Deep Beauty in Architecture: Comparative Analysis of the Traditional-Courtyard and the Contemporary Residences of Lahore

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Abstract

Lahore is among the major urban centers in Pakistan, with increased energy demands, that has resulted into frequent power blackouts. The growing population, economic disparities and competition, has further fueled the energy requirements and reliance on modern comforts [air-conditioners and heaters]. The standardized design layouts of modern houses suffer regional identity and continuity, that is typical of traditional residential settings rooted in time as they progressively evolved in response to cultural and climatic conditions of the city.

This study employs the methodology of the "Deep Beauty Framework" [1] used by Coates that critically looks at architecture [in our case house types] on three levels: functional, typological and archetypal. The comparative analysis between a typical traditional courtyard house and a typical modern detached single-family house allows to understand the diametric conditions in design and planning of the two house-types. It also addresses the paradigm shifts driven by current socio-spatial and cultural conditions, establishing new trends for the future.

We argue that the traditional courtyard house offers a valid proposition in the modern design and planning process. The design attributes of the traditional house instill a sense of place rooted in continuity with history, local/indigenous building materials and relies on passive heating and cooling techniques such as cross-ventilation, stack effect and evaporative cooling, that are legitimate propositions for a city that is frequently challenged by energy shortfalls till a permanent solution is achieved.

Geometric patterns and arabesque design in the traditional house-types echo cultural continuity with spatial continuity that can be experienced throughout the house with prospect and refuge spaces [2] such as connected courtyards and verandas besides high ceilings for light and cooling. Courtyards in traditional house-types are known to engender social activities within the joint family system in more than one way. Conversely, the present-day detached single-family house in Lahore falls short in meeting the criteria established by the Deep Beauty Framework.

The findings offer design opportunities to hybridize the unique spatial and physical characteristics of the traditional house with the spatial proclivities of the modern house for innovative designs that are more responsive to the current need, and to re-establish the continuity between the old and the new.

Key Words: Biophilic design, Courtyard house, Deep beauty framework, Detached single family house, Geometry, Orientation, Passive Design, Prospect and Refuge, Residential Architecture, Sense of Place

1. Introduction

Over time, the architecture of the city of Lahore, Pakistan, has undergone many changes. Throughout history, Lahore has been through instability, tranquility, cultural celebrations, invasions and destructions. In the eleventh century, Lahore became a metropolis and has remained a significant city ever since [3]. Lahore reached its glory under the Mughal rulers, who administered the city from the year 1524 till 1748 [4]. It remained a centre of power struggle between the Afghan forces and the Sikh *Misls* (brigade of warriors) up till 1798, after which Sikh rule was established in the Lahore Province. Ranjit Singh (d. 1839) was crowned the first *Maharaja* of the Sikh Empire (1798-1849), with its capital at Lahore. In March 1849, Duleep Singh (d. 1893), Ranjit Singh's teenage son and heir, gave up sovereignty to the British, who governed the city for the next 98 years [5]. At the end of the British rule, Pakistan was founded, and Lahore became its second largest city and the cultural capital.

All these important political changes in the region along with the introduction of technology have caused the architecture to evolve in many different ways. During the Mughal era, *Haveli(s)*, which is the regional name for courtyard houses, were built in the Walled City of Lahore. The Walled City is the home to many cultural traditions and these *haveli(s)* exemplify Lahore's traditional residential architecture [6].

The introduction of technology and globalization has greatly changed the way houses are designed and built today. The present-day residential designs have many problems that make them unfit. Lahore has a hot semi-arid climate (Köppen climate classification BSh). Summers are long and extremely hot, and winters are dry and warm [6]. Designers rely on mechanical means for thermal comfort which increase the energy demands. Consequently, the demand exceeds the supply resulting in frequent power shutdowns throughout the day. Air-conditioners and heaters provide a consistent interior environment that disconnects inhabitants from the outside world, bringing an end to the cultural rituals and habits [7]. The standardization of the built environment, therefore, results in a lack of regional identity.

To resolve these problems and create sustainable living spaces in the city, designers seek help from science and technology, although, the answer to a better future lies in our past. The difficulties that we see today were not a part of history. By comparing the traditional residential architecture of Lahore with the contemporary designs, we can learn from the wisdom of tradition to create solutions for the future.

1.1. Deep Beauty Framework

Gary J. Coates writes, "*To create Deep Beauty in whatever we make and do is an act of love, because only that which is loved is beautiful*." [8] The "Deep Beauty" framework is a holistic approach which looks at architecture from aspects of functionality, regionalism to deeper meanings of architecture to create a sustainable and life-enhancing 'architecture of place.' It comprises of three levels i.e. typological level, functional level and archetypal level which are explained below [8].

1.1.1. Typological Level

At this level, buildings possess a sense of history, community, nature and place. By taking inspiration from the bioregional traditions and historical building types, architecture is created that is both new and familiar [8]. Typology is regenerative so buildings can be of the same building type yet appear so different from each other [9]. Time-tested architectural types provide important lessons to reach high standards of excellence. Nature also provides lessons of sustainability and life-enriching design. Biophilic design in a built environment connects the users to nature through plants, animals and water.

1.1.2. Functional Level

This level deals with all the practical requirements of the building's users. Functional buildings merge well with their sites, respond to sun, wind and light, are of an optimum size, are energy efficient and make use of local building materials [8]. Besides providing shelter, a house serves the purpose of a social unit of space [10]. Another important function of a residence is to be appropriate for the family structure and the social setup of its users.

1.1.3. Archetypal Level

The Archetypal level reaches the deepest layer of meaning to attain a beauty that is universal. Buildings use archetypal elements from the world's sacred architecture. Such buildings possess greater levels of higher order by using sacred geometry and the qualitative number. The presence of biologically rooted polarities of 'complex order', 'prospect and refuge', 'enticement' and 'peril', respond to our psychophysical opposites [8]. Grant Hildebrand has identified these five survival-advantageous characteristics that increase the likelihood of creating deeply rewarding spaces [11]. We find appeal in sensory materials that are ordered but also complex at the same time because order alone becomes monotonous and complexity alone results in a chaos. Shelter is a necessity for humans to protect themselves from climate and other threats. Jay Appleton has referred to this characteristic as 'refuge' [12]. At the same time, we also need vast open spaces. Prospect is spread out and lit while refuge is narrow and dark. Both cannot be present in one space, but they must be contiguous. Stephen Kaplan concluded in his research that we also have a preference for scenes that present mystery [13]. Therefore, as humans, we have a desire to discover, in safety, what the obscured has to offer. Hildebrand calls this characteristic 'enticement'. Enticement only exposes part of the information and leaves the rest to be discovered. Additionally, we enjoy settings that let us experience thrill where we experience fear with pleasure. Hildebrand calls this characteristic 'peril'. In

situations of peril, we face real dangers but we also have the ability to control the risks [11].

