces” (Carmona et al., 2010b, p. 133). According to Carmona et al. (2010), a key element of urban design lies in understanding the association between people (society) and their environment (space). Over the last five decades, there have been countless studies and continuous efforts in relation to the examination of the social dimension of square. The emphasis of these studies has been on the role of a square more than simply as a channel of movement but as vibrant and lively social space (e.g. Jacobs, 1961, 1993; Appleyard, 1981; Gehl, 1987; Mehta, 2013). According to Carr (1992: 22-24), “a prerequisite to the development of public spaces is the presence of some kind of public life, which “has been an integral part of the formation and continuation of social groups”.

### **Social interaction**

Carr et al. (1995) stressed the major contribution of public spaces in offering a sense of positivity in people’s lives with a relaxing environment for every day-to-day interactions and encounters. In fact, in the view of Behrens and Watson (1996, p. 208), hosting social and interactional activities is the key role of public spaces. In addition to consolidating the relationship between public spaces and commercial activities, these spaces are also intended to provide additional spaces to overcrowded individual dwellings by means of recreational, private and tranquil settings. Similarly, by responding to people’s social needs, while providing them with a feeling of independence in terms of having some kind of privacy, it is more likely for social interactions to be positive and productive (Lang, 1987). One of the issues linked to attaining the social sustainability of environments like public open spaces is that of social interaction. According to Kunz (2006), cultural variations are too significant that no two societies would have similar social sustainability. As stated by Tang (2012) ‘Social’ can be defined as a group of human beings residing in structured organisations, which results in mutual responses that provide positivity and wellbeing to people. Besides, there are various implications for the term ‘Interaction’ in all fields. For instance, it focuses on kinetically vibrant interactions between people (Latour, 1996).

Despite appearing to be a secluded place for people to be away from others, these places can be very useful for social interactions given the shared and social aspects. As a result, they become the focus of various desires, needs, and goals (Cattell et al., 2008). There is thus a need for a variety of spaces to be established to capture the everyday social expectations by bringing people together or by making them flee (Cattell et al., 2008). Previously, it was possible for people to seek their roots in such places like public open spaces (Sennett, 1990), where people with different races, gender, and ages would go and spend some quality time (Mitchell, 2000). The chief characteristics of squares among general public spaces is their greater manifestation of the informative and educational aspects of a public spaces, possibly including physical platforms for conducting a conversations or discussions, in addition to being ideal spaces for political and social events, including

demonstrations, protests, and public speeches and marches. Similarly, a square is a space to which people can relate in terms of being a well-known environment, close to green areas, and central buildings and overseen by urban social standards (Carmona et al., 2010).

### **Security and safety**

It can safely be stated that when public spaces are reputedly of a poor quality, just the most important activities take place; on the contrary, when these spaces are known of having a good quality, it is possible to have a whole range of human activities. Despite the indirect influence of physical structure on necessary activities, these activities tend to last longer in high quality outdoor areas. As a result, when the quality of outdoor areas is high, optional activities take place more frequently. In addition, the number of social activities usually goes up noticeably with levels of optional activity increasing (Gehl, 2010). As opposed to Whyte's analysis, which was grounded on observation, the argument of Carr et al.'s (1992) is built on a synthesis of research on the utilisation of public places. According to Carr et al. (1992), "as well as being meaningful - allowing people to make strong connections between the place, their personal lives, and the larger world - and democratic -protecting the rights of user groups, being accessible to all groups and providing for freedom of action - public spaces should be responsive - that is, designed and managed to serve the needs of their users." (Carmona et al. 2010, p.208).

### **3.3.2 Functional dimension.**

A number of studies over the years, including key words by Jacobs (1961), Appleyard (1981), Gehl (1987), and Mehta (2013), have examined the functional dimension of squares. For example, Jacobs (1961) investigated the significance of social interactions that thrive throughout vibrant square spots. Similarly, in *Life Between Buildings*, Gehl (1987) highlighted the contribution of squares primarily as public spaces (for non-compulsory and social pursuits), rather than only for essential activities. More recently, Mehta (2013) explored contemporary roles of squares as social public spaces. As stated by Buchanan (1988b), an urban design is largely about place-making, according to which places are not only about a specific space, but also include any activities and events that make that urban design what it is. The vitality of the city surroundings is dependent on the intersecting and intertwining of events within it, and comprehending cities necessitates handling and managing a combination of uses as the 'essential phenomena' of urban life (Jacobs, 1961). The functional attributes of public spaces describe the way individuals function in a space or, more specifically, how they use these spaces. Therefore, in order for the public place to be successful, it needs to accommodate such activities and encourage them; the awareness of the way people use such places is therefore very important in the process of designing these places (Carmona et al., 2010b).

### **People's needs.**

The purpose of having public spaces is to meet the people's needs in the first place. As such, one can argue that ensuring a successful public place necessitates essentially studying people's inclinations, anticipations and demands. Another factor to consider relates to examining the reasons why certain spaces are not that

attractive. In this regard, the high priority of the designers of these spaces lies in understanding users' needs and meeting their expectations in public open spaces. This is confirmed by Lang (1994) who mentioned that when designing urban public spaces, capturing peoples' expectations is of utmost importance (ibid, 1994). In addition, by claiming that such places are intended to serve people in the first place, it is thus expected of them to consider people's preferences, along with what is required to fulfil those needs. According to Lang (ibid, p.154), "If the built environment is to serve human purposes, one must have a good model of human needs to use as the basis for asking questions about what should be done, what functions should be served in a specific circumstance".

#### **Accessibility and Movement.**

Accessibility is a primary factor that helps promote optimum social interactions in public open spaces (Nghah, 2013). Public open spaces should be designed in ways that ensure they are easily accessible to everyone irrespective of their cultural differences and social status (Holland et al., 2007). However, in some situations, public open places might not be the most appropriate area to promote cross-cultural interactions (Amin, 2002). Accessibility is paramount in designing a public open space; however, in cases such as cross-cultural/ ethnic interactions it can end up being a facilitator of dispute. According to Lau & Chiu (2003), accessibility can be defined as the ability of people to achieve their basic needs in order to live a quality life (p.197). However, many scholars argue that public open spaces should remain accessible regardless of the situation. According to Harnik (2003), public open spaces should remain accessible to everyone irrespective of their social class, financial position, cultural differences and physical capabilities.

According to Thompson (2007), public open spaces located within residences and workplaces are highly regarded by individuals. In terms of the physical aspects of the public, accessing public space remains a key issue, and is subject to both facilitation and limitation by the social environment. However, the accessibility of space is itself restrictive and sometimes completely limiting to accomplishing socializing in the public spaces (Talen, 2000). As Bertolini (2003) determines, the accessible public space provides a platform for interaction for various individuals, while it also allows people to do different kinds of things. This accessibility, therefore, makes these public spaces as physical places, and also a platform for several actions. Lang (1987) explores the relationship between patterns among people and identifies their two main indicators: functional distance and certainty. The first indicator describes the level of the difficulty that occurs when a person moves from one place to another. Functional certainty, on the other hand, describes the degree of ease of access to commonly used facilities for a group of people. Functional certainty further describes how often these groups would use and access these facilities. He argues that the most important consideration for these patterns is to help shape the behavior of users and be of help to their lives. This makes it essential for ensuring ease of access to such facilities. He further asserts that in order to promote interaction among people, they need to have the opportunity to meet and gather at one place.

Bill Hillier (1996) carried out a comprehensive practical study on the interrelation between the elements of movement, the spatial structure of space and the use

of land. In his study, he noted that the organization and formation of space and visual permeability play a vital role affecting movement patterns and chances of accessibility. He therefore used the term 'intelligibility' to refer to movement and visual permeability. He further noted that in any urban system there are three essential factors that affect movement patterns which are origin, destination and the spaces people need move to different place. Open, closed or controlled public places should all available to urban users. The physical patterns should play both social and symbolic roles in setting the boundary for social behaviors. This can be achieved by engaging either natural or constructional means. In this context, there are three kinds of access: visual, symbolic and physical.

- Visual access: This is experienced when people can see the interior of a space before deciding whether to go in or not.
- Symbolic access: This occurs when spaces contain symbols, which would either encourage or discourage people to go in. This, however depends on whether these symbols are threatening or welcoming.
- Physical access: This is when people are able to access and use a space unconditionally (Carr et al. 1992, p. 150).

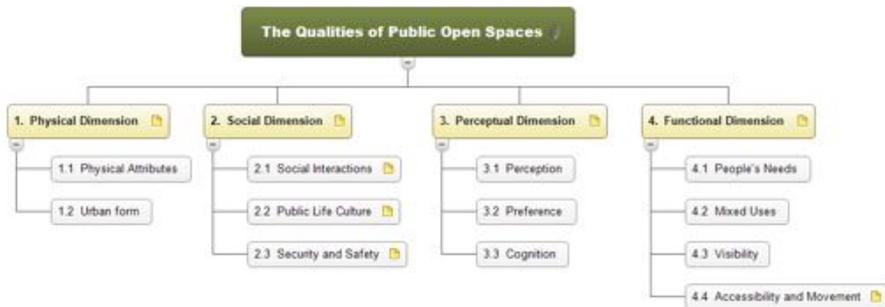


Fig. 2 The qualities of the public open spaces (Source: the researches)

#### 4. Enhancing the quality of public open space.

Several academics describe urban quality to be an intricate and multifaceted concept. Some literature provides components, models and indicators that explain urban quality to their readers while others only provide a fluid and open hint regarding urban quality. To provide readers with a clearer explanation, other literature use case studies that measure urban quality. According to Kamp et al. (2003), environmental quality is a multifaceted container concept with various philosophies correlated to various features of environmental quality.

Carmona et al. (2008) argue that awareness of the major principles that comprise public space is of less importance than an awareness of how such principles are aligned together to enhance public space quality to create a favorable environment for human actions. Gehl (1987, 1996 and 2010) explains that public space actions are sensitive to physical environmental quality and mainly vital public space perceptions. He further states that physical enhancements can stimulate social actions in public space thereby improving them. Improvement in the physical quality of public open space will result in many people in outdoor places, a high

increase in the range of outdoor events and an increase in the average time spent outdoors. Thus, harsh climate such as too cold, hot or wet can make outdoor events impossible or reduced (Gehl, 2010). Shaftoe (2008) stresses the need for providing protection against harsh climatic conditions. For instance, providing protection from the intense heat or too cold climate so that outdoor events in public spaces can be possible. He further argues that ventilation and shading provide a cooling effect in hot regions while enclosure effect in small buildings, proper clothing and use of outdoor heaters can provide warmth in cold regions. Shaftoe also proposes that pleasant spaces can be somewhat or completely roofed in the worst situation.

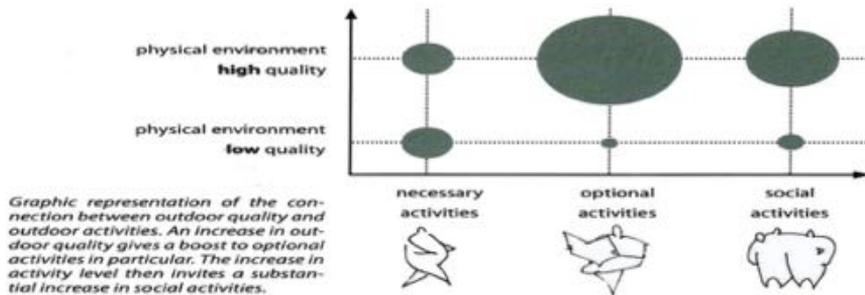


Fig. 3 Ways of enhancing the outdoor quality of public open space.  
(Source: Gehl, 2010, p. 21)

The author, Whyte, of the book, ‘The Social Life of Small Urban Spaces’ (2008) explains the existence of a close connection between qualities of city actions and city space. Whyte further states how to enhance the utilization of outdoor spaces through simple physical changes. For instance, Gehl 1987 asserts that seated activities increased by 88% in an experimental improvement aimed at increasing the number of seats by 100% in a pedestrian street in Melbourne, Australia. The same results have been realized by Project for Public Space (PPS) in several improvements undertakings in New York as well as other major U.S. capitals. According to Gehl (2010), people can adopt an entirely new pattern of use caused by space renovation or even modification in details and furniture. To conclude, Gehl (2010) examines his surveys in Copenhagen and Melbourne and argues that a close relationship exists between the use of city space by people, level of apprehension for the human dimension and the city space quality.

As also inferred, once more functional public spaces are launched, there will be increased use. In addition, Gehl (2010, p. 17) argued that the results of his research seem to be “generally valid in various cultures and parts of the world, in various climates and in different economies and social situations”. Also highlighted is the major impact of physical planning and design on the use patterns in urban public spaces. Similarly, Gehl called for enhancing the level of city space quality, as well as taking into account the human element in the design of public spaces and offering tempting invitations, which would eventually tempt people into strolling around and using public spaces, and therefore making most of their time there. In order to achieve this, “Invitations to do something outdoors other than just walking should include protection, security, reasonable space, furniture and visual quality” (Gehl,

2010, p.21).

MORI (2000) stated that people hope for good safety, hygiene, and neatness measures, as well as access for all and provision for dogs in parks, as found in their consecutive surveys that shed light on what people believe would most enhance such areas. According to Llewelyn Davies (2000), it is important to gain access to a public space that inspires the senses, in a visual and acoustic way, as well as by touching and smelling. It is paramount that such places are unique and attractive, while reinforcing the local feel, which means that they should be free of clutter, and equally exploit the power of public art and are characterised by good lighting and signage.

#### **Qualities squares factors.**

There are four key qualities that are crucial for high-quality public spaces according to an examination of more than a thousand public spaces around the world by the Project for Public Space (PPS) (2000), including **accessibility**, which indicates that a space that is easy to get to and move within, visible and convenient to use would be successful. The second characteristic is **comfort and image**, which is related to views of space as safe, clean, green, full of character and appealing. The third quality refers to **uses and activities**, which seems to be the main motivating factor for people to be there and contributes to the space's specialness and uniqueness. Finally, **sociality** can be a key feature as it nurtures friendship, cooperation, communication, diversity, and social rapport, Fig. 4.

Based on several studies focused on Saudi cities, the recommendations of Mandeli (2010) include standards, size and location for public space from a physical planning point of view. "to how these neighbourhoods offer the potential for residents to have a greater attachment to adjacent outdoor areas; to how to encourage individuals to participate in improving their immediate surroundings; to how public spaces within residential areas become accessible, aesthetically pleasing and more sociable; and to how to reduce a sense of risk and undesirable behaviour" (Mandeli, 2010, p.171). Such design criteria for public space provision are largely interested in the objective quality of public space. In fact, the difficulties in establishing appealing public spaces with high quality stem from such incomplete scope of action, as well as limited understanding of urban need, in addition to inadequate management systems. Also confirmed by Mandeli (2010) is the need to grasp the physical and non-physical qualities that may play a role in the delivery of high quality public spaces so that local authorities and their professionals are able to be more effective when it comes to improving the quality of the public space.

Similarly, Shaftoe (2008) indicates that design and architecture alone may not be sufficient factors in creating lively places since design interconnects with the setting, culture, and management. As shown in his scholarly work *Convivial Urban Spaces*, Shaftoe (2008) sheds light to the non-visual features of a place, such as sounds, feelings, smells, textural qualities, movement (both the feeling of movement and the actual movement through a space) and taste, which are frequently the ones neglected by designers. In this respect, his work extends beyond the visual element of urban design and architecture, thus enhancing the knowledge base of both physical and non-physical or visual and non-visual features (Gehl and Matan, 2009). As confirmed by Gehl and Matan (2009), involving users in the planning and design

process of public spaces has become a requirement in order to offer a positive approach on how they can best serve the interests of all users.

As shown in this section, a number of factors that can impact on the qualities of public open spaces have been reviewed, alongside the process of enhancing these qualities. An effective and comprehensive approach to analyse, understand and improve the quality of public open spaces lies in the social spatial approach, with terms like ‘socio-spatial approach, and ‘social spatial study’ emerging in the literature. Nevertheless, the term the ‘social spatial approach’ is used in this paper. Understanding the physical and non-physical characteristics of public open spaces can enhance the quality of these spaces. Thus, public open spaces should be seen as social places not as physical containers. Also, for better quality public open spaces, there is a need to analyse the spaces both socially and spatially so as to understand all the attributes that can affect the provision of high-quality spaces.

High-quality public spaces	
<b>Accessibility</b>	Which indicates that a space that is easy to get to and move within, visible and convenient to use would be successful.
<b>Comfort and image</b>	Which is related to views of space as safe, clean, green, full of character and appealing.
<b>Uses and activities</b>	Which seems to be the main motivating factor for people to be there and contributes to the space’s specialness and uniqueness.
<b>Sociability</b>	Can be a key feature as it nurtures friendship, cooperation, communication, diversity, and social rapport.

Table 1: High qualities for public space

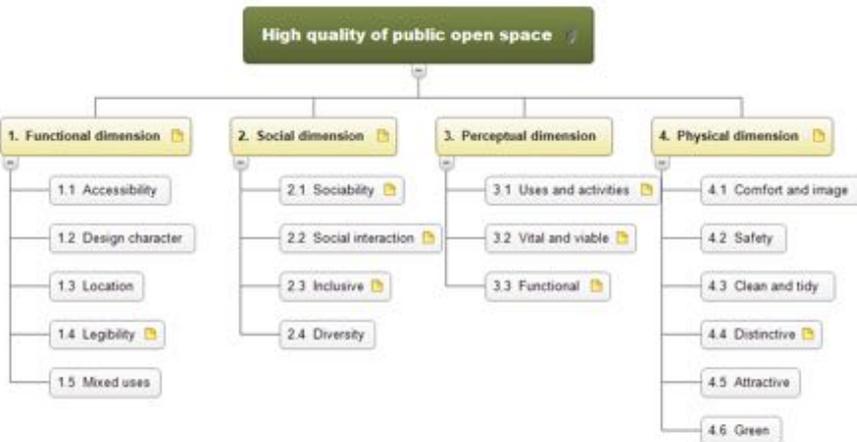


Fig. 4 The principles of high quality public open space

(Source: adapted by the author from the PPS, 2000, and Carmona et al., 2008)

Public open spaces have recently received growing awareness in all countries because of the impact it has on various environmental, economic, and social levels. It is important to have good quality and well-used public open space in any city as it offers a healthy living for its people, as well as a range of social activities and interactional events and in embodying cultural values. This, in turn, can help in

establishing a space full of social life and value. Clearly, there is a multiple impact of public open spaces on the social, physical, perceptual and functional qualities of urban design, which was discussed above. Considering the imageability and legibility when creating public open spaces contributes to an appealing and practical physical built environment. It is possible to use the five components of Lynch's theory to study the physical quality of the built environment, with the physical attributes of the urban form, including size, shape, height, and furniture impacting positively or negatively on the quality of public open spaces. As shown in this section, a number of factors that can impact on the qualities of public open spaces have been reviewed, alongside the process of enhancing these qualities. An effective and comprehensive approach to analyse, understand and improve the quality of public open spaces lies in the social spatial approach, with terms like "socio-spatial approach", and "social spatial study" emerging in the literature. Understanding the physical and non-physical characteristics of public open spaces can enhance the quality of these spaces. Thus, public open spaces should be seen as social places not as physical containers. Also, for better quality public open spaces, there is a need to analyse the spaces both socially and spatially so as to understand all the attributes that can affect the provision of high-quality spaces.

### 5. Research Methodology.

In attempt to respond to the identified objectives of this research and to answer the key research question, multiple evidentiary sources in research methodology are utilised. Underpinning the research strategy is the social spatial approach, which entails examining the spatial and social quality of public open spaces in Tripoli. In this research, the case study method is adopted as the primary research method because it allows the researcher to gain deeper insights into the complicated nature of public open space in Tripoli and to discover its social and spatial characteristics associated with it. The mixed qualitative and quantitative techniques are important tools to be used within this research process in order to collect data and analyse the results. **The Strategy a Social Spatial Approach**, the principal purpose of this research is to point out the various ways to enhance the quality of public open spaces, precisely the squares in Tripoli. Therefore, a comprehensive perspective will be used to explore and investigate all the factors that have affected the quality of public open space, and its potential development. Madanipour (1996) and Carmona (2003) stresses on the significance of understanding public open space as social and as physical space, and thus between others stress on the significance of using a comprehensive approach in exploring the quality and quality of public open space in a perspective that comprises of all the social and spatial attributes.

**The Social Study**, the social study searches the social characteristics that connect people in Tripoli to their civic free spaces. Its main goal is to understand people's opinions concerning the constructed environment, their views and understanding of public free spaces; and how they behave in these spaces. The various methods which were selected to ensure the fulfillment of the study's goal include; **questionnaire survey**, to help in understanding people's views, choices, and clarifications concerning the built environment of the city, especially in unrestricted open spaces. **Semi-structured interviews** will be used to disclose specialist's opinions of public spaces in Tripoli, lastly **observation and behavioral**

**mapping surveys**, to help in knowing the people’s behaviors in the case study.

**5.1 Case study selection.**

The rapid rate of growth of Tripoli City makes it one of the fastest growing urban centers in the world. In only twenty years, for example, the population therein has quadrupled from half a million residents to 1.5 million dwellers today (El-Hasumi, 2018). With significant assets at its disposal, the city is reputed for its urban and architectural heritage thanks to a post-modern plan and design. Like other cities, it faces challenges such as poor maintenance. Improper planning of open spaces and pedestrian paths to accommodate the growing population has led to congestion in the streets. According to Lakhder and Dugeny (2010), the busy coastal motorway in the coastal city has also become dangerous. Previously useful pedestrian paths have been overwhelmed and destroyed in the process of expansion strategies. The most impacting problem is the Libyan crisis, which has resulted in a rise in rates of criminal activities among other illegal phenomena. There is a deterioration in the orderliness in the town as car-park rules, hawking, and walkways are violated across the spectrum. Without clarity of the pedestrian’s pathway in the Martyr’s square (MS), for example, the central area and previously existing aesthetic comfort has been lost.



Fig. 5 Location of case studies

**5.2 Martyrs’ Square.**

The nearest street to MS is Omer Al-Moktar Street, is filled with a confusion of mixed cars and disorderly pedestrians. The once huge and peaceful area, notes As Alzklaa (2016) has lost its pride. The once 1500 long by 600 meters wide green space, which held the annual Tripoli International Fair is now a shadow of its former self. Although the buildings around the area remain useful, they are mostly ceremonial liabilities as opposed to independent commercial buildings. Apart from cultural and religious premises, others include; administrative, health, and educational centers, Fig. 2.



Fig. 6 Location of case studies

### 5.3 Methods.

The aim of the study is achieved by a mixed method. According to Alfonso (2005), accessibility, comfort, feasibility, pleasurability, and safety are five aspects that lead to a built environment. The consistency and validity of the critical dimensions of quality square design on Tripoli were accessed using two online surveys (administered via Google Form) with mixed methods of general users (n=68) and experts (n=7) (architects, urban designers, town planners, and transport engineers). Thus, the development of the online survey instrument for users was guided by the results from the expert survey. The social study searches the social characteristics that connect people in Tripoli to their civic free spaces. Its main goal is to understand people's opinions concerning the constructed environment, their views and understanding of public free spaces; and how they behave in these spaces. The various methods which will be selected to ensure the fulfillment of the study's goal include; Open-ended questionnaire survey, to help in understanding people's views, choices, and clarifications concerning the built environment of the city, especially in unrestricted open spaces. Semi-structured interviews will be used to disclose specialist's opinions of public spaces in Tripoli.

#### Stage 1: The Online Questionnaire for Users.

This survey seeks to examine the perception of people regarding public spaces. The purpose of the conducted survey is to offer comprehensive information regarding the interpretation of environment, and their perception of these spaces and the type of facilities and activities they anticipate in city squares. The strategy is especially employed in research anchored on the perception that individuals view the environment in diverse ways, focusing on specific responses resulting to contextual variables, an individual's mood, or showing varied moods at different times. According to Lang (1987), the feedback from people tend to be anchored on how they have categorized the environment and its elements, on the association they have built up over time, and on the reinforcements, they have received" (p.94).

**Stage 2: Semi-structured Interviews.**

One source of qualitative data is the semi-structured, face-to-face interviews that help the researcher in acquiring more data (Green, 1999). The significant advantage of a qualitative study is that it has an exploratory nature, and the semi-structured interview makes it possible for this strategy (Creswell, 2003). Bryman (2008) indicated that when researchers are conducting semi-structured interviews, they usually have several questions that comply with the regular schedule of interviews. Although, the interviewer is in a position of re-structuring the questions based on the responses obtained from the interviewees. The author suggests that semi-structured interviews are flexible, which enables a person to modify the items according to challenges experienced during an interview. “The interviewee may be interviewed on more than one and sometimes even several occasions” (Bryman, 2008, p. 437).

The survey purpose at exploring the perception of experts on public open space, as well as assessing their thoughts as professionals in the field, and also to determine if there are any variations between their views and those of the users. Furthermore, the survey focused on collecting information to be utilized in the different aspects that impact and influence the process.

**6. The Analysis and Discussion.**

As a finding of stage 1, five qualities were found to affect qualities squares and public spaces in Tripoli: 1) Accessibility and movement; 2) Comfort and image; 3) Uses and activities; 4) Sociability; 5) Safety and security. A total of 68 valid responses were collected from the online survey. The sample included 28.30% females and 71.70% males. Respondents’ age group is based on gender and age categories focusing on six groups in the survey. The gender category of respondents consists of 38 males 71.7% and 15 females (Table, 2 & 3).

**What is your gender?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	38	71.7	71.7	71.7
	Female	15	28.3	28.3	100.0
Total		53	100.0	100.0	

Table. 2 Gender groups

**What is your age?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-20	2	3.8	3.8	3.8
	20-29	10	18.9	18.9	22.6
	30-39	29	54.7	54.7	77.4
	40-49	7	13.2	13.2	90.6
	50-59	2	3.8	3.8	94.3
	60-74	3	5.7	5.7	100.0
Total		53	100.0	100.0	

Table. 3 Age groups

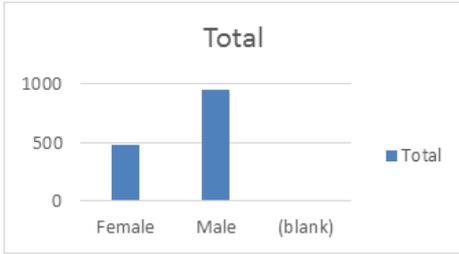


Fig. 7 Gender groups

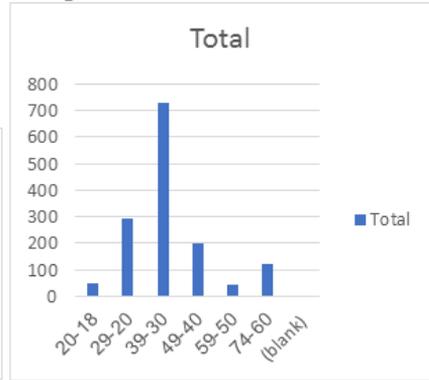


Fig. 8 Age groups

As per the data analysis, 62 out of 68 questionnaires were used after the exclusion of unreliable or incomplete questionnaires. As per the findings from the current study, 81.10% of respondents went to open space from their own houses to visit the square as go to the square at weekends, 52.80% as indicated by the current study findings. This indicates that the qualities of open space in Tripoli depend on the distance between open spaces and the house. However, the results indicates that 75.50% of respondents used car on account that the open space was far from their houses. An experience of the square by feet represented by 7.50% of respondents as compared to 22.60% of respondents in comfort open space was encouraged by safety and security factor. Most males aged 30-39 years, which is 54.70% of respondents, were the most frequent users walking for 15-20 minutes in Martyrs Square, as shown in Figures 7 and 8.

**How ofeten do you visit public spaces in Triopli city centre?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every weekdays	1	1.9	1.9	1.9
	Several days per week	1	1.9	1.9	3.8
	Every weekend	28	52.8	52.8	56.6
	Once a month	20	37.7	37.7	94.3
	Once a year	3	5.7	5.7	100.0
	Total	53	100.0	100.0	

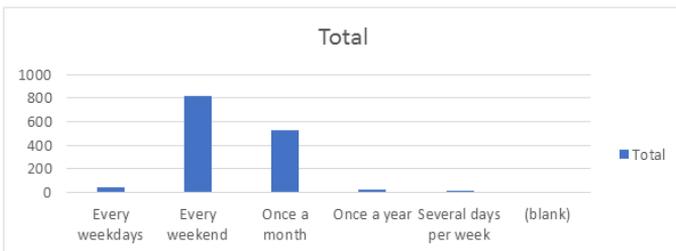


Fig. 9 Information about the needs of users in squares and the qualities.

In the survey study, all respondents, apart from some of residents, responded about the knowledge of Tripoli city and its urban features. From the responses, it

## ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS

was clear that they understand Tripoli city very well, especially the nature and the built environment. There were prominent places that were frequently mentioned by most of the respondents, including the Martyrs' Square, the old city, the Omar Al-Mokhtar Street, and Al-Sarya Al-Hamra. The location of Al-Sarya Al-Hamra at the Tripoli city centre, gives a panoramic view of the entire town and hence a special landmark among people in Tripoli. More so, the historical significance is another aspect whereby Martyrs' Square and coastline are viewed while at Al-Sarya Al-Hamra. The beautiful scenery of landscape and views were also mentioned in the response, especially the main square and green park in the city.

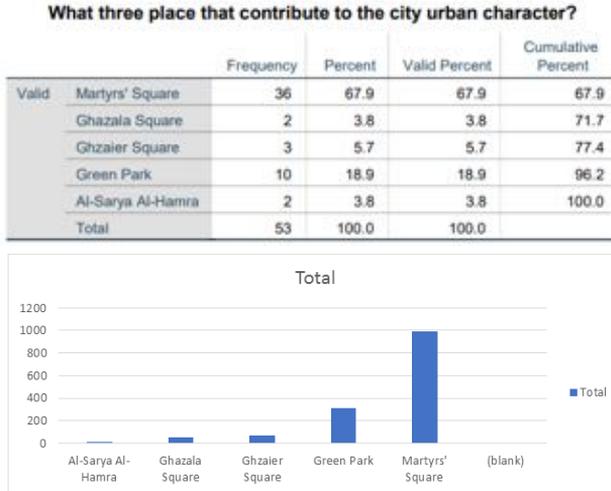


Fig. 10 General Information about Tripoli

The city of Tripoli, also known as Al-Sarya Al-Hamra and Martyr's Square, has been given its identity due to its aesthetic, distinctive architecture of the coastline, and historical significance. According to most of the respondents, the Al-Sarya Al-Hamra is a unique feature. This explains why most answers revolve around the Al-Sarya and the Martyrs' Square.

**Mention three a significant landmarks in the city centre of Tripoli?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Martyrs' Square	10	18.9	18.9	18.9
	Ghzaier Square	4	7.5	7.5	26.4
	Al-Sarya Al-Hamra	27	50.9	50.9	77.4
	Omar Al-Mokhtar Street	10	18.9	18.9	96.2
	Emhedmed Al-Mghrifl Square	2	3.8	3.8	100.0
<b>Total</b>	<b>53</b>	<b>100.0</b>	<b>100.0</b>		

Table. 4 Important landmarks in the city.

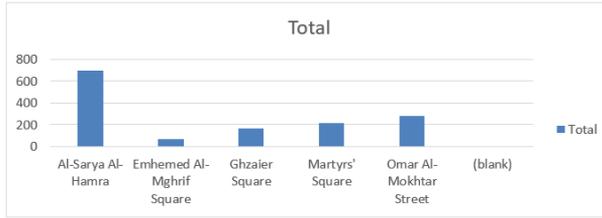


Fig. 12 Important landmarks in the city.

Fig. 13 shows that 47.2% of Tripoli respondents were determined to see enhancements in the city’s environments. 18.9% of the respondents mentioned city’s cleanliness as a significant aspect alongside the city’s architecture that they believed was of aesthetic relevance. Another essential element that 17% of the respondents mentioned includes improvements in public open spaces and road networks in the city. According to the respondents, they believed better road networks would minimize accidents by reducing congestion. The enhancement of road networks was also considered to be a critical element for the improvement of the city’s connections.

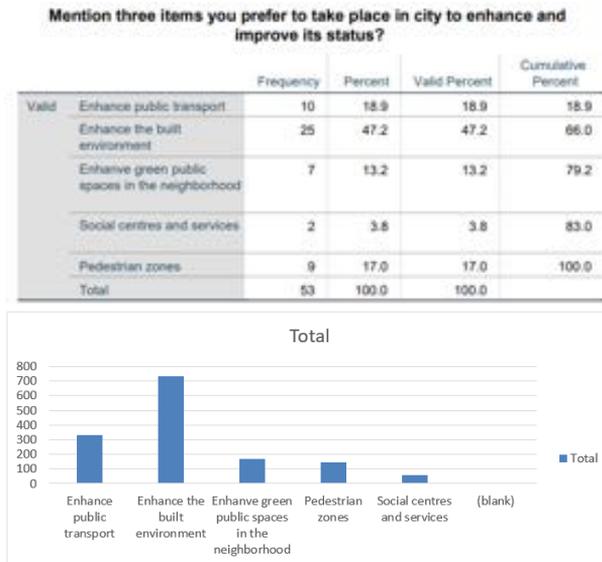


Fig. 13 Important landmarks in the city.

**6.1 Traditional activities.**

The question that revolved around the city’s traditional activities aimed at understanding Tripoli’s social and cultural life and determining if it had links or connections to the public squares. According to Asma (2018), Tripoli is one of the capital cities where its residents have intimate associations not only with their social traditions but also cultures. This is evident in how they conduct themselves and the answers they provide to study questions. The most critical traditional

activities in the city include the Ramadan nights and Eids, commonly referred to as religious celebrations and other annual political celebrations. Based on the study, 47.20% of the respondents said to have taken part in Ramadan nights. There are a number of activities that take place at the Ramadan and 32.10% of the respondents said to have taken part in Eids. Some of the activities include shopping tents at Martyr’s Square, exhibitions, social and cultural activities. According to the respondents, entertainment activities, including funfairs held in Ghazala Square and Ghzaier Square, concerts, theatre performance, are very important during the Eids. Additionally, the respondents stipulated that the festival is vital in promoting economic growth within the city, given that huge shopping fair takes place, especially at Al-Saraya Al-Hamra, Fig. 14, 15.