By studying the three levels of the Deep Beauty Framework, the following rubric has been developed that can be used to evaluate works of architecture in terms of sustainability. In this research, this criterion is applied to compare the traditional-courtyard house and the modern house along with the proposed new hybrid design as a solution for the future.

Table 1: Rubric for Evaluating Deep Beauty [33]

Typological Level	**Functional Level**	**Archetypal Level**
Sense of History, Community & Place	Orientation of Building	Orientation in Space
Building Type	Building Materials & Construction Methods	Geometry, Proportion and Numbers
Layout	Family Structure & Social Setup	Spatial Polarities in Natural Settings
Biophilic Design	Comfort	

2. Typical Traditional Courtyard House

Haveli is the regional name for a courtyard house. Due to the decay of wood and brick, it is difficult to deduce the early evolution of havelis but Cooper and Dawson conclude that they are a contribution of the Mughal tradition [15]. The Mughal legislation declared that a person's wealth should return to the royal treasury on his death. This discouraged the wealthy from spending their money on building magnificent residences, however, the culture of havelis remained. After the nineteenth century, this law was removed and the havelis continued to be glorified. An owner dreamed of an ever-expanding joint family that would carry forward his name. Walls were made thick so that further floors could be added to the *haveli* as the family size increased [15].

2.1. Typological Level

Based on the rubric mentioned in Table 1, at this level of Deep Beauty, this paper analyzes the role of bioregional traditions and historical building types in the traditional courtyard house.

2.1.1. Sense of History, Community and Place

Over the centuries, India has witnessed predominance of variety of religions and dynastic rulers that have influenced Indian architecture. The histo`ry of this region begins from the Neolithic Times in the 6000BCE. From the 3rd millennium BC, the Indus Valley Civilization lived in courtyard houses made of brick. From the 4th Century B.C., the region was predominantly settled by the Buddhists, who followed distinct and organized religious practice. The presence of open courts, verandas, lattice screens, balconies is seen in Buddhist monasteries and prayer halls. Hinduism prevailed from the 5th Century A.D until the arrival of Islam in the 13th Century A.D. The courtyard type continued to exist in religious buildings like mosques and (collegiate buildings) (*madrasas)* [14] as well as in the residences.

Haveli(s) are found in the Walled City of Lahore which represents the traditional architecture of the city. This area is also referred to as the "Old City." Archeologists estimate that this locality was originally founded between the first and seventh century. However, the area was developed during the Mughal Empire [16].

Fig. 1: Drawings of the Walled City Street in 1858 [17]

It can be clearly noted that throughout history of the sub-continent, the courtyard has remained a common architectural element of design until recently. Randhawa highlights the importance of courtyards in India by narrating: *"Courtyard house architecture reflected the style and culture of its time. It was indicative of the owner's self-image and aspirations, with a distillation of the historical influences. It manifested itself in degrees of solidity to extreme ornamentation* [18]*."*

Features like screens, verandahs, courts, biophilia and geometry are all part of the region's architectural history. The *havelis* of the Walled City of Lahore are courtyard houses that possess a sense of history and place, because they originated in this region and depict an architectural style that is local.

2.1.2. Building Type

The courtyard housing typology of the Walled City of Lahore mainly involved an open-to-sky court that was surrounded by interior spaces with openings to allow interaction between the outdoor and the indoor.

2.1.3. Layout

A conceptual layout and section of a typical haveli has been developed by observing and reading about numerous havelis of the walled city including the Nao Nihal Sing Haveli, Lal Haveli, Barood Khana Havel and Dhian Singh Haveli. The typical courtyard typology becomes evident in almost all residences of the Walled City by examining its master plan.

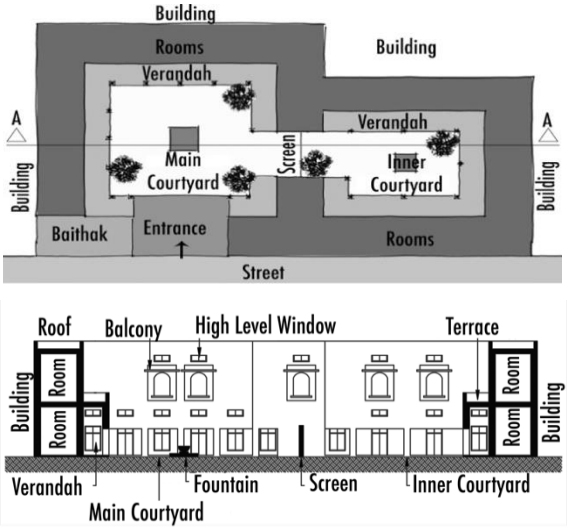


Fig. 2: Conceptual Drawings of a Typical Haveli in the Walled City [33] *(Above:Plan; Below: Section AA)*

The entrance of a typical haveli was through a huge arched door that would be large enough for an elephant to pass through [19]. The first room that faced the street was called the '*baithak*' (sitting area). '*Baithak*' was a male domain and served as a transition between the public and the private space [20].

A typical *haveli* had two courtyards, the outer one for the males and the inner one for the women and children of the house. The courtyards were usually decorated with fountains and plants [19]. A covered corridor with pillars, called the '*beramdah*' (veranda), surrounded the courtyard and provided access to the interior rooms. The rooms on the upper floors had shaded '*jharokas*' (balconies) from which one could look into the courtyards and the street. These openings were covered with '*jali*' (lattice screens), to provide privacy, prevent glare and decrease the force of hot winds. '*Teh khan*a' (basement) was used to store valuables and served as a cool refuge in the summers. The staircases were uncomfortable due to their narrow widths and high risers. Ornamentation was an essential part of *haveli* decoration [20]. The flat roof tops were accessible and used at night for sleeping during the summer months [19].

2.1.4. Biophilic Design

Plants and water features in the courtyards brought nature into the house. It allowed its users an escape from the urban setting to a natural setting. The presence of earth was shown when plants or trees were rooted into the ground. The level of the courtyard was almost always below that of the arcade, differentiating the domestic from the more natural. In times of rain, the earth dried slowly, dispersing a strong aroma in the air for the senses. The water on the ground acted as a mirror, reflecting its surroundings and dispersing the sunlight to form patterns [21].

Seasonal changes affected the aesthetic appeal of the courtyard. In winters, the plants withered out leaving a more barren landscape. When spring arrived, fresh flowers and green leaves showed up that were enjoyed all through summer until fall, when the plants began to change color and fallen leaves filled up the courtyard floors [21].

Plants influence all of our senses. The filtering, reflecting and shading of the sunlight make them a delight for the eye. The rich variety of colors, shapes and textures along with the different smells of the flowers enrich the overall experience of a space. Fruits and vegetables are savored through the sense of taste. Plants provide shade from the scorching sun and cool the air through transpiration which comforts the skin. The ears enjoy the sound of the cool breeze, rustling of leaves and the sounds of insects.

John S. Reynolds describes the roles of a courtyard. He says, *"The courtyard can represent many things: an oasis in the desert of city streets; a fragment of nature (thus a reminder of natural landscapes beyond the city); a center of interest for the building; a concentration of light, sound, and water; a life-sustaining refuge of safety and privacy* [21]*."*

2.2. Functional Level

According to the rubric mentioned in Table 1, this level investigates how the pragmatic needs of the building's users are fulfilled.

2.2.1. Orientation of Buildings

The absence of a grid pattern of streets in the layout of the city has led to a variety of orientations for the houses and the courtyards. Amita Sinha has observed that the Muslims faced the entrance of their courtyards to the West (towards Mecca) and the Hindus faced it towards the East [22].

2.2.2. Building Materials and Construction Techniques

Brick was used by the Mughal Emperors to build the city wall of Lahore, forts, mosques, havelis and the brick-paved streets. The architects and builders faced the brickwork with colorful tiles by taking inspiration from the Persian customs. By the sixteenth century, colored tile was not commonly used for houses, tombs and wells. At times, the brickwork was arranged in a decorative manner to break the plainness of the wall. Laying the bricks diagonally, setting them on an edge or projecting them out from the corners are a few ways in which brickwork was made more interesting. The size of the brick varied over the years. In Lahore, the indigenous *'Lakhauri'* brick was used but the size of the brick could vary within a single building [15].

Lime plaster was not commonly used before the arrival of Muslims in the sub-continent. The Muslims used it for plaster and stucco as it soon became a vernacular material due to the rich sources of lime present in the region. The *havelis* were constructed with brick, held together with lime plaster. In the ceiling, beams supported the closely spaced joists that were filled with bricks, mortar and rubble. Fine lime would be used to finish the roof that sloped in a way to allow the rainwater to drain properly [15].

2.2.3. Family Structure and Social Setup

Moving on to the cultural requirements of the society, the traditional-courtyard house successfully fulfilled needs of the family. The culture of the region favored a joint family system in which three or more generations lived in the same house. After marriage, the son brought his wife home and they both resided with his parents. This led to large domestic formations, including family members and servants that helped with household chores.

The veil system for the women in Islam influenced the residential design. The inner court that was separated from the outer court by screens, was used by women (Fig. 2). Sometimes the house had separate entrances for the women and men. The fascination of Muslims with light was reflected in the intricate patterns used on windows, screens, doors and shading devices that were used for socialization inside and outside the house. The latticework on the exterior windows allowed ventilation and daylight and provided privacy to the residents [23].

The courtyard formed a social center of the house that promoted maximum interaction of people and nature. It provided a natural setting, some furniture to sleep or relax, play areas for the children and sitting for family discussions, all within the privacy and safety of the house. It was also a place where important cultural and religious ceremonies took place.

As the floor levels moved up, the level of privacy increased which allowed the residents on the upper floors to look down from the balconies. The roof top provided maximum detachment from the courtyard but granted contact with the neighboring houses and the street from above [21].

In the old times, people used animals as a mode of transportation and to earn a living. The courtyard would be the sleeping and eating place for the domestic animals. This way they would remain safe without intruding the interior spaces of the house.

2.2.4. Comfort

Traditional buildings maintained thermal comfort through architectural elements like *jalis* (screens), *verandas, jharokas* (balconies), *fountains, plants, chajjas* (overhangs), courtyards and basements [24]. The windows were unglazed but covered with *jalis* (screens) and opened into *jharokas* (balconies) that allowed ventilation but prevented direct glare. The *chajjas* (overhangs) shaded the courtyard and deflected the monsoon rains. At the heart of the building was the courtyard that protected the interior spaces from direct sunlight. The high ceilings of the rooms facilitated ventilation and kept spaces cool.

Ilay Cooper and Barry Dawson described three methods that were used to cool a large urban haveli: '*teh khana'* (basement), '*khus'* (screens made from dried grass roots) and '*punkah'* (fan). '*Teh khana'* was sunk into the ground and remained indifferent to the fluctuations in the outside temperature. '*Khus'* was hung in front of the openings, windows and doors. This screen was wetted which cooled the passing air and scented the air with the smell of grass. *'Punkah'* was operated manually by a man who would sit outside

the room and pull the ropes to make a to and from movement of the fan [15].

The functions of the rooms were flexible and their usage was adapted according to the time of the day and the seasons. In summers, people preferred to stay in the basement or in the courtyard where the water features and the plantations provided cool air. At night, they moved to the roof tops to sleep in the cool breeze. However, in the winters, people preferred the roof during the day to gain maximum heat from the sun and moved to the rooms on the upper floor that were warmer than the rest of the house. If the interior spaces became too hot, household activities like cooking would be moved to the courtyard.

Thick walls were built to overcome the structural inadequacies of the building materials but they also provided the advantage of thermal and sound insulation. During summer days, the structure, due to its thermal capacity, absorbed most of the heat and prevented the internal temperature from rising. Shading devices further helped in keeping the wall surfaces cool. At night, the outside temperature dropped and the walls started to quickly loose heat to their surroundings [25]. Brick and lime were the main construction material for paving, walls and the roof. Their porous nature has the ability to slowly release moisture back into the environment and create an evaporative cooling affect.

2.3. Archetypal Level

In discussing the third level of Deep Beauty, this paper moves beyond the obvious and looks at the deeper layer of beauty that is universal.

2.3.1. Orientation in Space

In a space, direction is important for a person to understand where he or she is. An indefinite space can be given direction with reference to the heavens. The primary system of orientation of north, south, east, west, up and down constitutes the entire world [26]. When Muslims built their courtyards towards the west (Mecca), it allowed them to orient themselves to the Kabah (House of God) which is the center of the world for all Muslims. The mirror-like pool located in the center on the courtyards holds symbolic importance in Islam as it reflects the heavens, which unites the above with the below [26].