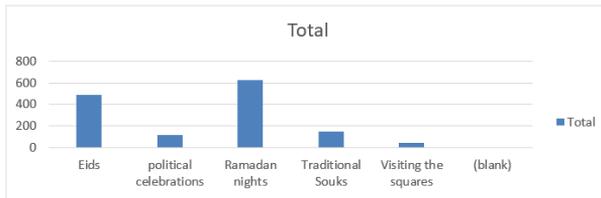


Fig. 14 Background about the culture and social life in Tripoli



Fig. 15 Squares and sidewalks are in bad condition in Tripoli.

### 6.2 Comforts.

Squares as comfortable places to sit was preferred by 69.8% and as spaces for enjoying landscaping/gardens were preferred by 26.4% respondents.

**What Kind of amenities / features could be provided in the short term to make public spaces more comfortable and attractive for you?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sculptures / art displays	1	1.9	1.9	1.9
	Landscaping	14	26.4	26.4	28.3
	Comfortable places to sit	37	69.8	69.8	98.1
	Water feature / fountain	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

Fig. 16 Information about the needs of users in squares and the qualities.

### 6.3 People’s needs

Among the respondents, 81.10% liked to visit to square and enjoy the beauty of nature. Other reasons that made the respondents visit public squares include hot climate, psychological comfort, aesthetic and natural aspects, social interaction, and entertainment. In regard to the use of squares, 52.80% of the participants

indicated that they like using squares. Half of the participants visit the squares on rare occasions. 52.80% visit the squares once every weekend while 37.70% visit the squares once in a month. For those who don't visit the squares, they stated that the squares are unattractive places. Also, the climatic conditions at the squares are not conducive. According to them, the squares do not take into consideration the climate issues. Other limitations to visiting squares include time constraints and family commitments. The opinions of the experts concerning the existing squares' quality varied, as some had the same perspective while others had different ideas. Approximately half of the interviewed professionals considered Al-Saraya Al-Hamra as an appropriate public place due to the historical significance associated with it (being one of the city's oldest square, which was created in 1911), its location at the center of the town, and its proximity to the Castle and Martyrs' Square. Also, the modifications made in the square, more specifically, the lighting project, contributed significantly since it made it a secure place.

**Do you visit public space?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of suitable transport	8	15.1	15.1	15.1
	Yes	43	81.1	81.1	96.2
	They are too far away, and I do not feel safe visiting squares and open spaces	2	3.8	3.8	100.0
	Total	53	100.0	100.0	

**How often do you visit public spaces in Tripoli city centre?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every weekdays	1	1.9	1.9	1.9
	Several days per week	1	1.9	1.9	3.8
	Every weekend	28	52.8	52.8	56.6
	Once a month	20	37.7	37.7	94.3
	Once a year	3	5.7	5.7	100.0
	Total	53	100.0	100.0	

Fig. 17 Information about the needs of users in squares and the qualities.

The most frequently cited squares were the Martyrs' Square and the Ghazier Square; each cited by 79.2% of the total respondents. Because of its location in the city centre and near the sea, as well as the presence of Al-Sraya Al-Hamra, Martyrs' Square was liked and chosen by the respondents. To the residents, the Martyrs' Square is of great aesthetic value as well as a private playground. When it came to the Ghazier Square, respondents had varying reasons, including its great height and the panoramic view of the sea it provides, the presence of Al-Sraya Al-Hamra and the general likeness the people have towards the whole city. Furthermore, Ghazier Square was chosen because it is located on the ancient castle site. For most respondents, the squares hold historical possesses aesthetic value and provides fresh air. Additionally, most respondents stated that the squares could be accessed without incurring costs and thus it was affordable for all.

The presence of private cafes along the river was liked by respondents, being citing several times as good places they would visit. However, these cafes were also cited many times as places the respondents did not want to visit as they were costly. In addition, the poor quality of the facilities did not match the expensive

cafes. Furthermore, because of the inconsistent nature of the sea level, the cafes were disliked because of the bad smell during periods when the sea level is low.

Some of the respondents also mentioned that they did not like Martyrs' Square. One of the reasons given was that the square lacked proper care and the public facilities were of poor quality. Insecurity was also reported as a major concern including anti-social behaviors by some of the users of the square. However, the interview findings showed that the current public open spaces are substandard, and as a result, designers belonging to the Design Department proposed the need for quality enhancement. In particular, the designers attributed the inferior quality of the squares to the failure to adhere to the original design. The local government, through experts from Public Works Department, indicated that two more reasons had failed public squares implementation. These are designers failed to provide site analysis since they rarely visited the site, and inexperienced private contractors implemented the designs.

**List three activities you desire to do in a public square?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Relax and sit	20	37.7	37.7	37.7
	Enjoy the beautiful nature	9	17.0	17.0	54.7
	Relaxing and recreation	16	30.2	30.2	84.9
	Food and drink	4	7.5	7.5	92.5
	Walking	4	7.5	7.5	100.0
	Total	53	100.0	100.0	

Table. 2 Activities uses like to do in a squares.

The respondents of this question is a Both with 50.9 % that claimed to be involved with group 39.6% in some sometimes on their public spaces were asked to identify what they saw as benefits of using open-places and also what they used visits for in terms of Facilities for spaces.

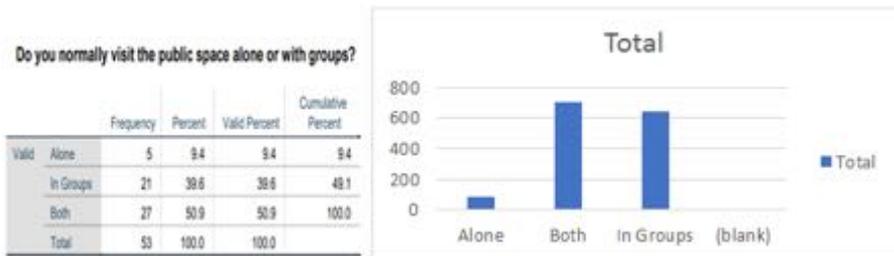


Fig. 18 Activities uses like to do in a squares.

**6.4 Accessibility and movement**

The distribution of the responses from the respondents is done in three almost-equivalent groups based on the transport mode used in visiting a square. The justifications for walking preference included: waling is a healthy activity, problems in getting public transport, comparatively a small distance from home as well as

economic reasons. Respondents who mentioned using taxi and car quoted poor condition of public transport and the overall distance from their residences. Among the respondents, 75.5% preferred private car due to the ease of accessibility. The respondents who used bus in reaching their destinations indicated frequent use of bus due to the fact that private mode of transport was not affordable for them.

**How do you get there?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	On foot	4	7.5	7.5	7.5
	Car	40	75.5	75.5	83.0
	Taxi	8	15.1	15.1	98.1
	Bus	1	1.9	1.9	100.0
	<b>Total</b>	<b>53</b>	<b>100.0</b>	<b>100.0</b>	

Table. 3 How do you get squares.

There were question about what the respondents usually do when they go to public spaces. It is clear from figure 1.15 that 66% of the respondents go to public places to sit or relax 17% to eat / have coffee outside. To walk/jog/exercise and socialise and spending time with coworkers is preferred by 7.5%. There is also a general lack of public transportation within the capital. This study has found that accessibility within the streets of Tripoli is wanting, especially in terms of continuity and directness. As a result, necessary improvements need to be considered urgently.



Fig. 19 How do you get squares.

### 6.5 Important qualities

Among the respondents, 43.4% prioritized good facilities clean environment and facilitation of public toilets in terms of choosing the squares to visit. The key reasons offered by respondents included health problems, basic needs, sufficient seating places, comfort, facilitation of clean water and excellent lighting qualities. They further mentioned that such important amenities and features within their squares encouraged them to utilize them more often and there are higher chances of them to prolong their visits.

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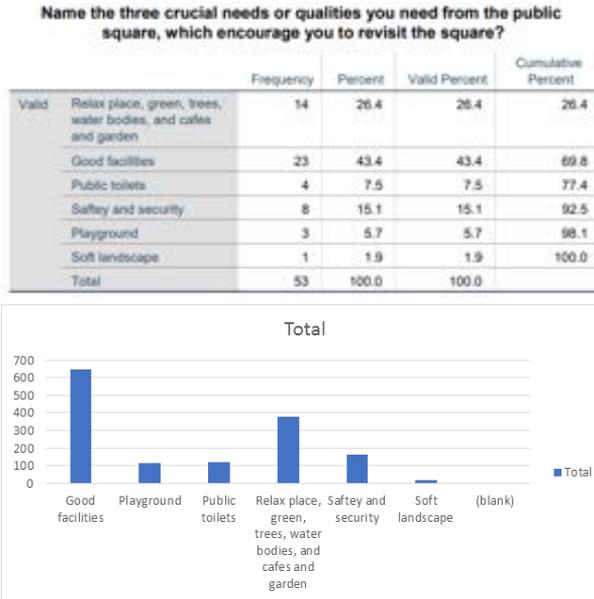
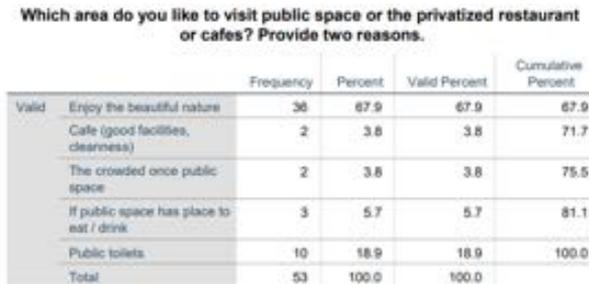


Fig. 20 Important qualities or needs you require from a public open space

### 6.6 Facilities and services

67.9% respondents stated that they preferred to visit a square rather than a restaurant or café, because they enjoyed the beauty of nature in these places and they like to sit freely enjoying the natural fresh air. Another important reason mentioned was public toilets, as 18.9% of the respondents mentioned that they could not afford to visit private restaurants and cafés. The other half of the respondents preferred to visit commercial restaurants and cafes, explaining that these places provided them with their required needs and facilities such as safety, a clean environment, as well as food and drink and entertainment. However, the interview findings showed that a public sector’s designer, when interviewed, suggested that the Martyrs’ Square was the best compared to the existing squares, but there is a need for more maintenance. Despite the square being considered the best, several individuals indicated that it lacked certain public facilities like a playground, and the available amenities, such as public toilets, were poorly maintained.



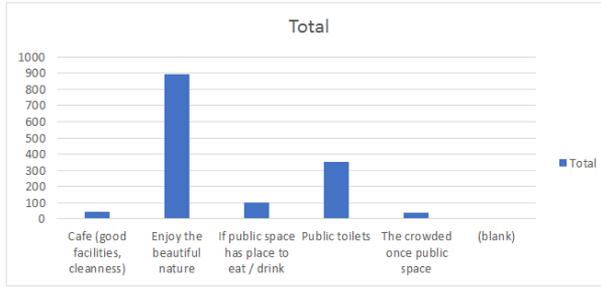


Fig. 21 Activities and facilities or needs you require from a public open space.



Fig. 22 Squares and sidewalks are in bad condition in Tripoli.

The primary change that was cited by the respondents is the privatisation of open public spaces. Recently, several of the spaces have been converted to private spaces, which were out of reach for some users. This was cited by 20% of the respondents while 15% of them stated that the privatisation had impacted the available options for users. Respondents also reported that the public squares provided by the local government had been subjected to neglect and their usability was therefore limited. Poor sanitation with dirty and unkempt squares, inadequate maintenance, dilapidated infrastructure, filthy public toilets, pollution, and uncomfortable seats were some of the main reasons that respondents gave regarding the neglect of the public squares. They gave these reasons as their opinions regarding the neglected spaces.

**State three transformation that happened to the squares that you disliked.**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Safety and security	12	22.6	22.6	22.6
	Enhance public facilities	18	34.0	34.0	56.6
	Enhance clearness in public squares	11	20.8	20.8	77.4
	Care of playground	1	1.9	1.9	79.2
	Public toilets	2	3.8	3.8	83.0
	Provide public transport	9	17.0	17.0	100.0
	Total	53	100.0	100.0	

Table. 4 Important qualities or needs you require from a public open space

**6.7 Safety and security**

22.60% respondents indicated that they felt insecure due to lack of security and safety in the squares. Various reasons were given for not feeling safe, including antisocial behavior, delinquent behaviors among adolescents, absence of danger-warning signs, improper lighting leading to physical and psychological harm, and absence of security personnel. Additional reasons given included absence of safety where children play due to substandard quality of the material utilized as well as several strangers being around. This was also reflected in the interview results, several professionals considered Martyrs’ Square to be less successful compared to other squares. Although others still thought of it as an appropriate place due to its historical significance, its location providing a view of the whole city, and its dense green area, which was optimal for family picnics and availability of a playground. On the contrary, several interviewees stated that the physical quality of the square was inadequate, for instance, the square had poor lighting, and the stadium was unsafe. According to the experts, there was scheduled maintenance of the pathways and light to take place soon, but it will be general maintenance, which might not fulfill the users’ needs.

**Mention the three items that make you feel insecure in public space?  
Provide three reasons.**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	noise, crowd, dirt	1	1.9	1.9	1.9
	Lack of safety and security	12	22.6	22.6	24.5
	Health concern	24	45.3	45.3	69.8
	There is no fence or walls	16	30.2	30.2	100.0
	Total	53	100.0	100.0	

Table. 5 Important qualities or needs you require from a public open space

The response to the questionnaire provided useful insights on how Tripoli residents interpreted and perceived their public squares and built environment. The study participants perceived Tripoli public squares as a complex relationship between different group of people and the environment as well as a significant physical entity. The respondents perceived the public squares as green environments that were worth visiting for social and cultural communication and interaction. The squares were significant sites for facilitating cultural and religious interactions, exhibitions, and celebrations and generating useful interpersonal interactions among individuals visiting the site. The users of the square appreciated the role of the site within the purview of natural aesthetics, public health, protection from harsh climate, as well as physical and psychological comfort. Some of the critical points that were revealed by the respondents are highlighted below:

- The squares highlighted most by the respondents were the ones with historical significance and centrally located within the city. The features accorded the sites identity and sentimental meaning.
- More than half of the study participants liked the public squares that they visited but only a third of those interviewed accessed the sites frequently. The modes of transport used by the respondents was bus, taxi, and walking.
- The most cited activity among the respondents that visited the squares was enjoyment of the beauty of the environment. They reported that they

enjoyed relaxing as they enjoyed the attractive views.

- The most important qualities that the visitors of the public squares sought were security, safety, relaxation, and comfort. The need for relaxation and comfort was related to physical and psychological wellbeing of the visitors of the public squares. There was diminished use of the squares due to poor quality of public facilities.

### **Safety and security**

According to respondents answers, safety and security were considered the most deserved quality. Safety and security are of considered as essential stages in Lang's hierarchy of fundamental human needs. The respondents' expectations regarding security and safety included enhancing personal safety, meeting needs related to health and well-being, and reduction of threats due to insecurity and social problems. The respondents also considered the availability of clean spaces in their environment essential to safety. Accordingly, 80% of the respondents expressed their expectations that these measures would lead to enjoyment of pleasant and healthy spaces, improved standards, and environmental comfortability. On the other hand, 60% of the respondents were uncomfortable with having their children playing in public spaces. Among their main concerns include poor maintenance of public spaces, and the unsuitability and unsafety of the component materials.

### **Comfort and Relaxation**

As expressed in similar studies, comfort was considered to be an important quality sought by people in public parks. Comfort and related variables were mentioned by respondents up to many times. The respondents associated comfort with qualities such as quietness and relaxation, convenient places for seating, fresh air enjoyment, convenience, pleasantness, and hot summer climate. Also, the respondents claimed observed that comfortability is achieved through public spaces psychological maintenance, and availability of public toilets.

### **7. Conclusion.**

Martyrs' Square in Tripoli has been a symbol of national and international significance for decades. It has served through several rulers since its construction close to a century ago and continues to play a vital role in the country. This paper has however identified several architectural problems with the Square that require urgent attention. The urban planners need to increase the quality of the Square with regards to its accessibility, safety and comfort. First, high-quality and pedestrian-friendly facilities need to be installed. They include square furniture, traffic signals and trees for shade. Improving these majorly works towards improving the pedestrian's levels of safety and security within the square. Secondly, the Square was re-established after the 2011 Libyan Civil War. As a result, there have been cases of insecurity and the unavailability of police officers within the Square, which fosters the spread of crime and an absence of respect for the law. Improving the security will make the Square more popular and more open to everyone. Thirdly, the safety, access, comfort and quality of pedestrian facilities needs to be improved. There are no pedestrian facilities, car parking, lighting at the Square at night, diversity of activities and square landscapes. The lack of such facilities further

prevents people from visiting and enjoying Martyrs' Square. Finally, it is important to note that the current pedestrian ways, especially their existence, condition and manner in which they are used, is vital to city design professionals in classifying the quality urban space elements. They improve the level of quality within the city centre in improving their sustainability as well as making the city more liveable.

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# NEO-LIBERALISM IN SLUM REDEVELOPMENT IN INDIA – A CASE OF THE DHARAVI REDEVELOPMENT PROJECT

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## **Abstract**

With the onset of globalization, economies across the world have been moving towards a market based neo-liberal agenda in various policy sectors. In India, a key sector that has adopted the neo-liberal approach is that of slum redevelopment, and the provision of affordable housing. In Mumbai, an acute shortage of land in a city where the rates of homelessness have soared in the past decade (Dhillon & Carr, 2017) has resulted in a surge in land values and real estate prices. The land on which the slum dwellers of Dharavi, one of the largest slums in Asia (Patel & Arputham, 2007), currently reside upon has been valued at about INR 31,000 per sq.ft (Sathyanarayanan, 2013) and hence is a piece of prime real estate property. But the quality of houses that currently occupy this expensive piece of land speaks of a completely different story. Families live in cramped houses that are as small as 120 sq.ft (Kumar, 2011) and have limited or no access to water and toilets. However, the unhygienic living conditions of the area have enabled the availability of a huge housing stock at affordable prices to people belonging to low income groups. This has resulted in a large number of people moving to Dharavi, resulting in the creation of one of the densest localities in Mumbai. While the area provides lifelines – both residential and commercial - to a large number of people, the appalling conditions of the residents of Dharavi has gathered the attention of the government, who has decided to redevelop the area. The growth of Dharavi over 60 years is one that has been orchestrated purely by the residents of the area. However, the Dharavi Redevelopment Project (DRP) fails to acknowledge the relevance of the residents of Dharavi as stakeholders. Through the example of the DRP, this paper aims to analyze the impact of neo-liberalization on slum redevelopment in India, particularly on the current residents of the area. It also aims to understand the need for community

involvement in slum redevelopment projects, and for alternative modes of engagement and representation in poverty alleviation projects, particularly in the context of developing countries.

**Keywords:** Neo-liberal, Dharavi, Slum, Mumbai, Community

“Dharavi is probably the most active and lively part of an incredibly industrious city. People have learned to respond in creative ways to the indifference of the state.... Over 60 years ago, it started off as a small village in the marshlands and grew, with no government support, to become a million-dollar economic miracle... No master plan, urban design, zoning ordinance, construction law or expert knowledge can claim any stake in the prosperity of Dharavi...Dharavi is an economic success story that the world must pay attention to during these times of global depression. Understanding such a place solely by the generic term ‘slum’ ignores its complexity and dynamism” (Echanove & Srivastava, 2009)

### **Introduction**

The idea of neo-liberalism is one that “...defends market freedoms, and oppose[s] the use of redistributive taxation schemes to implement a liberal theory of equality” (Kymlicka, 2002). One of the most salient features of neo-liberalism is a shift of emphasis from state planning to reliability on market forces (Nijman, 2008). It was from the 1980’s onwards that India saw a shift in policies towards a free market regime, which received acceleration upon the introduction of the New Economic Policy in 1991 (Doshi, 2013). The free market economy encouraged privatization, and implementation of projects through partnerships between the state and private companies. One sector that this shift in policy particularly influenced was the delivery of affordable housing and slum redevelopment projects in India.

Being one of the largest metropolitan cities in the world, Mumbai was no exception to the gradual shift towards neo-liberalization that the country was experiencing. The city and its administrators were aiming to achieve a “global city” status (Sassen, 1992), and the redevelopment of the large number of slums was key to achieving this, especially since 55% of the population of the city lives in slums (Balachandran, 2016). Dharavi is one such slum of about 525 acres (Day, et al., 2010) that is located in the central part of the sprawling city of Mumbai. The slum is home to approximately 1 million inhabitants (Patel & Arputham, 2007), most of whom also work and have commercial establishments in the area. However, these residential and work spaces have remained in cramped and unhygienic conditions over the many years of its existence, and is in dire need of redevelopment. It was in the post neo-liberalization era that the government announced its plan to redevelop Dharavi through the involvement of the private sector (Patel & Arputham, 2007). The prime location of Dharavi, and the potential for the land to generate enormous profits led to a huge interest in the redevelopment project. The idea was to allow private contractors to redevelop the area and provide free housing for the people who lived there; the remaining area would then be used to build commercial establishments that would create profits. However, the Dharavi Redevelopment Plan failed to recognize the existing social and commercial networks and establishments of the slum, and the government aimed to develop the project along the frameworks of

a greenfield development. Residents of Dharavi were not involved in the decision making process, and the plan failed to recognize them as stakeholders (Patel & Arputham, 2008).

The involvement of the private sector in slum redevelopment projects and the consequent marginalization of the poor in India has given rise to a large number of civil society organizations that aim to act as the voices of slum dwellers and to adopt the roles of negotiators between stakeholders (Nijman, 2008). One such organization is the Society for the Promotion of Area Resource Centers (SPARC), which has its operations in Mumbai. Along with key stakeholders, including NGO's and academic institutions in Mumbai, SPARC developed a document that provided an alternative plan to the redevelopment of Dharavi, one that would protect the rights of the citizens of the slum area (Day, et al., 2010). This was done through a process of community engagement, in-depth spatial analysis of Dharavi and by obtaining inputs from the residents. The alternative proposal developed by SPARC emphasizes most on the needs of the local residents, and less on the requirements of the private developer, thus developing a plan that would only generate enough profit for the sustainability of the project (Day, et al., 2010). However, the proposal by SPARC does not fit into the neo-liberal agenda of the state that is inclined towards the profit-driven mechanisms of the private sector.

This article aims to criticize the neo-liberal political agenda in slum redevelopment in India through the example of Dharavi in Mumbai and establish the need for community engagement and involvement in redevelopment projects that affect their lives and livelihoods.

### **What is Dharavi?**

In the 19<sup>th</sup> century, Bombay (now Mumbai), developed largely in the island city (also known as the fort area) which lies in the Southern part of the large metropolis. Dharavi was a fishing village located in the marshlands of the northern part of the city, and did not hold much value at the time. However, the massive expansion of Mumbai towards the north in the late 20<sup>th</sup> and early 21<sup>st</sup> centuries resulted in development occurring around Dharavi, thus leading to its relevance in Mumbai's real estate sector. Today, Dharavi is a centrally located slum that lies on an expansive 525 acres (Day, et al., 2010). It is well - located between two of the major railway lines of Mumbai (the Central and the Western lines) and is hence easily accessible. The fort area, which is the business district of Mumbai, and the recent Bandra- Kurla Complex (international business center) are located in close proximity to Dharavi, and are well-connected to the area, by both road and public transportation.

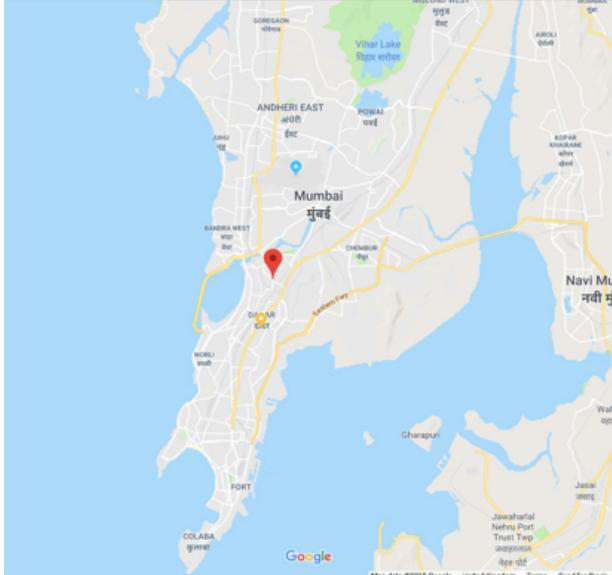


Figure 1: Location of Dharavi in Mumbai  
Source: Google Maps, Accessed: 28<sup>th</sup> April 2019

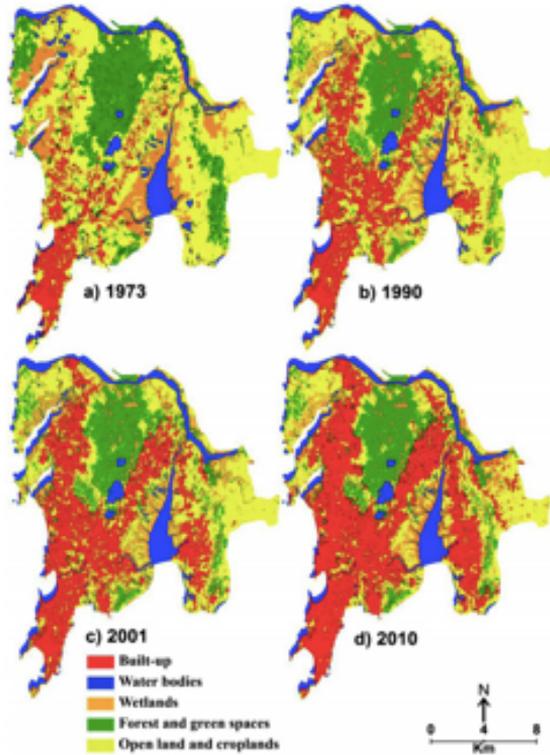


Figure 2: Growth of Mumbai towards the North  
Source: (Moghadam & Helbich, 2013) , Accessed: 28<sup>th</sup> April 2019

Dharavi was once a small fishing village, but the affordability of the houses in the area and its central location lead to immense informal densification resulting in the slum that it is now. Today, Dharavi is home to approximately 1 million people (Mumbai Population, 2019), most of whom are also employed in the area. It was roughly estimated that the annual turnover of the industries in Dharavi is about INR 15 – 20 billion (Day, et al., 2010). Moreover, this estimate does not include a large percentage of the small businesses that are run within houses, hence we can infer that the actual turnover of Dharavi is higher than the “guesstimate” (Day, et al., 2010, p. 14) provided. The National Slum Dweller’s Federation (NSDF) conducted a survey in 1986 that estimated the existence of about 1044 manufacturing units in Dharavi, out of which about 250 were small scale industries that hired about 5-10 people, hence providing employment at the grass-root levels. However, “[t]he actual number is likely to be larger as many smaller units, which work out of homes and lofts, would have fallen outside the scope of the surveys” (Day, et al., 2010, p. 14). It can also be assumed that these numbers have grown significantly in the 23 years since the survey has been conducted.

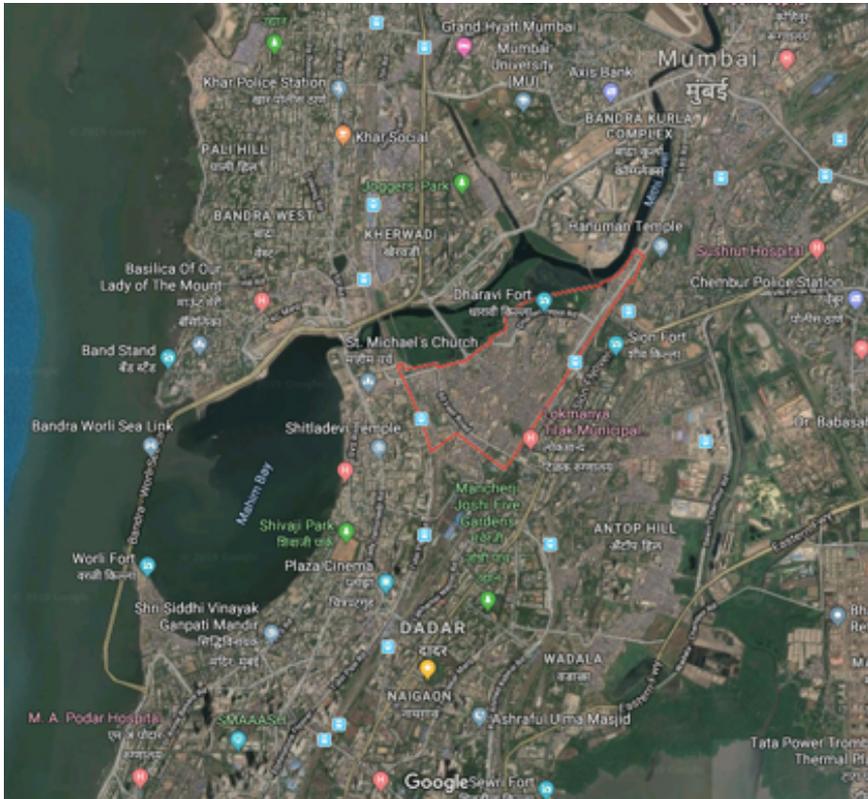


Figure 3: Dharavi in the Neighbourhood Context  
Source: Google Maps, Accessed: 28<sup>th</sup> April 2019

Leather production is the most prominent industry in Dharavi, with an estimated annual turnover of about INR 600 million (Day et al., 2010). While tanneries were

banned in the city due to pollution regulations, Dharavi is still one of the largest producers of finished leather goods in the country, and provides employment to more than 3000 people (Day, et al., 2010). A single large unit of textile manufacturing, which is another leading industry in Dharavi, can produce an annual turnover of about INR 7 million per annum. (Day, et al., 2010). About 250 families live in the *Kumbharwada*, or the Potters Colony. The houses of the potters have been constructed in a manner that enables the movement of finished products easily from the manufacturing area to the street in order to display finished goods (Day, et al., 2010). The food making industry is another huge industry in Dharavi, which provides employment to a large number of women. One of the key sectors of this industry is *pappad* (cracker or flat breads) rolling, which usually require large amounts of terraced areas; however, the women of Dharavi have derived alternative mechanisms to do so in the limited space that is accessible to them (Day, et al., 2010). The 1986 survey by the NSDF also established that the recycling industry in Dharavi is one of the largest in India, and employs about 5000 people (Day, et al., 2010). Most of the garbage that arrives here from across Mumbai is processed through an intricate system of separation, reusing and recycling, which enables a sustainable system in a largely consumerist economy (Day, et al., 2010). Dharavi also hosts a number of other small scale industries including jewelry manufacturing, printing presses, etc. (Day, et al., 2010). These examples showcase the extent of the economy that exists within the narrow lines of an area that has been largely classified as a slum, and the importance of the existing built spaces and neighborhood networks in allowing the sustenance of the economy of Dharavi.



Figure 4: Leather Industry, Dharavi

Source: <https://curlytales.com/dharavi-also-asias-largest-small-scale-industry/> ,

Accessed: 28th April 2019



Figure 5: Recycling Industry, Dharavi

Source: <http://www.reinventingdharavi.org/resources.php> , Accessed: 28th April 2019



Figure 6: Potter's Colony, Dharavi

Source: <http://www.reinventingdharavi.org/resources.php> , Accessed: 28th April 2019



Figure 7: Tailoring Unit, Dharavi

Source: <http://www.reinventingdharavi.org/resources.php> , Accessed: 28th April 2019

### Neo-liberalism and Slum Redevelopment in the Indian Context

Broadly speaking, “[n]eoliberalism is a theory of political economic practices proposing that human well-being can best be advanced by the maximization of entrepreneurial freedoms within an institutional framework characterized by private property rights, individual liberty, unencumbered markets, and free trade” (Harvey, 2007, p. 22). The political theory of neo-liberalism essentially reduces the intervention of the state, and encourages a free market mechanism through which goods and services are supplied by the private sector according to market demands. Neo-liberalism encourages freedom of the market, and aims to limit the role of the state in the provision of services.

Privatization in the 1980’s gave rise to a phenomenon of globalization that encouraged de-regularization and the opening up of national economies to foreign investment (Sassen, 1992). In the urban context, liberalization translated into the development of global cities, which were “the command and control centres of the ‘global’ economy (Sassen, 1992), which serve as the organising nodes of global economic systems and through which the regional, national, and international economies are articulated within the global capitalist system (Friedmann, 1993)” (Mahadevia, 1998, p. 13). The growth of cities like Shanghai and Hong Kong became iconic examples that city administrators aimed to replicate in varyingly different contexts. “Metropolises located in the Global South deserve special mention in this respect, as they show[ed] signs of intense conflict due to the imposition of the neoliberal framework, reflecting contestation between global society and segmented localized communities” (Banerjee-Guha, 2012, p. 77). In India, it was Mumbai, as

the financial capital of the country, that was identified as the representative, to uphold national interests in the global economy (Mahadevia, 1998). What followed was a process that could be termed as the “Shanghaification of Mumbai” (Roy, 2011). The New Economic Policy introduced in 1991 paved the roadway for the liberalization of the Indian economy, with a push towards privatization, and soon urban policies were being developed in a similar framework.