The presence of monumental buildings, for example, the Lahore Fort, the Badshahi mosque and the Wazir Khan mosque (located in the Walled City), allowed the residents to orient themselves. Their tall minarets and the call for prayer that took place five times a day, would give the listener and the viewer a sense of direction. The close proximity of the Walled City to the river holds importance for the Hindus as sites close to water were considered sacred in India. According to Hinduism, *"Gods reside near forests, rivers, mountains, rivulets and in the cities which are full of gardens.*" [27]

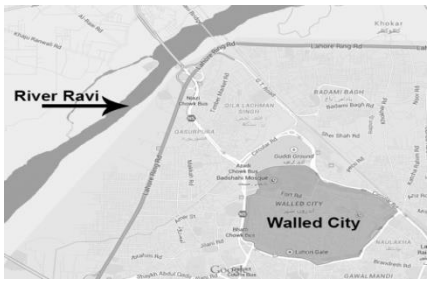


Fig. 3: Location of the Walled City [28]

The Walled City is located on the northwest side of Lahore. The river Ravi flows approximately two kilometers west of the area. The area is outlined by the Circular Road. Two important historical landmarks of the city, the Badshahi Mosque and the Lahore Fort, are located on the north side. The area comprises of narrow streets for pedestrians and vehicles, residences, commercial areas, health clinics, schools and colleges

2.3.2. Geometry, Proportion and Numbers

Numbers in Islam are qualitative as well as quantitative. So they are not simply identified with the rules of addition, subtraction, multiplication and division but hold a projection of the Unity. For example, in Islam, the number '4' symbolizes the four directions, the four seasons, the four gateways to heaven [26] and the four rivers that flow in heaven. The number four is prevalent in the design of Mughal gardens known as the '*char bagh'* (lit. four gardens). The garden is a quadrilateral that is divided into four parts by walkways. Prevalence of number in *havelis* is unknown but Schoenauer & Seeman have made an observation about the courtyard houses *"It is obvious that in a large country like India one must encounter many regional differences in court-house building traditions. However, there is one characteristic which applies to the Indian builder in all regions: he has an excellent sense of proportion and is highly skilled, despite his simple tools, producing buildings with a distinctive dignity and beauty"* [29].

Surface adornment is a way in which matter loses its heaviness. This applies to all scales of architecture from monuments to floor carpets or even brass trays. Walls of a building are transformed by the patterns of brick, plaster and tiles. Floral patterns and geometric designs are carved on arches to make then appear less heavy [26]. The domes, walls and floors of most Mughal buildings are decorated with geometric patterns, calligraphy and arabesque. Different 6-point, 8-point and 10-point geometric patterns are visible in the interiors of all Mughal buildings situated in Lahore. These patterns are also visible in the *jalis*, through which sunlight creates numerous configurations of shadows throughout the day.

2.3.3. Spatial Polarities in Natural Settings

The five survival- advantageous characteristics: 'complex order', 'prospect and refuge', 'enticement' and 'peril', are in response to our psychophysical opposites [8] and create deeply rewarding spaces. A combination of prospect and refuge spaces is an integral part of *haveli* design, which is made possible through various design features. Larger rooms like the dining room and drawing room, usually have high ceilings forming the interior prospect while bedrooms with low ceilings form the interior refuges. Basements of the haveli are dark and cool places to relax and the open courtyards provide a feeling of vastness and openness to the sky. Verandahs surrounding the courtyards, giving the user refuge spaces from where he or she can easily see the prospect-claiming courtyards. Trees in the courtyard develop shaded areas that form exterior prospects and exterior refuges. Courtyards, which expose the residents to the weather, and balconies that look below into the courtyards enrich the experience through their perilous thrill.

The complex street network of the Walled City and the variations in house sizes and shapes leave the visitor with a sense of mystery. The absence of a straight path does not allow the user to identify what will happen once the path turns. Yet, in this complex network, the presence of geometry gives the design a characteristic of complex order that can be recognized by moving through the space.

3. Typical Present Day House

Present Day Houses have evolved into two major housing typologies: detached, single family house or a semi-detached, single family house (Fig. 5).

3.1. Typological Level

Following the rubric mentioned in Table 1, the research attempts to find the relevancy of bioregional traditions and historical building types in present day residential architecture.

3.1.1. Sense of History, Community and Place

Once the British took over India, they worked toward improving the infrastructure of the city and made way for roads and railways. As the 20th century progressed, the cost of labor and traditional materials increased. Steel girders and cement became the primary building materials. The building industry followed the fashion of western forms which were made possible by the arrival of the electric grid and cooling machines. Traditional architecture was left behind [15]. With time, people migrated from the congested urban center and the city started to expand outside the traditional Walled City. Over the years, the new urban development has had little concern for tradition.

At present, though the construction materials, layout and family setup of houses are similar to each other, a variety of front facades are visible throughout the city. As can be seen from the photographs below, there is no distinct regional style present as far as the elevations of the houses are considered. The styles do not relate to the traditional architecture of the region and take inspiration from around the globe. When all these different facades are put together in one housing development, the urban landscape lacks harmony and appears chaotic.

Fig. 4: Photographs of Famous Housing Developments [30] *(Top left: Lake City; Top Right: Oasis; Bottom Left: Divine Gardens; Bottom Right: Bahria Town)*

3.1.2. Building Type

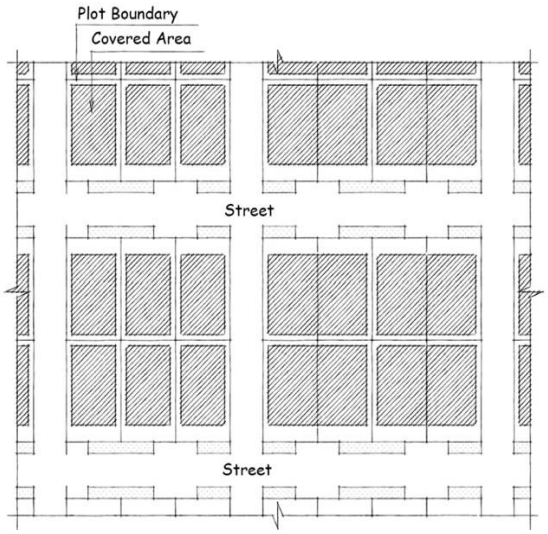
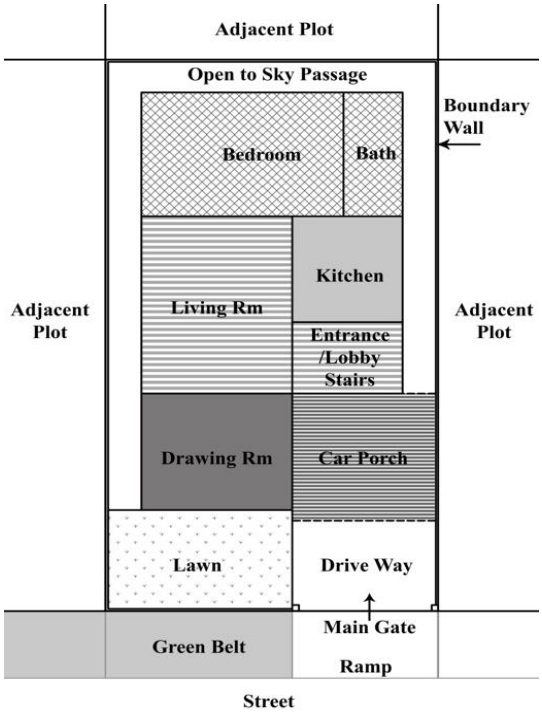