“At the city level, it was characterized by limitations on planning and the political capacity of elected municipal governments, privatization of basic services, withdrawal of the state from urban development, escalating support for public-private partnerships, increasing gentrification and urban restructuring to expand space for elitist consumptions, and a growing exposure to global economic forces and global competition reflecting the power of a disciplinary finance regime and a hegemonistic cultural framework” (Banerjee-Guha, 2012, p. 76)

The huge demand for office spaces in Mumbai coupled with a limited availability of land resulted in exponential and unprecedented growth in real estate values (Doshi, 2013). This opportunity was utilized by city planners in the post-liberalization era to maximise the economic output of the city through the second draft regional plan of Mumbai.

“The economic liberalisation policies of the Govt. of India provides immense opportunities for Bombay to not only seek it’s economic recovery but develop as a business and finance centre of an international level. Positive steps need to be therefore taken in this direction” (BMRDA, 1995, p. 19).



Figure 8: Wealth and Poverty in area around the Bandra-Kurla Complex  
Source: <https://unequalscenes.com/mumbai>, Accessed: 28<sup>th</sup> April 2019

The neo-liberalization of India’s (and Mumbai’s) urban policies was an indicator of the diminishing role of the state as a provider of housing for the poor. This was most significantly highlighted through the repealing of the Urban Land Ceiling and Regulation Act (ULCRA) in 1999. While the act had various flaws in its implementation, its primary objective was to set a ceiling on urban land and distribute the surplus

to the poor at affordable prices (Baweja, 2015). In its place, a new urban policy was introduced in which the primary role of affordable housing provider would be played by the private sector. Developers were encouraged to redevelop slums and rehouse the existing residents into high rise buildings on the site, or relocate them in free housing in the peripheries of the city. The land that would be freed up through this process would then be utilized to develop commercial establishments, thus allowing developers to reap maximum economic benefits from the process. However, the policy fails to recognize the negative implications of rehousing slum dwellers through this framework. In the first case where slum dwellers are rehoused into high rise buildings on the same site, recent examples have shown us that they are unable to afford the high maintenance costs of buildings (Burra, 2005), for example, electricity charges for running elevators. This leads to the dwellers selling their new houses and moving back to slums, or to peripheral areas, where housing is affordable to them thus resulting in a wave of gentrification. The second scenario is one in which slum dwellers are relocated to new houses in peripheral areas of the city. This peripheralization of low income slum dwellers tends to push people further into the cycle of poverty as this leads to increased time and costs of commute, especially in large cities like Mumbai. This is particularly relevant in the case of cities in developing countries like India where poverty is absolute, and not relative (Mahadevia, 1998). It can thus be concluded that neo-liberalization of slum redevelopment policies have resulted in the segmentation of the population into two categories – the rich and the poor (Mahadevia, 1998). It can be argued that the poorer half of the population is forced to pave the way for development (as it has been conceived by the state) through slum evictions and relocations.



Figure 9: Map showing Peripheralization of Slums in Mumbai  
 Source: PK Das Associates, Mumbai (<http://www.pkdas.com/maps.php?p=9>) ,  
 Accessed: 28<sup>th</sup> April 2019



Figure 10: Living Conditions in Dharavi

Source: <http://www.reinventingdharavi.org/resources.php> , Accessed: 28th April 2019



Figure 11: Contrast between Dharavi and its Neighbourhood

Source: <https://unequalscenes.com/mumbai> , Accessed: 28<sup>th</sup> April 2019

### **The Dharavi Redevelopment Plan**

The first plan to redevelop Dharavi was introduced in 1985, when an award of 350 million rupees was provided to the city of Mumbai for this purpose, by the then Prime Minister Shri. Rajiv Gandhi (Patel & Arputham, 2007). A special unit

was set up within the Maharashtra Housing and Development Authority (MHADA) to enable the redevelopment of the slum (ibid.). Using the allocated funds, the leather production industry was relocated to the outskirts of the city, mainly due to environmental reasons. Additionally, a few houses were constructed in this phase, but the project failed to create any significant impact in the landscape of Dharavi (Patel & Arputham, 2007). The second wave of the Dharavi Redevelopment Project was conceptualized in the post liberalization era with the involvement of the private sector. During this period the role of the state was changing from that of a housing provider to one of a regulator. The role of the private sector in the housing industry, particularly in the provision of affordable housing, received unprecedented significance. A large number of Public-Private Partnerships (PPP) were being introduced by the government and Dharavi was one example of a slum redevelopment project that was to be implemented through PPP models. The area was to be divided into five zones, and bids were invited by private developers for the redevelopment of each of these zones.

The project aimed to maximize the land value of Dharavi and re-house most of the existing residents into new housing units in the same area. The remaining land would then be redeveloped by the developers, and market housing and commercial establishments would be generated, which would cover the costs of re-housing of slum dwellers, profits for the developers, and would additionally generate income for the government. Developers were also incentivized with the proposition of Transferrable Development Rights (TDR) that would enable them to use unutilized FAR (Floor Area Ratio) in other projects in Mumbai, which would generate more profits for them. The phase-wise redevelopment plan for Dharavi was conceived by architect Mukesh Mehta whose principles of sustainable urbanism were aligned with the neo-liberal idea to transform Mumbai into a “World Class City” (Baweja, 2015).



Figure 12: Mapping of Dharavi (Current Conditions)

Source: KRVIA (<http://www.reinventingdharavi.org/resources.php>) , Accessed: 28th April 2019



Figure 13: Dharavi Redevelopment Plan (Proposed)

Source: SRA (<http://www.reinventingdharavi.org/resources.php>) , Accessed: 28th April 2019

For the purpose of the project, the FAR for redevelopment was increased to 4.00 from the existing 1.33 in the area (UDD Maharashtra, 2012). The idea was to provide residents with free apartments of 300 sq.ft through rehabilitation (UDD Maharashtra, 2012). The free component would be provided on the basis of production of documents that proved residency of the beneficiary in Dharavi to a date before 1<sup>st</sup> January 2000, which was the cut-off date for free housing that had been set by the government (UDD Maharashtra, 2012). The developer would also be responsible for the provision of 225 sq.ft of commercial/industrial space to eligible beneficiaries, and additional space would be available for purchase if required, as per the rates mentioned in the Dharavi Redevelopment DCR (Development Control Regulations) (UDD Maharashtra, 2012). Social infrastructure such as schools and nursery centers were to be provided by the developers for free in specific localities, and a number of other public amenities were also to be constructed for which the developers would be compensated (UDD Maharashtra, 2012). The project aimed to provide hygienic living and working conditions to the residents of the Dharavi. However, while the community agreed with the need for the slum to be redeveloped, a major criticism of the Dharavi Redevelopment Project was the lack of involvement of the community in the drafting of the redevelopment plan (Patel & Arputham, 2008), and its focus on the generation and maximization of profits for the private sector.

### The Criticism

A 2003 report by the Cities Alliance stated that it is the residents of slums who should have primary decision-making roles as they have the best knowledge of the issues of their community, are the ones who have to live with the outputs of the project, and have a constitutional right to participate in decision making processes (Nijman, 2008). While this statement provides common knowledge that is logical, the Dharavi Redevelopment Project is an example of how this key piece of information is missing in slum redevelopment projects in India even today. The opposition to

the Dharavi Redevelopment Plan, as mentioned previously, has mainly arisen from the lack of involvement of the community in the conceptualization of the project. This opposition has developed due to a large number of reasons, some of which have been elaborated in this section.

Slum redevelopment projects in India are required to obtain the consent of at least 70% of the population currently living in the area before the plan can be implemented (Patel & Arputham, 2008). However, this clause has been eliminated in the case of Dharavi which is in violation of the 73<sup>rd</sup> and 74<sup>th</sup> constitutional amendments that allows for the decentralization of democracy and community participation (Patel & Arputham, 2008). This allows the developers to go ahead with a plan that is profitable and beneficial to them at the cost of the requirements of the local community. The lack of participation can be identified through a clause in the DCR which states that public feedback was invited upon publication of the regulations in a local newspaper, however, this eliminated the possibility of involvement of the largely illiterate community residing at Dharavi. More importantly, the residents of Dharavi cannot be considered as the public in this project; they are key stakeholders as it is their homes and places of work that are being redeveloped. Thirdly, the government has stated that only people who are able to prove their residency in Dharavi to a date before 1<sup>st</sup> January 2000 are eligible for free houses under the project, and specific requirements for documents that can be used for this purpose have been laid down. This could mean that a large number of people who are unable to produce documentation would be ineligible for free housing, which would favor the developers who now have to provide lesser number of houses. Moreover, there is no consensus on the number of people who live and work in Dharavi as it has been too complex to collect this data so far (Patel & Arputham, 2008). A detailed socio-economic survey is required to be undertaken before a redevelopment plan is to be initiated in Dharavi, and this cannot occur without the co-operation of the slum dwellers (Patel & Arputham, 2008). Additionally, it has been mentioned in the DCR (Appendix IV, Clause 8) that residents need not be relocated in the same sector as they are currently residing in, and the rehabilitation housing component can be provided in any sector that falls within the Dharavi Notified Area (DNA). There has been no mention in the DCR regarding the location of commercial spaces, hence it can be assumed that the rehabilitation of both commercial and residential spaces have been designed without an understanding of current spatial, social and community networks of Dharavi.

### **The Alternatives**

One of the major criticisms of this project has been the lack of involvement of the residents of Dharavi in the conceptualization of the redevelopment plan. In accordance to this criticism, SPARC, along with KRVIA (Kamla Raheja Vidyaniidhi Institute for Architecture and Environmental Studies) proposed an alternative masterplan for the redevelopment of the area. Due to time and resource limitations, the "Re-Dharavi" document focuses on Sector 4 of Dharavi in order to provide an example of an alternative development plan for the the area, one that was based on the requirements of the citizens. The first step towards this was the mapping and identification of the different residential clusters, transportation routes and commercial networks that existed in the area. The various *chawls*, housing

societies and *nagars* (residential areas) had been developed over a long period of time based on social relations, religious preferences, commercial links, etc. The proposed masterplan aimed to utilize these existing networks in order to propose a sustainable and effective redevelopment of Dharavi.

The first strategy of the plan was to strengthen the existing road network in the area. Roads were identified as primary vehicular, secondary vehicular, and pedestrian, and the plan focused on developing and widening these existing roads in order to improve efficiency. Additionally, huts and squatter settlements that would be cleared in order to widen these roads would be rehabilitated in the same sector, thus minimizing the negative effects on their social and livelihood networks. The residential clusters would be allowed to conduct redevelopment on their own, and could rope in private contractors in order to do so, as is currently allowed under SRA (Slum Rehabilitation Authority) regulations for slum redevelopment in Mumbai. This would enable current social relations to thrive, hence avoiding any negative effects on individual and familial well-being. The plan also proposed the strengthening of open spaces based on current utilization, which has evolved around usage during festivals and other celebrations, and the use of smaller spaces by communities and neighborhoods. A cluster based FSI plan is also drawn out based on existing densities of the area, thus developing a more sustainable proposal built on the infrastructure capacities of the locations. The alternative masterplan for Dharavi is based on a system of “deep democracy” (Appadurai, 2001), which enables a process of decision-making and poverty alleviation that focuses on the citizens and residents affected by the project in question, that effectively re-directs power to the grassroots level.

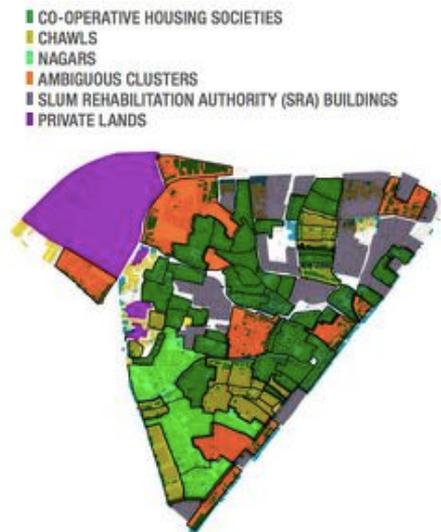


Figure 14: Mapping of Existing Residential Clusters in Dharavi (Sector IV)

Source: (Day, et al., 2010) , Accessed: 28<sup>th</sup> April 2019



Figure 15: Mapping of Existing Commercial Zones (Sector IV)  
Source: (Day, et al., 2010) , Accessed: 28th April 2019

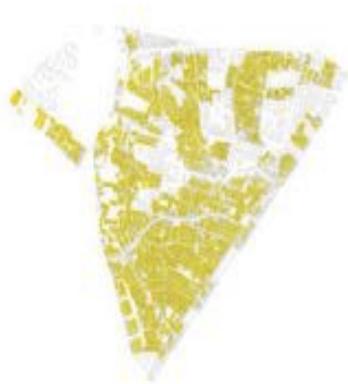


Figure 16: Mapping of Existing Residential Zones (Sector IV)  
Source: (Day, et al., 2010) , Accessed: 28th April 2019



Figure 17: Mapping of Existing Road Networks (Sector IV)  
Source: (Day, et al., 2010) , Accessed: 28th April 2019

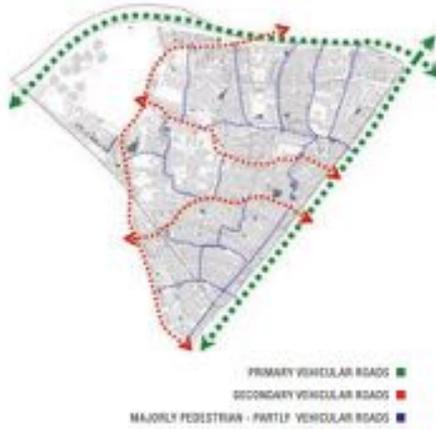


Figure 18: Proposed Road Network  
Source: (Day, et al., 2010) , Accessed: 28th April 2019



Figure 19: Proposed Open Space Network  
Source: (Day, et al., 2010) , Accessed: 28th April 2019



Figure 20: Proposed Residential Clusters  
Source: (Day, et al., 2010) , Accessed: 28th April 2019

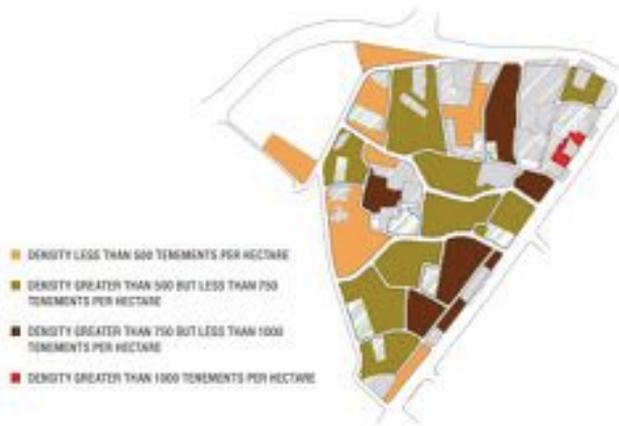


Figure 21: Density Mapping for FSI Proposals  
 Source: (Day, et al., 2010) , Accessed: 28th April 2019

Another major criticism that the Dharavi Redevelopment Project (DRP) faced was that the objective of the project was defined on the basis of maximizing profits for the private sector and the government, based on the land value of the identified area. However, a key aspect that has been omitted in this plan is that the annual turnover of Dharavi, in its current state, is about INR 15-20 million, as has been mentioned previously in this article (Day, et al., 2010). The question that then arises is why the state would be willing to turn a blind eye to this large income generating population and their spatial needs. One reason for this lack of consideration could be attributed to the fact that the official calculator of economic growth, the GDP, fails to incorporate the turnovers of the informal sector and grassroots level employment (Jain, 2016). This is most surprising in a country like India, where about 80% of the employed workforce belong to the informal sector (The Wire, 2018). Privatization and commercialization of the land on which the slum sits on proves far more profitable in terms of GDP calculation, and this could be one of the key issues of the Dharavi Redevelopment Project and slum redevelopment projects in India in general. One of the alternatives that has been recommended to better capture poverty and well-being has been the capabilities approach proposed by Sen (1999), however, the scope of this alternative is beyond that of the current paper, and may be elaborated upon in future research on the issue.

### Conclusion

With the introduction of the New Economic Policy in 1991, the movement of policies towards a discourse of neo-liberalization received acceleration in India. One of the key sectors affected by this change was the development of affordable housing and slum redevelopment in the country. A key example of this is the Dharavi Redevelopment Project (DRP), which aimed to redevelop one of Asia's biggest slums that is located in Mumbai. In order to improve the sub-standard living and working conditions of the slum private developers were invited to submit proposals for redevelopment, which was to be implemented through public-private partnerships. The redevelopment plan focused on maximizing the profits that could

be generated from the high value of the land that Dharavi resided on. It did not account for the existing social networks of Dharavi, or the thriving commercial sector of the area which produces an annual turnover of about INR 15-20 billion (Day, et al., 2010). SPARC, a non-profit organization based out of Mumbai, along with other key NGOs and academic institutions, developed an alternative proposal for the redevelopment of Dharavi that focused on existing social, commercial and infrastructure networks, and aimed to develop the area at a grassroots level focusing on the requirements of the residents of the area. The alternative proposal essentially aimed to put power back into the hands of the people of Dharavi, and provided a plan that would generate minimal profits, which would purely enable the sustainability of the project. However, this proposal does not align with the neo-liberal agenda of the state and the private sector that aims to maximize profits through marginalization of the slum dwellers. The article also aims to draw attention to the flawed calculations of economic growth under the current GDP model, which does not account for well-being of citizens, or profits generated from the informal sector.