Fig. 5: Layout of Detached and Semi-Detached, Single Family House [33]

The housing developments for middle class families offer houses on plot sizes of 2250sft, 2700sft, 3150sft, 4500sft, 6750sft, 9000sft. Residences follow two housing typologies: detached, single family house or a semi-detached, single family house (Fig. 5). Users have their separate entrance, their own car porch, their independent lawn and so forth. The concept of shared spaces is not entertained.

3.1.3. Layout



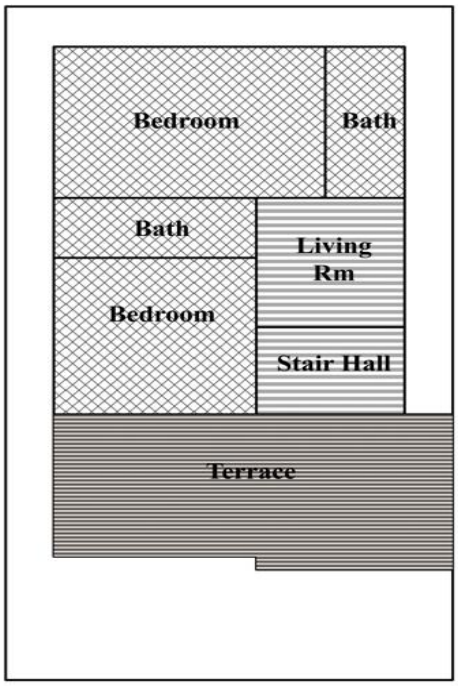


Fig. 6: Basic Layout of a Modern House *(Above: Ground Floor; Below: First Floor)* [33]

The plot is usually surrounded by a 7 foot boundary wall for the purpose of safety and privacy. The front side of the house has a metal gate that leads into a semi-covered car porch. On one side of the car porch is a lawn. Most housing developments require leaving a 5 ft. wide open space on all four sides of the building to allow for sunlight and ventilation. The size of the car porch, the lawn and the side passageways can vary according to the size of the plot.

Fig. 7: 3D Image of Typical Modern Houses [33]

The entrance door typically leads into a lobby that has access to a drawing room, a powder room and the living room. The drawing room is an essential part of the house where guests are entertained. These guests are not intimate enough to be led into the rest of the house and a separate

powder room is also provided for them. Over the years the veil system for women has become more flexible but the women still remain inside the privacy of the house and are separated from the male guests.

The living room is the main social center of the house, where all the family members relax, watch TV and discuss family matters. The dining area is sometimes a part of the living room depending on the size of the house. The kitchen is a separate room so that heat, smell and moisture does not penetrate into the rest of dwelling. One or more bedrooms with attached bathrooms are also designed on the ground floor. A staircase from the living room leads upstairs to other bedrooms with attached bathrooms, terrace and the roof top. The terrace and the roof top are sometimes used for activities like laundry.

Electricity load shedding is a common phenomenon these days, which causes people to migrate from one place to another inside the house when the temperature becomes unbearable. The modern houses rely on mechanical systems for interior comfort and so in case of power shut down, the interior environment can become intolerable. In the summers, people move to the coolest room of the house or the roof top at night. In the winters, all activities shift to the hottest room of the house or the roof top during the day.

3.1.4. Biophilic Design

As land is expensive in the city and population is high, the residents focus on accommodating as many rooms as possible in the layout of the house with the least amount of area to be left open. The front lawn is the main source of interaction with nature, with a small fountain or waterfall, and a smaller patio or backyard is sometimes designed in houses that are 4500sft or larger. The terrace is a paved area but can be converted into a roof garden with potted plants.

3.2. Functional Level

According to the rubric mentioned in Table 1, this level evaluates how the practical requirements of the building's users are met.

3.2.1. Orientation of Buildings

The relationship of sun, wind and light with the building is not usually considered while designing of housing developments nor houses as independent units. An example is the plan of one of the famous housing developments known as the Lake City shown below. The division of the plots is done in such a way that all the houses have variable orientations.

Fig. 8: Plan of the Lake City Housing Development in Lahore [31]

3.2.2. Building Materials and Construction Techniques

The British replaced the '*Lakhauri'* brick with a standard 9 by 4.5 by 3 inch brick [15] that is currently used in Pakistan. Brick walls and cement mortar form the load bearing wall structure for residences. The ceilings are made of reinforced concrete slabs that are usually fabricated on-site. At times, the main entrance of the house has a solid wood door but to reduce the cost, flush doors made of plywood are installed with a metal frame throughout the house. Aluminum sliding windows are common because they are easier to maintain. Flooring materials vary from space to space: the car porch is covered with concrete tough pavers; the interior flooring materials include tiles, marble, solid wood and laminated wood; rugs and carpets are used for decoration; bathrooms and kitchen have tile work with a huge variety of colors and designs of tiles available in the market; and brick tiles are used on the roof.

3.2.3. Family Structure and Social Setup

Due to the joint family system, the households in Pakistan are large. On average the household size is considered as 6.9 persons per house in urban settings [32]. The family usually consists of two grandparents, two couples and their children. Two to three servants also work around the house which are sometimes provided accommodation in the residence.

3.2.4. Comfort

The placement of houses close to each other form narrow passages in between them. In this way, the buildings are able to shade each other from the sides and the back while the front is mostly left exposed to the sun. Horizontal shades and pergolas block the harsh sunlight from entering through the windows and provide cooler areas on the terraces and the lawn for sitting.