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# A SPATIAL PATH FOR THE TRANSFORMATION AND DEVELOPMENT OF FORESTRY CITIES IN HEILONGJIANG PROVINCE, CHINA

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## Abstract

Heilongjiang province is the largest forestry province of China, with nearly half cities are covered by vast forests. In the last century, these cities developed rapidly based on logging, however, as China's ecological policy tightening, the development of these cities obviously lag behind others, the transformation becomes an inevitable choice. In the process of transformation, the relationship between urban system and resource environment is not well coordinated for these cities, this results in a series of problems restricting the regional sustainable development. Therefore, we use the Gray System theory to sort out the complex relationship and design a spatial planning model based on scale effect, a variety of evaluation methods are merged to arrange the living, production and ecological space in a suitable pattern from multi-angle. In addition, the spatial heterogeneity of forest resource and environment is considered to propose different solutions for cities in different situations. Our research aims to fill the gaps in the sustainable spatial planning of forest resource-based cities in China, and provide a reference for the space management of cities in a transformation process.

**Keywords:** Heilongjiang province, transformation and development, transformation and development, grey box system, spatial planning model, resource environment

## 1. Introduction

China is a country with severe shortage of forest resources. According to the results of the 8th National Survey of forest resources, the per capita forest area in China is 0.15hm, it is only 25% of the world average, and per capita forest volume is 10.98m<sup>3</sup>, which only equal to 14% of the world's average level (Yu, 2011). However,

China has been in a state of high intensity logging for a long time, the ecological environment has been seriously damaged, and frequent ecological disasters have led to a series of economic and social problems (Gao, 2008). It was not until the implementation of the National Natural Forest Protection Project in 2000 that this situation was alleviated (Xu, 2004). At the same time, the huge forest industry system and a large number of cities with the exploitation of forest resources as the core driving force of development are unable to adapt to this change, resulting in the difficulties in people's livelihood and the sluggish socioeconomic development in forestry areas (Xue, 2001). As the demand of the ecological civilization construction and the optimization of economic structure, the rationality of the forest resources and transformation of forestry cities become the focus of the forestry development in China, the country has issued a series of macroeconomic policies to carry out a clear direction for the management of forest resources and transformation, forestry cities are facing new opportunities as well as challenges(Gao, 2015).

Heilongjiang province is a major natural forest region in China, and also an important ecological barrier in the north. The forest volume in the province is 1 billion m<sup>3</sup>, accounting for 12% of China. However, because of years of cutting and the propulsion of urbanization, compared with the early stage of development, the forest edge back to the north more than 100 km (FAO, 2001), more over, the ecosystem diversity and stability on the space appear bigger difference, wetland shrinking, forest land desertification, soil pollution and erosion are increasingly serious. In addition, due to the unique characteristics of industrial structure, especially the embedded and one-way flowing economy system, as well as the relatively weak geographic location, its development has been greatly restricted (Fang, 2010). Under the dual pressure of protecting ecology and seeking development, the forestry cities in Heilongjiang province have focused on the industrial transformation in recent years, and some achievements have been made. However, there is still a lack of scientific demonstration to guide the key issues such as the mechanism and direction of urban transformation both in social, industrial and spatial aspects.

Based on the above background, this paper puts forward the comprehensive measures based on resources and environment of Heilongjiang province, and shows a spatial way to response the need of urban transformation pattern. On the premise of protecting the ecosystem and promoting the transformation effectively, we explore the operating mechanism of the collaborative system constituted by resource environment, urban transformation and spatial response, which is the basic to realize the ecological sustainability, reasonable allocation of resources, distinctive industrial features and coordinated space organization of forestry cities in Heilongjiang province.

In order to solve the transformation challenge of the forestry cities, our research proposes specific strategies according to the following steps. Section 2 introduces the overall situation of research area, and elicits the core problems. Section 3 analyzes the complex relationship between the resource environment and the urban system, and proposes the method to solve the transformation problem by using the resource environment measure; Section 4 shows the system response of spatial organization to the transformation of forestry cities. Based on the last two parts, section 5 constructs the spatial planning model supporting urban transformation

and development. Section 6 discusses the feasibility of the framework and makes a conclusion.

## 2. Research area

Heilongjiang province is located in the northernmost part of northeast China, with the most dense forestry cities. Under the action of coherent forest ecosystem and similar geographical and climatic environment, these cities have similar urban development track and spatial development rule, forming a special forestry city group. In the new stage of urban development in China, the transformation has become a common demand of these cities. At the same time, the role of resources and environment has changed from the main motivation of urban development to the role of constraint conditions (Jiao, 2015).

The *National Sustainable Development Plan for Resource-Based Cities* clearly defines the specific scope of forestry cities. Among the 118 resource-based cities in China, 21 of them are forestry cities, among which 6 cities belong to Heilongjiang province. However, no specific definition method has been given. At present, the relatively accepted definition standard in the academic circle is that the proportion of the output value of the extractive industry reaches more than 15% of the GDP, or the output value of the extractive industry exceeds 1 billion yuan, or the proportion of workers in the resource industry exceeds 10% of the total population of the city, which can be identified as the standard of resource-based city (Zhang, 2012).

By referring the *Forest Regionalization in Heilongjiang, Functional Zoning Map of the Forestry Bureau* and the results of remote sensing image interpretation, combining with the actual development situation of forestry and related industries in cities, we make a rule to revise the scope of forestry cities, which is, the forest coverage rate in the administrative area is more than 70%, or local forestry departments have greater administrative power and economic income. Finally, the research area is defined as Figure 1, it comprises all or part of the smaller cities under the jurisdiction of five major cities, and a total of 26 administrative units (Table 1).

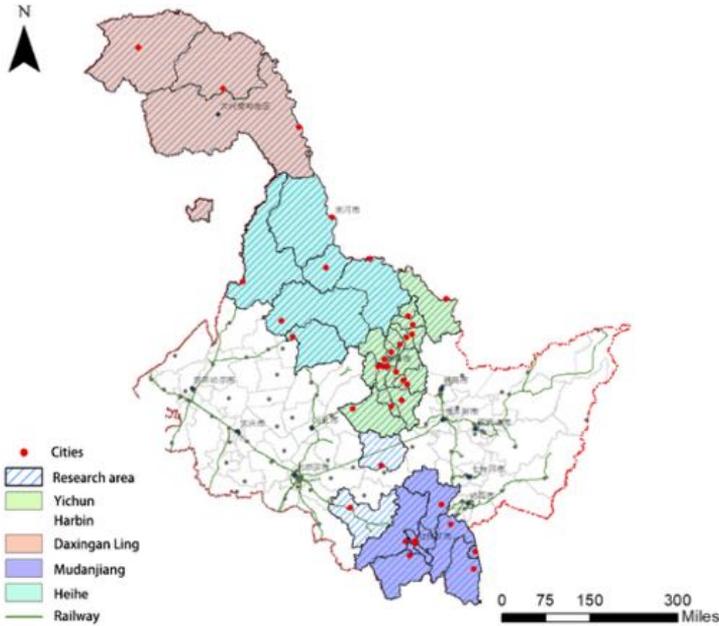


Figure 1. Spatial scope of forestry cities in Heilongjiang province

Major cities	Secondary cities	Land area <i>Km<sup>2</sup></i>	Forest area <i>Km<sup>2</sup></i>	Forest coverage rate	Population
Da Hinggan Ling	Mohe	18427.19	17192.57	0.93	78029
	Tahe	14420.49	11680.60	0.81	92473
	Huma	14335.00	12012.73	0.84	53000
	Xinlin	8702.94	7332.23	0.84	43174
	Huzhong	7419.99	6626.05	0.89	56935
	Jagdaqi	1587.67	1016.11	0.64	156000
Yichun City	Jiayin	6739.52	4717.66	0.70	81000
	Tieli	6620.64	4965.48	0.75	355736
	Yichun north	10501.09	8962.70	0.85	179346
	Yichun	25284.51	22263.61	0.88	468468
	Yichun south	4129.50	3368.26	0.82	179950
Heihe City	Nenjiang	15109.20	9618.52	0.64	464733
	Aihui	14446.30	10235.20	0.71	197000
	Beian	7149.64	2819.10	0.39	425000
	Sunwu	4454.71	2004.62	0.45	104200
	Xunke	17344.80	12217.68	0.70	96208
	Wudalianchi	9874.83	4651.04	0.47	316033

Harbin City	Tonghe	5678.20	4235.94	0.75	255000
	Shangzhi	8910.93	5694.08	0.64	584225
Mudanjiang City	Suifenhe	460.84	211.39	0.46	69607
	Ningan	7924.73	4168.41	0.53	422300
	Dongning	7139.00	6082.43	0.85	207200
	Muling	6187.10	4355.72	0.70	321223
	Linkou	7129.39	4634.10	0.65	437304
	Hailin	8711.85	6795.24	0.78	377858
	Mudanjiang	2516.00	1410.21	0.56	977289

Table 1. Summary table of forestry cities in Heilongjiang province

The scale of land occupied by forestry cities is about 241,000 km<sup>2</sup>, more than 50% of the land area of Heilongjiang, and the total forest area is about 179,000 km<sup>2</sup>, accounting for 90% of the whole province, these cities cover nearly 7 million people, which is 19% of the total population. Therefore, the forestry city is another existence form and the main body of the forest ecosystem in Heilongjiang, and plays an important role in regional economic and social development (Figure 2).



Figure 2. The data proportion of forestry cities

Under the constraint of resources and environment, the forestry cities have formed an urban group with remarkable characteristics. After a long period of extensive growth, many problems in forestry cities have been magnified and projected under the pressure of transformation from various levels, such as the stepped differences in resources and environment, the high quantity and low quality of forest ecological resources and the arduous ecological restoration task. Recent research shows that the forestry cities in Heilongjiang province are faced with many difficulties as follows, convergence of development direction, imbalance of regional development, introverted economic structure, lack of motivation for transformation and weak infrastructure construction. The root causes of this dilemma are all directly related to the spatial attributes of resource environment,

which shapes the urban space, disperses the urban network, solidifies the urban production mode and separates the urban social structure.

**3. Relationship between the resource environment and urban system**

Many scholars have systematically analyzed the relationship between resource environment and other subsystems of human society, and put forward many binary or multivariate system models, such as “resource-environment-economy” or “resource-environment-population-economy”, etc., which provide valuable basis for clarifying research ideas. From a more macro perspective, “resource and environment” are two attribute concepts of natural ecosystem, and this concept implies the relationship with human social system. Both resources and environment can be summarized as a specific role or state of natural ecosystem based on the development of human society (Kaufman, 1981. Sloane, 2003. Guan, 2011 ).

Therefore, the problem of resource environment can be understood as the relationship between natural ecosystem and human social system. Resource environment is the most important factor and medium in the interaction between the two giant systems. Natural ecological system to follow the law of the natural science, and human social system to follow the law of social science, even though we can grasp the natural ecological system through various measuring external features and internal mechanism, and the characteristic of human society system can be obtained through the statistical analysis method, but there is a grey system deeply integrated between the boundaries of two systems, which cannot be determined completely because of too many variables and iterative effects (Kristensen, 2004).

There are two main directions to solve the gray box problem. One is based on the observable explicit boundaries of the systems, the change rules of the system state are summarized, so as to build a simpler relation model outside the grey box. The second is to deduce the structure of the grey box by using the known correlation rules of some subsystems in the grey box, and gradually clarify the mechanism of the grey box system. At present, the applied research on resources and environment is basically covered in these two directions (Figure 3).

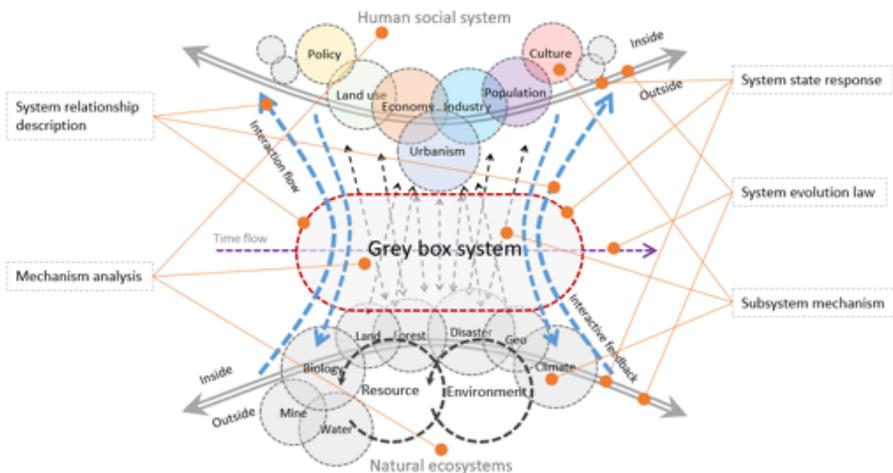


Figure 3. Relationship study based on grey box system

By combing and summarizing the theories and methods related to resource and environment, the characteristics and structural logic of the grey box system are taken as the framework to construct the method flow as follow.

1. The object target of resource and environment measurement is determined. For this research, the endowment characteristics of forest ecosystem and the social and economic characteristics of urban developmen with a transformation background are the main body.
2. Appropriate system relations are used to match relevant elements, and the system status of regional resource environment and urban development should be interpreted based on the matching situation, so as to seek the internal causes of system problems, and then the future development path is evaluated and classified accordingly.
3. Measure factors are screened according to the differences of system state types, and the set of goal-oriented factors is integrated.
4. The system mechanism between resource environment and urban development is established, which is composed of subsystem mechanisms for different levels and perspectives. When introducing specific measurement factors, it may need the cooperation of multiple subsystem mechanisms.
5. According to the combination of system mechanisms, a library of measurement methods for different system optimization objectives is constructed to convert factor information into measurement results. According to results, the adjustment strategies of each system level are obtained, and the coordination and consistency of each adjustment plan are taken into account to form a comprehensive adjustment plan aiming at the overall goal.

#### **4. Spatial response to the urban transformation**

Urban is a collection of production, living and ecological space, as well as centers for the accumulation of various functions such as transportation and communication. Industrial upgrading and functional transformation of cities are closely integrated. In fact, urban function orientation is strongly linked to urban industrial structure and even urban land use structure. It is more accurate to interpret urban transformation experience from the combination of urban industrial upgrading and functional transformation (Gaubatz, 1999).

The transformation mainly includes three dimensions: industrial economy, social structure and spatial environment, that is to say, the urban development mode is transformed from from extensive resource consumption to intensive, and the driving force of urban development is transformed from factor-driven and investment-driven to innovation-driven. Urban transformation, to a large extent, is a profound transformation of urban functional framework, involving urban development foundation, mode, pattern and space. In fact, the process of urban transformation is a process of system innovation, which includes concept, system, technology and government decision-making mechanism, etc. In the process of system innovation, the level of the city is constantly improved (McCormick, 2013).

Although different transformation modes determine the future development direction of the forestry cities, including the choice of leading industries,

the composition of industrial structure, and the difference of ecological and environmental protection objectives, however, these transformation needs can be realized through four spatial paths, that is, macro-control of urban land, protection and restoration of ecological space, reorganization of industrial spatial pattern, and quality improvement of human settlements, which respectively correspond to the problems of economic structure, ecological environment, industry and social system in urban transformation.

After systematically connecting the demands of urban transformation with the spatial path, how to use appropriate technical means to allocate the space of different scales and levels is the key to realize the transformation. Therefore, it is necessary to use the theoretical framework of the grey box system to determine the functional relations, so as to propose appropriate spatial strategies. In addition, for spatial management, the fundamental issue is to provide accurate spatial reference, such as spatial boundary, spatial type, spatial structural relationship, spatial scale, etc., through spatial organization in different levels, a spatial response system can be formed to lead different directions of urban transformation (Figure 4). This is the main basis for selecting a specific spatial planning method.

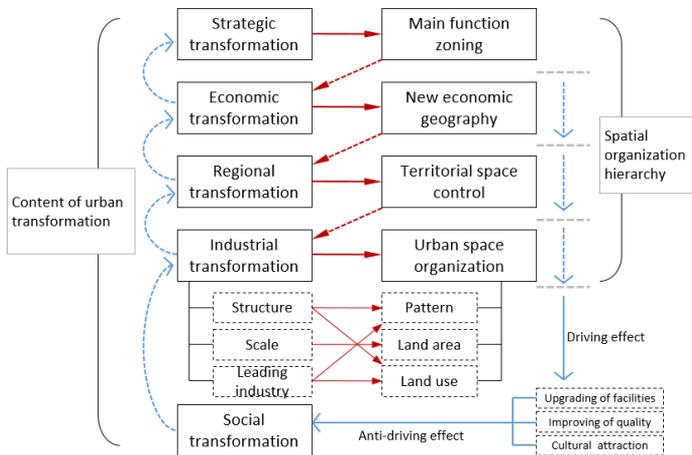


Figure 4. Spatial planning system facing the urban transformation

### 5. Spatial planning model supporting urban transformation

We build a spatial planning model of urban transformation, which fully considered the sustainability of resource and environment, the diversity of cities and the different need in transformation, and a variety of spatial evaluation and ecological evaluation methods are integrated. The model is composed of pattern recognition and spatial response, and its running process is as follow.