To provide heat insulation, some users build a cavity wall as the exterior wall of the house. This cavity wall has a 9 in. thick brick wall, a 1 in. air gap and then a 4.5 in. thick brick wall. This increases the width of the wall to approximately 15 in. and takes up a lot of space which is why it is not encouraged in smaller houses. Roof and wall insulation materials like polyurethane foam are slowly making their way into the construction industry.

3.3. Archetypal Level

At the third level of Deep Beauty, this paper attempts to find the deeper layer of beauty, by searching for archetypal elements from the world's sacred architecture.

3.3.1. Orientation in Space

As mentioned earlier, the housing developments do not consider orientation which results in plots that face in all directions. While designing the interior, it is important for people that the bed and the water closet do not face the west direction which is the direction toward the Kabah, the house of God for Muslims. It is considered disrespectful to face one's feet or urinate in that direction.

3.3.2. Geometry, Proportion and Numbers

The plot sizes are rectangular in shape with proportions of 25ft. by 45ft., 35ft. by 6ft., 50ft. by 90ft. and so on (Fig. 5). The by-laws set by housing developments require certain areas to be left uncovered on the sides. This leaves a rectangle within the plot on which the interior spaces are designed.

The divisions of interior spaces are mostly done based on functionality. Items like doors, windows, tiles, kitchen counter tops and furniture are mostly available in standard sizes in the market. The dimensions of these items dictate the sizes of the rooms.

3.3.3. Spatial Polarities in Natural Settings

The exterior prospect spaces in the house are the front lawn and the front terrace (Fig. 9). The rooms that have openings to the front are refuge spaces from where the prospect claiming lawn, terrace and street are visible. Other interior rooms have openings into outdoor spaces on the sides and back that are narrow and do not serve the purpose of a prospect. Though the concrete slab is poured at a single height to save cost, false ceiling designs and double height entrance halls create interior prospect and refuge spaces.

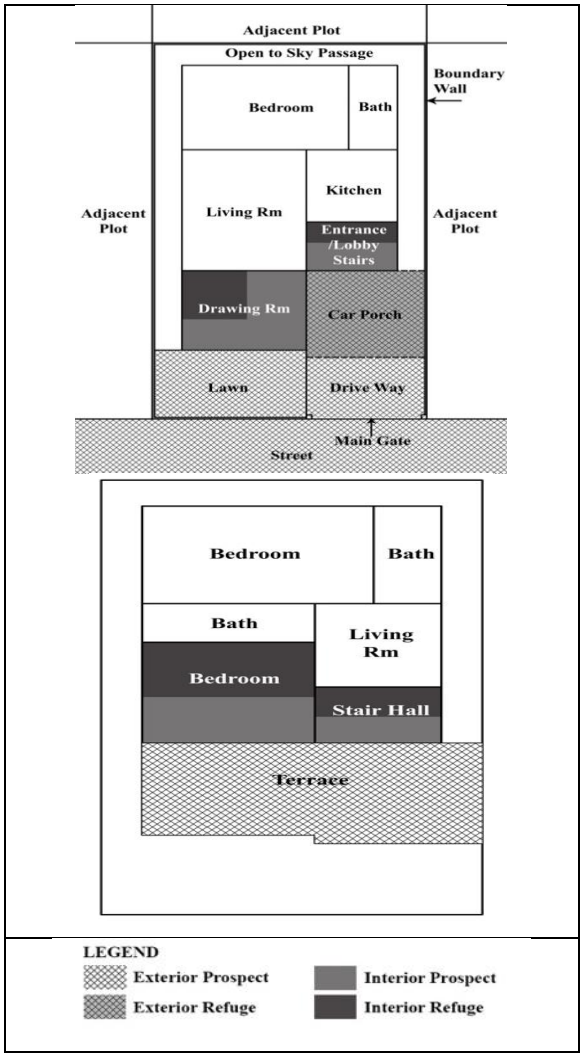


Fig. 9: Present Day House; Prospect and Refuge[33] *(Up: Ground Floor; Below: First Floor)*

The outdoor spaces are mostly straightforward and do not hold any mystery. An order is visible in the design as the spaces are arranged in a specific sequence. Strategies that are currently visible in houses to introduce peril are balconies, double height spaces and glass railings.

4. Conclusion

The present-day house clearly falls short on many aspects of "Deep Beauty." The house does not take into consideration the orientation of sun and wind. Though the vernacular building material brick is used, other imported materials have invaded the market. The house relies on machines for thermal comfort and passive design techniques are not applied. Building type is the western detached and semi-detached single-family house (Fig. 5) and the facades take inspiration from many different architectural styles, which results in a lack of sense of history and place. The front lawn is the only source of biophilia for the residents and the open spaces on all the other sides are unused spaces that provide light to the interior rooms. Geometric shapes and their proportions are not found. A proportioning system is observed that is based on the availability of interior elements like tile size, door and window size and so on. Spatial polarities of prospect and refuge can only be experienced in the front of house where the front lawn, the front terrace and the street are prospect spaces (Fig. 9).

5. Problems with Courtyard Housing

After identifying all the design strategies and concluding that the traditional house is more sustainable than the contemporary one, it is important to understand why the architects today do not follow the courtyard house.

The plot area of the haveli is five times more than a typical 4,500sft modern house for a middle-class family. The rise in land prices has resulted in this reduction of plot size. To accommodate the family size of 7 persons, the present-day designers focus on covering the maximum plot area, which leaves less space for a spacious courtyard. Leaving large amounts of space for a courtyard will usually be seen as a waste of expensive land. The current housing developments and urban policies are different from that of the Walled City. The covered area is dictated by the by-laws set by the housing authorities which leaves little margin for the architect to deviate from the prevalent housing type.

The arrival of mechanical means to regulate temperature ended the need for the courtyard house that operated on passive design techniques. The typical family size continues to reduce and the joint family system is endangered. This has given rise to the detached or semi-detached single-family houses.

The ornamentation in the traditional *haveli* is expensive and requires skilled labor. Formations of geometric patterns on floors and lattice screens are difficult to build as compared to a modern house that has less ornamentation.

Lastly, clients and designers both are inspired from the West. Exposure to magazines, internet and television generates a desire to mimic other architecture styles from around the globe. It can be said that the traditional courtyard house is now considered as out-of-fashion.

6. Design Solutions

Keeping in mind all the above-mentioned problems associated with a courtyard house and the study of both the typical houses, design solutions are proposed below (Fig. 11 & Fig. 12) to cater for the modern day housing problem. In Lahore, the infrastructure for many new housing developments is under construction presently. These developments have been designed according to the standard plot sizes and proportions that already exist (Fig. 10). Therefore, to make the design solutions more applicable, typical modern day plot size and proportions are considered. Since privacy of women is an important part of the social structure and security problems in the city are common, the plots are kept independent of each other.

The two design options proposed Option A and Option B are shown in Fig. 11 and Fig. 12. In option A, the courtyards of four adjacent plots are placed together to allow maximum sunlight. To avoid invasion of privacy that might occur by penetration of sound from one courtyard to another, option B looks at a design in which only two courtyards are next to each other. This way the building acts as a buffer zone between two courtyards.

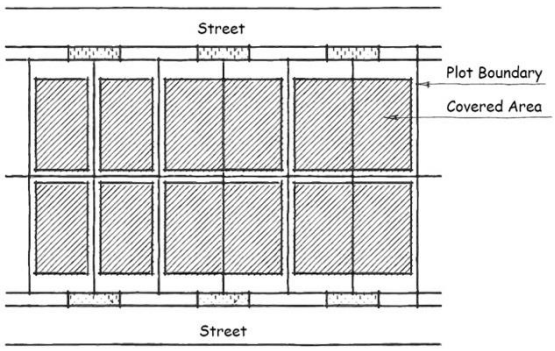


Fig. 10: Existing Housing Typology [33]

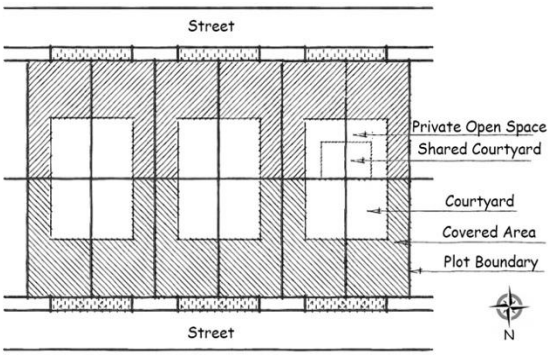


Fig. 11: Proposed Courtyard Housing in Existing Plots (Option A) [33]

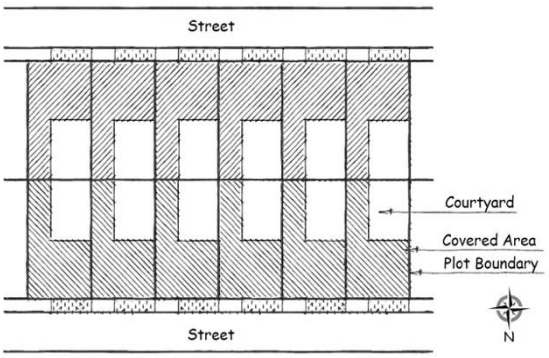


Fig. 12: Proposed Courtyard Housing in Existing Plots (Option B) [33]

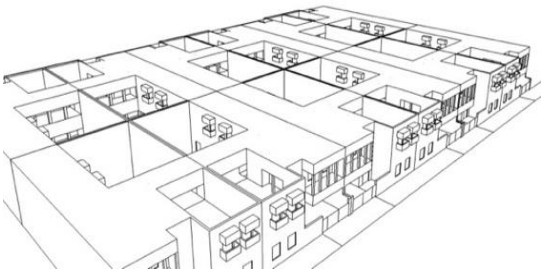


Fig. 13: Isometric View of Proposed Courtyard House (Option A) [33]

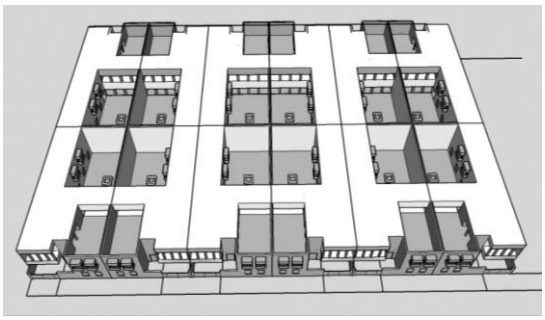


Fig.14: Top View of Proposed Courtyard House (Option A) [33]

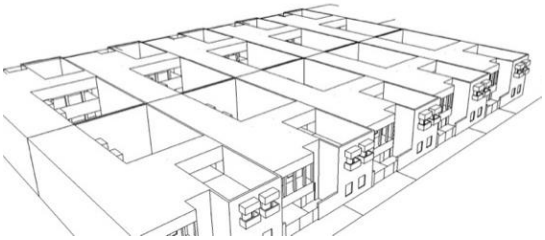


Fig. 15: Isometric View of Proposed Courtyard House (Option B) [33]

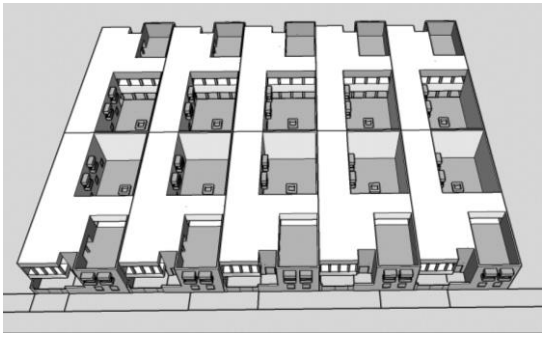


Fig. 16: Top View of Proposed Courtyard House (Option B) [33]

The plans and section (Fig. 17 and 18) are designed for a 4500sft house that can be modified for smaller or larger plot sizes as they are of the same proportions. It is designed to meet the present day needs of socializing, living style and technology. Following the typical design of a modern housing development of Lahore, the entrance into the plot is through a gradual ramp. This slope enables cars to enter into a semi covered car porch. One enters the interior of the house through an entrance lobby from where, the guests are taken to a formal space, the drawing room, and the family members enter into the living room which is an informal space. The dining room is accessible for both guests and family members. The drawing room, the dining room and the courtyard lead one into another so that in case of a larger social gathering they can be opened up to form one large space. A verandah runs around the courtyard which has a fountain in the center. From this verandah, the kitchen and the bedroom can be entered. A staircase from the living room climbs to a living area on the first floor. This living room connects the two bedrooms and a verandah. Balconies and verandahs on the south look below into the courtyard and the ones on the north look out on the streets