1. The indicators of resource environment and urban development are integrated as the pattern pointers of different transformation path, four catalogs are used: the abundance degree of resource environment, dependence degree on resource industries, support degree from urban development and advantage degree in locational conditions.
2. After the pointer reading, the pattern recognition and classification of forest

industry cities are carried out by cluster analysis, then we get different transformation paths suit for various forestry cities.

3. Based on the differences of paths, the measurement method of spatial response is selected, and the overall pattern, ecological restoration, industrial structure and habitat quality solutions are measured by carrying capacity analysis, ecological security pattern, ecosystem services evaluation and spatial suitability analysis , respectively.
4. According to the specific situation of each city, the spatial response aggregation is constructed, and the system strategy of transformation is formed in terms of scale cascading effect between the resource environment and the urban system.
- 5.

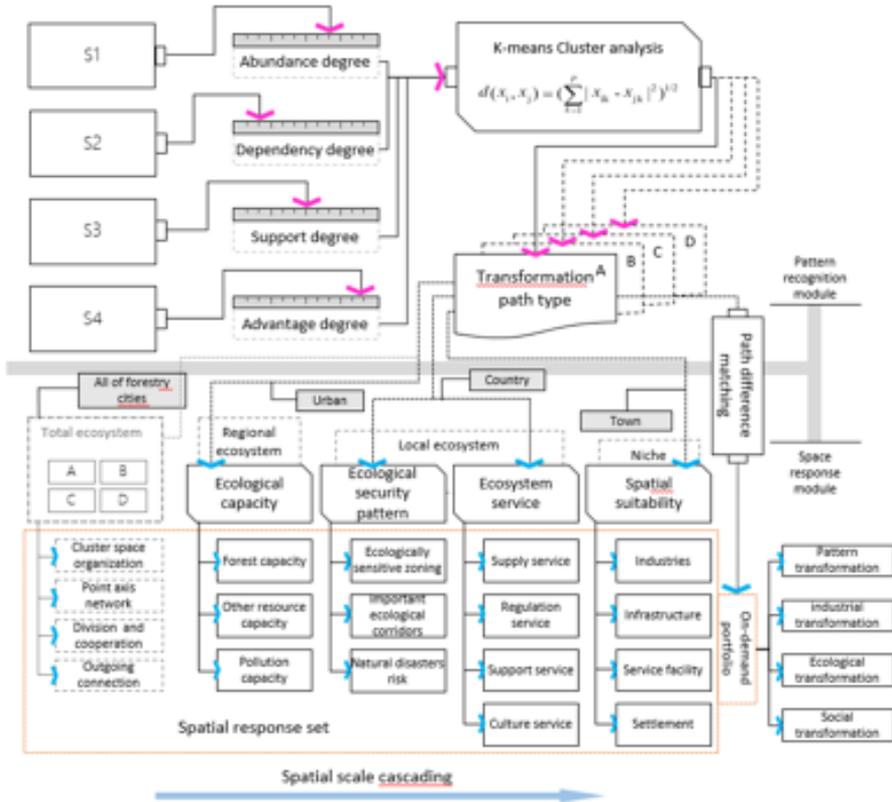


Figure 4. Spatial planning model facing the urban transformation

### 6. Discussion and conclusion

The grey box system between the resource environment and the city system is complex, not fully discoverable and real-time interactive. In the existing research results, a variety of research frame has been proposed to explain the relationship between resource environment and urban, after decades of development, carrying capacity theory, ecosystem service, landscape ecological pattern and the spatial suitability evaluation has been widely used in various areas and scenes, its research edge is constantly expanding, and the final strategies are all closely related to the

rational layout of urban space. So far, however, there is still no any kind of system can systematically solve the contradiction between the city and the resource environment, moreover, the limitations of various methods are also gradually discovered and identification.

Therefore, our research proposes a coupling model based on spatial scale, for different transformation problems, Various measurement methods are applied to the most suitable scale and dimension, giving full play to their advantages, thus, the spatial planning strategies of transformation in forestry cities is constructed as required, The model runs smoothly based on the following conditions.

1. System registration on scale. Spatial scale is the most clear relationship between resource environment and urban system, factors in different scales can be measured and analyzed in a relatively closed range, which simplifies the complexity. Especially for the forestry cities in Heilongjiang, the urban areas of major cities coincide with the four distinct regional ecosystems. The ecosystem within the same scale does not interact strongly with the external resources and environment, human activities in these cities play the main role. The local ecosystem corresponds to the spatial scope of secondary cities, while the impact of smaller township units is mainly reflected in the niche level.
2. Cascading effect between scales. Between the resource environment and urban system, there exists the same cascading mechanism: the higher scale of environment change or spatial structure directly affects and determines the system status of next level, and the lower system changes can accumulate together from bottom to top, and actuating the system change in a higher scale. Due to the mechanism of cascading, the scales can be well connected, and the integrity and locality of the system can be disassembled, thus simplifying the complexity of the unknown system.
3. Scale advantages of different methods. One of the basic conditions for realizing the model is the effectiveness of different methods on a specific scale. Although in more and more empirical research, different methods have scale extension, but the mechanism principle of the method determines its inherent characteristics. For example, capacity analysis has the best applicability in large scale space organization, because of its methods and measures are based on the target to output boundaries of city development or ecological sustainable threshold. Ecosystem services and landscape ecological pattern have higher demand for spatial data and fine-grained statistical data (Costanza, 1997), especially the measure of landscape pattern based on landscape patches, which is generally classified by land use types, but the scientific of their measurement on macro space or micro niches has always been controversial, conversely, the applicability of space suitability evaluation on micro scale is more intuitive and clear.

By reviewing the development history of the forestry cities in Heilongjiang province, our research summarizes the main problems in the transformation period, which are actually caused by the complex relationship between the urban system and the resource environment system. We use the grey system theory to elaborate the methods and strategies to solve the problems. Spatial planning is a main entry point, because it participates in every process of urban transformation and plays an

important role in guiding the direction of urban development. We build a spatial planning model applicable to various forest industry cities, which integrates the existing various technical methods to coordinate the environment and urban. Through the medium of spatial scale effect, these methods are combined to meet different demands of urban transformation. In the future research, the space strategy using in urban individuals will be the focus, and also a way to verify the effectiveness of the model.

### ACKNOWLEDGMENT

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# REDEVELOPING PLACE ATTACHMENT IN DISTRICT 10 — LESSONS LEARNT FROM CONDUCTING A RESIDENTIAL SURVEY

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## **Abstract**

People and architecture shape the character of a neighborhood. In the traditional neighborhood setting, the streets had the significant role of creating social interactions among the residents. As semi-public-private spaces, the streets were an inseparable extension of the houses and created a sense of community that fulfilled the basic human need of belonging to a place.

Ever since Tehran has become Iran's capital city, it has undergone limitless construction and extreme urban transformation. The "apartmentization" of Tehran increased the urban density of the capital by allowing more residential units in each neighborhood. While these changes were a critical response to the population boom and the limited land area of the city, it redefined the character of the neighborhoods. As the densest district in Tehran, District 10 has witnessed serious crisis in terms of social communication and place attachment. This paper will examine how District 10 has transformed from single housing units with active street life in the past to its current condition of neighborhoods comprised of high rises. Moreover, it explores the quantitative and the qualitative aspects of the available community spaces in the neighborhood. In a survey of residents of the district, when the responders were offered the chance to relocate to their desired location among the 22 districts in Tehran regardless of their economic situation, a minority chose to continue living in district 10. In further analysis, it was discovered that there was satisfaction with living in district 10 among the respondents in the

specific age group that expressed fulfillment with the current level of public spaces provided in the neighborhood. Through identifying the type of spaces that the least satisfied age group needed for social interaction, this study recommends possible alternative spaces to redevelop the lost place attachment in the target age group.

**Keywords** — Apartmentization, high density, neighborhood, place attachment, social interaction, street life, urban transformation.

### **Introduction**

Human beings are complex organisms. In order to understand human beings, we need to understand the variables that have an impact on them. According to Dak Kopec, one of the fundamental theories on human-environment relationship is a human focused theory (Kopec, 2006, p. 35). In human focused theory, human beings are dominant to their physical environment and a successful environment is a responsive space to human needs. According to Maslow's Hierarchy of Needs, the emergence of a particular need is related to the achievement of another. The five-level hierarchy starts from basic physiological needs and moves up to more complex needs such as safety needs, belonging needs, esteem needs and finally self-actualization needs (Maslow, 1943). In Tehran, the rate of five safety-need factors—such as employment rate, literacy rate, living in basic residential unit, access to living facilities and health insurance—is above 80% (Statistical Center of Iran, 2009). Through examining the statistics, it is understood that the belonging needs of the people living in the capital ought to be fulfilled through a strategic design.

### **Physical space – a neighborhood in Tehran**

By combining the two most relative definitions of the word “environment” in the *Longman Dictionary of Contemporary English*, it can be stated that environment is divided into two main groups: the natural and the built environment (Pearson Education , 2009). The built environment refers to the man-made surroundings whereas, the natural environment is anything that exists without human intervention. Human beings primarily come into contact with their built environment. Different types of common spaces create varied depths of social interactions in a neighborhood, and if there are available facilities, opportunities and resources, human beings readily become attached to their environment (Kopec, 2006, p. 89). The individual's dependency on this physical environment creates place attachment. In such a neighborhood, place attachment is shaped through environmental experiences that include the type of involvement with a place, place familiarity level, knowledge of a place and place satisfaction (Najafi & Shariff, 2012). This signifies the importance of designing our built environment as it has a great impact on satisfying human beings' social needs of place attachment.

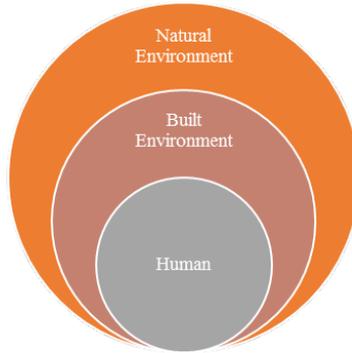


Figure 1: Human interaction with the environment

The creation of the early neighborhoods in Iran can be traced back to tribal settlements (Alireza Zadeh & Raz Jouyan, 1995). In order to be protected, the members stayed united and supported one another which in turn created an internal relationship between them. As the tribes expanded and formed neighborhoods, the sense of place attachment among the neighbors continued. Initially the neighborhoods in Tehran were formed with the centrality of a cultural or a communal place (Mazlumi & Pour Keramati, 2016). This indicated how well the built environment of the neighborhoods responded to the needs of their occupants. However, as housing demand increased in the capital, the concept of a neighborhood has undergone changes. The current neighborhoods in Tehran have lost their authenticity and are facing a crisis in terms of poor communication among neighbors.

### **Housing transformation in Tehran in the 20<sup>th</sup> century**

There is an important difference between the terms “house” and “home”. A house is a physical space in which one resides whereas a home is a place where one creates and develops emotional attachment. From the formation of early settlements that provided shelter, people’s concept of a house has changed. People no longer just seek shelter to fulfil their basic needs; rather, they wish for a place to call “home”. By referring to Maslow’s hierarchy of needs, as human beings advance they tend to give importance to fulfilling more intangible needs.

With the rise of the Pahlavi reign (1925-1979), the capital witnessed major transformations (Norouzi Talab, 2011). As the population of Tehran increased, there was an increase in housing demand and due to the limitations in available land, the value of land gradually increased. This marked the shift towards shared housing. These types of housing began from a single house with several rooms shared by different families and slowly more levels were added. As technology advanced, apartments came into existence to maximize land usage. Apartmentization of Tehran increased the urban density of the capital further as it allowed more residential units in each neighborhood. Although this type of housing system was a critical response to the initial population boom and the limited land area, it redefined the character of the city. Moreover, mass production houses altered neighborhoods’ identities, and with an increase in the number of occupants in a building, neighborhoods witnessed crisis in terms of place attachment and social

communication (Shahcheraghi & Bandarabad, 2017, p. 347).

### **Single-unit housing and street life**

In the traditional Iranian house, significant importance was given to private, semi-public-private and public spaces. A central courtyard was the intermediate space between the entirely private rooms and the semi-public-private street. The street life as an extension of the interior spaces of the house was an important aspect of traditional Iranian housing. These streets were semi-public-private spaces and they differed from the main roads as fewer strangers passed by. Streets were mostly used by the residents of each street for social interactions. Around the 1930s, Tehran witnessed a profound “Modernism” (Rajabi, 1998). During this period the residential open and closed spaces were rearranged towards North and South and the building of central courtyards was banned (Vakili Sani, et al., 2015). These new housings were still single unit and the street life continued to be lively, creating strong relationships among the neighbors (Hatami & Nadimi, 2010).

### **High-density housing and social communications – apartmentization of Tehran**

As defined by the *Longman Dictionary of Contemporary English*, density is the degree to which an area is filled with people or things (Pearson Education, 2009). Therefore, it can be stated that high-density housing is a residential space where a large number of people reside. In such a housing system, although the number of acquaintances is high, people are rather indifferent towards one another. As stated by Georg Simmel, it is neither possible nor healthy for each unceasing contact to be addressed with the same depth (Simmel, 1969). Besides high acquaintance rates, in a high-density housing system, neighbors easily shift between geographic locations, resulting in even more new annual acquaintances. Due to this, residents are also less willing to socially interact with their neighbors. Moreover, high-density housing is responsible for the occurrence of several problems at the societal level and for destroying the characteristics of the neighborhoods (Broyer, 2002). When living in a multifamily residential building, certain apartment etiquette should be followed, which reduces people’s independency and increases conflicting interests. As a result, the levels of social support and cooperation among residents decrease as the building height increases (Shahcheraghi & Bandarabad, 2017, p. 348).

Apartmentization of Tehran began during the Pahlavi I dynasty (1925-1941). Under his command, a boulevard was constructed in the North of Tehran and financial incentives were given to construct four-storey-high buildings (Alemi, 2001, p. 67). Due to the housing crisis around the 1970s, the public sector focused on massive low-cost housing projects (Alemi, 2001, p. 67). Affordable high-density apartments for low-income residents attracted land investors. In Tehran up until the mid-20th century, the tallest building in the city was Shams ol-Emareh (Alemi, 2001, p. 67). This building has five floors and it was used by the Kings of Qajar dynasty to enjoy the panoramic views of Tehran. Ever since, there has been a rapid increase in the amount of high-density housing in the capital and these structures have become an inseparable part of Tehran.

### District 10 – the studied area

The investigative context for this research is district 10. There are two reasons behind this decision. District 10 is a neighborhood that has witnessed the transformation from single-unit housing and vivid street life to high-density apartment blocks becoming the norm. District 10 is also currently the densest district among the 22 districts of Tehran (Municipality of District 10, 2006, p. 11). With an approximate population of 327,000 in 817 hectares, district 10 has a population density of approximately 399 person per hectare (Tehran Municipality, 2017). With a population density twice the average density of Tehran, this district is also the second smallest district in the capital (Municipality of District 10, 2019). Unsuccessful at preserving its old urban identity, district 10 has turned into high-density neighborhoods. Considering the above characteristics, it is interesting to investigate the depth of social communications in district 10 and to explore how people fulfill their basic human need of social interaction and place attachment.

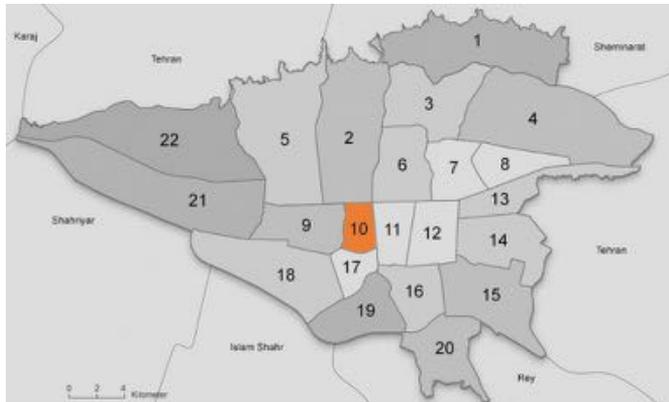


Figure 2: The location of district 10 among the 22 districts of Tehran (Municipality of District 10, 2006)

District 10 is located in the West of Tehran and its neighboring districts are district 2 (to the north), district 9 (to the west), district 17 (to the South) and district 11 (to the east). It is situated between Azadi Street to its North, Qazvin Street to its South, Shahid Navvab-e Safavi to its East and Shahidan Street to its West. This district consists of 3 regions which are further divided to create 10 neighborhoods. Region one includes Jey, Soleimani, Haft Chenar and Beryanak; region 2 includes Hashemi, South Karoon and South Salsabil; and South Zanzan, North Karoon and North Salsabil are located in region 3 (Sasanpour, et al., 2015, p. 164). In terms of accessibility, district 10 benefits from an ideal location. An appropriate distance from the metro station, the railway station, the West Terminal and the national airport have increased the district's population density even further (Design and Architecture Consulting Engineering, 2005, p. 31). In terms of urban land, 57% of district 10 is dedicated to residential use (Sasanpour, et al., 2015, p. 164). With the dominance of residential use, there also seems to be some insufficiency of land dedicated to basic municipal services. The table below demonstrates these services and the shortage of area per capita in each sector.

**ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS**

Land use	Available area (hectares)	Available per capita (m <sup>2</sup> ) (1996)	Ideal per capita (m <sup>2</sup> ) (2005)	Shortage (hectares)
Educational	34	0.5	1.74	34
Healthcare	9	0.3	0.69	9
Green space	14	0.5	3.65	89
Sport	2	0.1	0.71	18
Total	66	1.7	6.92	150

Table 1: Shortage of area per capita (Design and Architecture Consulting Engineering, 2005, p. 5)

The 150-hectare shortage of social services is intensified with the disappearance of street life and the existence of high-density small residential units that account for 53% of the total residential units in district 10 (Design and Architecture Consulting Engineering, 2005, p. 12). Therefore, it is decided to study district 10 further in order to investigate how the residents fulfill their basic human need of social interaction and place attachment.

**Methodology**

The research methodology involves a mixed-method approach. A combination of library data and a field survey method was used to understand the context and investigate district 10. After carefully studying the available library data, a field survey was conducted to collect social data from the residents of district 10. The questionnaire, as a form of field survey, was used for direct data collection. In order to have a group of 200 residents that reasonably represent the district’s population, several locations throughout the three regions within district 10 were studied. Parks, a sport complex, a library, streets and shops were among the places that were visited in order to administer the survey. The survey was conducted between 2019 and 2020, at various times of the week and at different timings in order to increase the diversity of the respondents. As a sampling method, a combination of cluster sampling and stratified sampling method was used. Primarily, the population is divided into residents and non-residents, and only the resident population is included in the sample. Respondents in this cluster are more familiar with the neighborhood and probably spend most of their time there. Secondly, the population is stratified by sex. The goal was to have a sex ratio of the participants that matched the sex ratio of the residents in district 10 which is roughly around 96:100 women to men, respectively (Municipality of District 10, 2019). Furthermore, from each of these strata a convenience sampling method is used for inclusion. The polled population is categorized into seven age groups, starting from below 18 years old up to 70 years old and above.

The questionnaire survey combines open-ended and close-ended questions in order to collect qualitative and quantitative data from the respondents. There are four sections in the questionnaire, and each section is a step towards understanding and exploring the depth of relationships among the residents of district 10. Section A approves the legitimacy of the respondents and encompasses primary

information. Section B identifies the residential mobility level based on house ownership. This level can result in new annual acquaintances which negatively effects place attachment and social interaction among the neighbors. The area of each residential unit and vehicle ownership are among the other questions in this section that aim at investigating the consequences of the shortage in social services. In section C, the respondent's relationship and communication level with their neighbors is examined. In the last section, the resident's social interaction and place attachment level is studied. The data collected is analyzed by using statistical techniques to identify the available community spaces and to examine the place attachment level of different age groups in district 10. Furthermore, this study recommends possible alternative spaces that aid in redeveloping the lost place attachment in the target age group.

### **Results and evaluation**

The main findings from the questionnaire survey support that the street life is lost and, due to the lack of qualitative and quantitative community spaces, place attachment no longer exists among the neighbors in district 10. Close to half of the participants have lived more than 20 years in the district; this illustrates that they have first-hand experience of living in both single-unit houses and apartment buildings. A little less than 50% work in district 10 and as high as 70% have relatives in the neighborhood. This demonstrates that besides residing in this district, the respondents spend a high portion of their time within the neighborhoods. Therefore, the shortage in municipal services has a higher negative impact in fulfilling the individual's social needs. Moreover, nearly two-thirds of the respondents have bought their houses and 80% do not own another house. This illustrates that residential mobility, which is responsible for the reduction of residents' willingness to build strong relationships with their neighbors, is low in district 10. The 80% car ownership that drastically differs from the traditional pattern in the district highlights two important factors. It means that residents are more capable of travelling and are more exposed to the better level of community spaces that are available in other districts. Secondly, this high vehicle ownership explains the heavy traffic congestion and air pollution that worsen within narrow streets and dead ends and is exacerbated by the lack of parking. Urban transformation and apartmentization of district 10 have resulted in more than half of the polled population residing in small 60 to 99 m<sup>2</sup> apartments. The cramped living spaces and a lack of open community spaces have created a crisis in social communication and place attachment that deserves further investigation in district 10.

## ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS

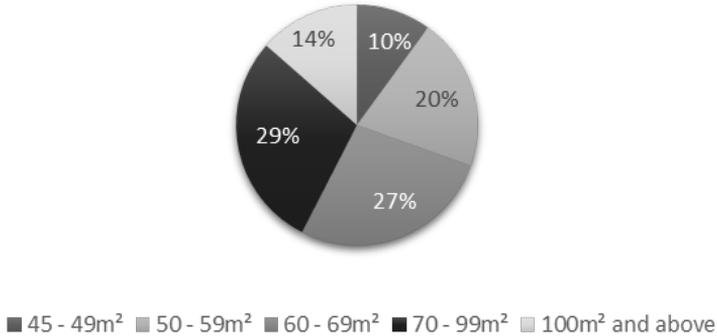


Figure 3: The size of the respondents' residences

The findings of section C prove that the participants' relationships with their neighbors were at the least possible level. Speaking to neighbors only in chance encounters was the norm among the respondents. Considering society today, this level of social interaction is not surprising. What is interesting is that two-thirds of the participants have confirmed that it is very important to know their neighbors. People in district 10 feel isolated from their neighbors and no longer have a sense of community. In addition, the district that they reside in lacks social spaces that encourage communication to fulfill their need of belonging. This is where a smartly designed neighborhood can revive the loss in place attachment among the neighbors and encourage street life.

The final section of the questionnaire concentrates on the respondents' place attachment and communication level, and it explored whether the residents think the type of housing system has an impact on the fulfillment of their social needs. As predicted, more than four-fifths of the participants have previously experienced living in a single-unit housing and are currently residing in an apartment. Since most of the participants have first-hand experience of living in both housing systems their responses are highly valuable. Eighty-five percent of the participants mentioned that they were happier in general when they lived in a single-unit housing. The most common reason behind their happiness was stated to be their independency. The participants appreciated the freedom of choice in their daily activities in single-unit housing. Secondly, the presence of open spaces was appreciated in the traditional housing system, and closer relationships between the neighbors were among the other highly valued characteristics. According to the participants, single-unit housing is considered to be the most suitable type of housing for creating close relationships. The plurality (40%) of the respondents stated that when they lived in single-unit housing most of their neighbors were homeowners, which encouraged them to socially interact and create strong relationships.

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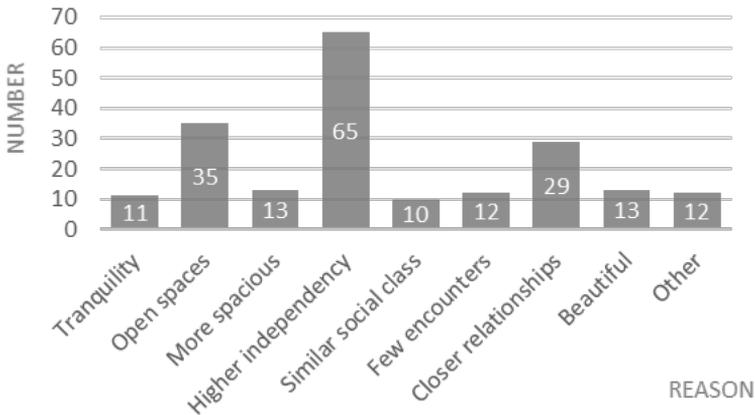


Figure 4: The respondents' reasons behind being happier in a single-unit housing

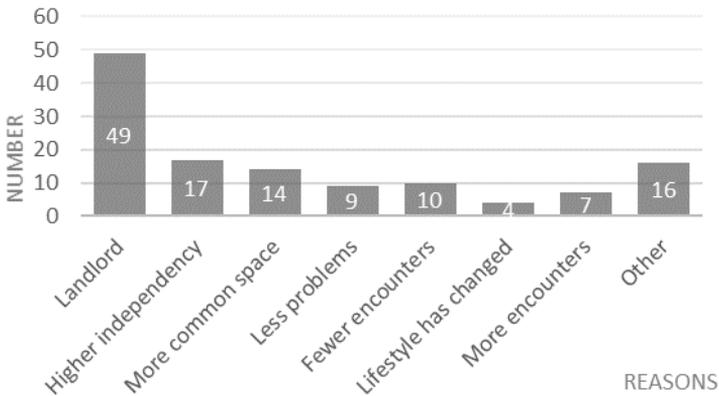


Figure 5: The respondents' reasons behind having close relationships in single-unit housing

Regarding the level of community space, unfortunately, close to two-thirds of the respondents stated that the district had very poor community space and that they mostly met their friends at each other's houses, cafés and restaurants or at parks. The fact that 60% of the respondents meet their friends at each other's houses reveals that the neighborhood lacks in creating a pleasant space for neighbors to communicate and interact with one another. The second most visited place is a café or restaurant, which again is an enclosed space and not public. This further signifies the absence of suitable outdoor spaces. Parks are the third-most visited place for those who wanted to fulfill their social need of belonging. Despite the small number of parks in district 10 and other outdoor meeting spots that are available, some residents would go out of their way to use these free public spaces. Parks mostly attracted women age 56 and above who utilized the free public space for social contact. This age group is the most familiar with the neighborhood and has the strongest place attachment. Lack of design and unsuitable lighting also attracts dangerous activities inside the parks, which was an issue for the age group of 18-25.

## ARCHITECTURAL DESIGN AND CITY PLANNING PROCEEDINGS

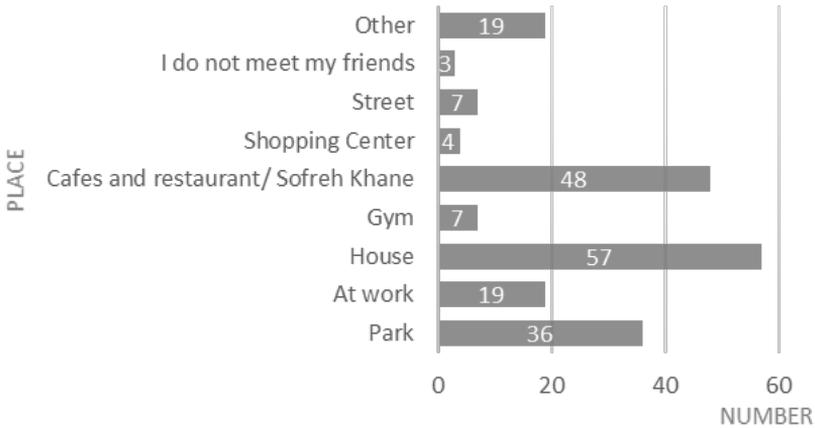


Figure 6: The respondents' hangout places

Furthermore, through exploring the regularity of physical and virtual encounters, the questionnaire examined whether the meaning and pattern of social communication and social attachment has changed over time. About 4 in 10 of the participants met their friends daily. The majority of this group (30%) are 18-25 years old and they also spend between 4 to 6 hours daily on social media speaking to their friends. These participants are considered to be the most active age group in this research. When the participants were given the chance to relocate within the 22 districts of Tehran regardless to financial circumstances, as predicted only one third (equivalent to 58 respondents) chose to continue living in district 10. In further analysis, it was discovered that there was satisfaction with living in district 10 among the respondents in the specific age group that expressed fulfillment with the current level of public spaces provided in the neighborhood. The largest group that chose to continue living in district 10 if given a choice were those age 56 and above. Out of 10 respondents aged 70 and above, eight chose to remain in the neighborhood. Therefore, for simplicity the two eldest age groups were merged together. As people get older and become more familiar to a place they are less willing to change and adapt to a new place. Therefore, the entire group revealed that they had the tendency to stay in the neighborhood because they were familiar with everything. The second highest age group belonged to the most active age group, who were 18 to 25 years old. These respondents met their friends on a daily basis, and they also mentioned that due to place familiarity they wanted to remain in the same district. Being young and having less information about the other districts along with their daily gatherings has created a place attachment in this age group.

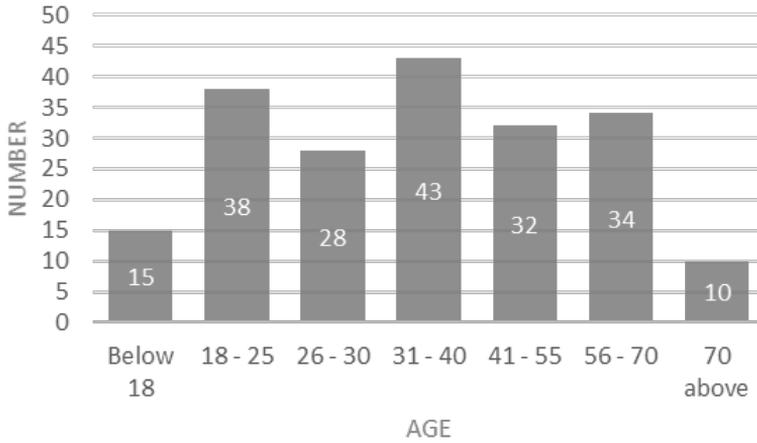
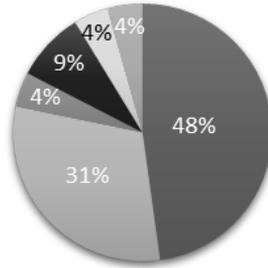


Figure 7: The age group of the 200 questioned participants

The least satisfied age group among the participants in the district are 26 to 30 years old. This group has a wider perspective about the other 21 districts in Tehran; therefore, they have higher expectations from their built environment. The two favorable districts to live in according to this age group are district 1 and district 2, respectively. The reason behind these responses are higher social class, less air pollution and tranquility. District 1 is the most expensive district in Tehran, and people with higher social class reside there. Due to its geographical location it has the best weather in Tehran and it possesses the most luxurious facilities. Therefore, district 1 is expected to be the number one choice of every individual living in Tehran. District 2 on the other hand, is a neighboring district towards the north of district 10. People in this district belong to a higher social status in comparison to the residents of district 10, and the ability to reside in district 2 is not as farfetched as living in district 1. Moreover, besides offering high-quality community spaces and due to its location, district 2 is perhaps the most visited district among the participants. Once more the factor of place familiarity plays a significant role. Usually, a high level of community services is offered to people belonging to higher social class and that is the reason why the majority in this age group have chosen to live in district 1 and 2. In addition, living in the densest district in Tehran with high air pollution are among the other factors that bother this age group. By considering the reasons behind their lack of place attachment to district 10, various spaces that are attractive to this age group should be designed.



■ District 1 ■ District 2 ■ District 3 ■ District 5 ■ District 6 ■ District 8

Figure 8: The favorable districts to reside in according to 26-30-year-olds

### Conclusion and proposal

The level of social communication and intimacy among neighbors is a comparative measure that differs in each group, age, culture and society. Among the 200 respondents residing in district 10, the least satisfied age group is 26-30 years old. All the respondents in this age group are willing to relocate in search for a district with higher level of community space, more clean air and calmer environment. Through identifying the type of community spaces that fulfill these needs, this study recommends alternative spaces in order to redevelop the lost place attachment in the target age group. In district 10, the street is both the problem and possible solution to developing a new place attachment. The narrow streets and crowded parking areas create congestion and air pollution. Public parking structures could be used to move cars away from key streets that in turn could be redeveloped into pedestrian-only streets of one or more blocks. These streets could be redesigned with natural landscaping and urban furniture. There is plenty of precedent for this type of urban redevelopment in the historic districts of European cities. There could also be varying degrees of street conversion to community spaces. From converting one or two parking spaces per block into small conversation parks, to transforming entire blocks into urban parks, there are a lot of various possibilities for rethinking the streetscape of the district.

While there is not much space and financial incentive to retrofit existing apartments, the entrance area of apartments would be an opportunity to recreate the seating areas that once existed in the traditional Iranian housing system. Through designing modern seating areas, residents would be once again encouraged to linger and meet and spend time with their neighbors. The roofs of most apartment buildings are utilitarian and typically go unused. These spaces could also be converted into communal spaces for the building occupants belonging to this age group. Besides creating an area away from the noise and pollution of the street with access to sun, these spaces respond to the issue of proximity and time which is another concern for the adults between 26-30 years old.

New building codes could also be a way in which to ensure that the design of new residential buildings addresses the need for community space. The design of communal spaces such as lobbies and entrance halls could be an important component of building design as fire safety and egress currently already are. The results of this survey show that respondents have the desire to know the people

who live around them. To be able to develop this relationship, there must be opportunities and spaces where this can naturally and easily happen. Only through the concerted efforts of government, community and designers working together to address these issues will place attachment be reinvigorated.

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