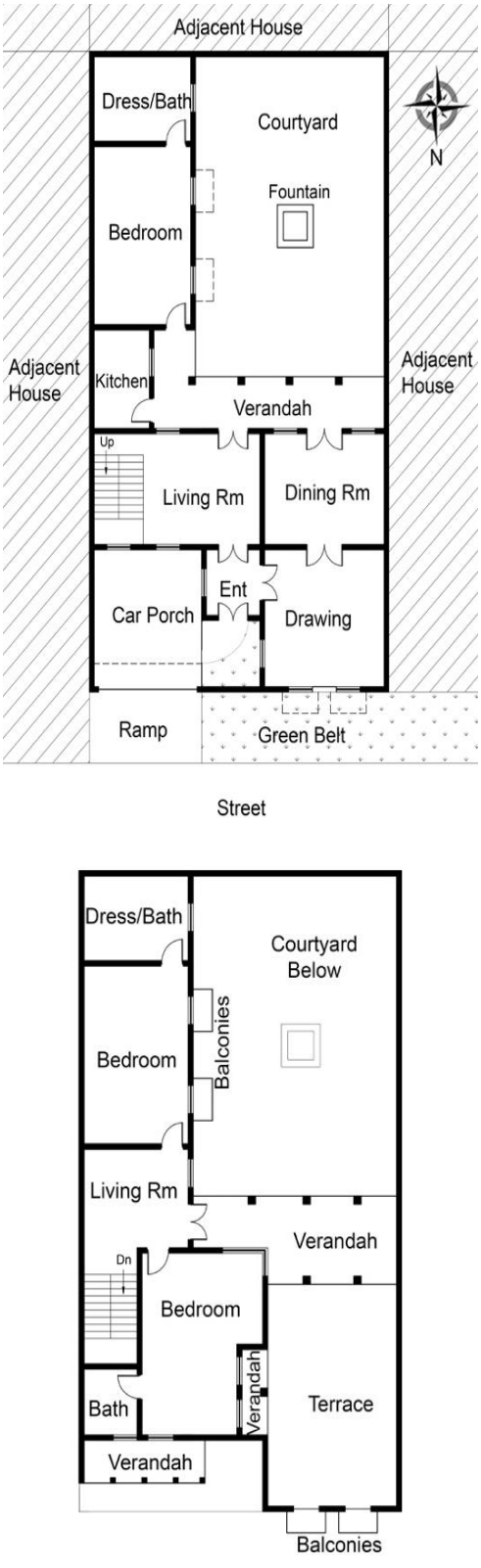


Fig.17: Plans of Proposed Courtyard House (Option A) [33] *(Up: Ground Floor Plan; Below: First Floor Plan)*

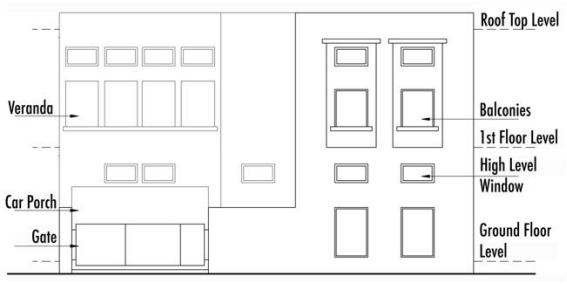


Fig. 18: North Elevation of Proposed Courtyard House (Option A) [33]

6.1. Comparison of Square footage

L-shaped house with a south facing courtyard and terrace can well adapt to the shape of the plot. To address the issue of vast open land in a courtyard house, the amount of open and covered areas has been kept the same in the proposed deign as that of typical modern house. The diagram (Fig. 19) below illustrates how the open spaces on the sides of the house that have no utility due their narrow widths, can be more efficiently used. Bringing all that open area into one central location can form a positive courtyard.

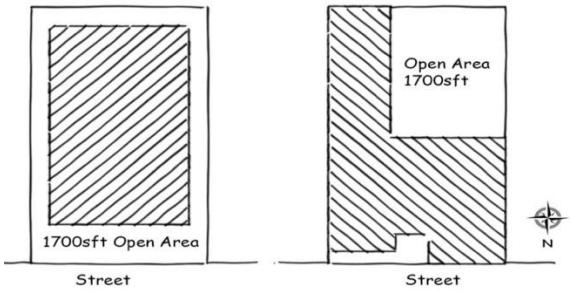


Fig. 19: Same Open Area in Existing and Proposed Modern House [33] *(Left: Existing Modern House; Right: Proposed Modern House)*

6.2. Typological Level

The design follows the courtyard housing typology that is native to this region. The intimacy gradient of a typical modern house is followed in the proposal where the car porch and drawing room are formal spaces located at the front for the guests. Further into the house, are the living room, the dining room and the courtyard. The most intimate space is the bedroom which is located furthest into the house.

The central location of the courtyard is the key to bringing nature into the house. Potted plants, trees, water fountain, water pools, climbers are all features that can be easily incorporated into the courtyard and terrace.

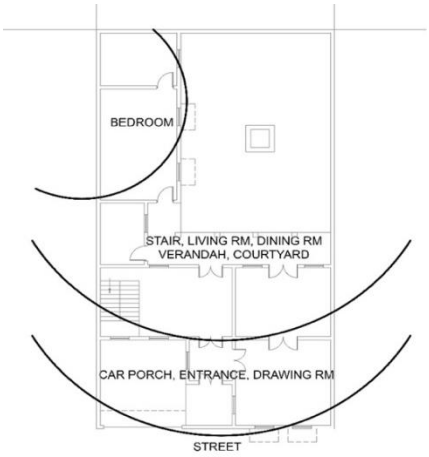


Fig. 20: Intimacy Gradient of Proposed Design [33]

6.3. Functional Level

The south facing courtyard provides a well-lit space through which the interior spaces are also illuminated. The rooms on the south side are shaded by the verandah and balconies. The courtyard is visible and directly accessible from all of the informal spaces. This preliminary design has the potential to allow features like outdoor furniture and plants along with the central fountain to create a social space with a sitting circle and quite places. This house can easily be constructed using bricks. Cross ventilation has been enhanced by placing two or more openings adjacent to each other in one room. Stack ventilation is created by high ceilings and high operable windows (Fig. 18). The fountain in the center of the courtyard and plants can create evaporative cooling.

6.4. Archetypal Level

Courtyard of the house has the proportions of a root 2 rectangle. When combined with the adjacent courtyard, it becomes a larger root 2 rectangle. Geometric and arabesque patterns can be designed on the doors, screen, windows, floors and ceilings for decoration purposes.

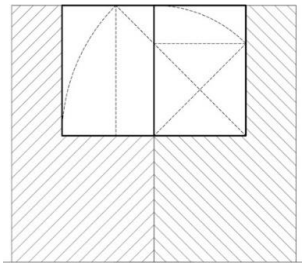


Fig. 21: Geometric Analysis of Proposed Design [33]

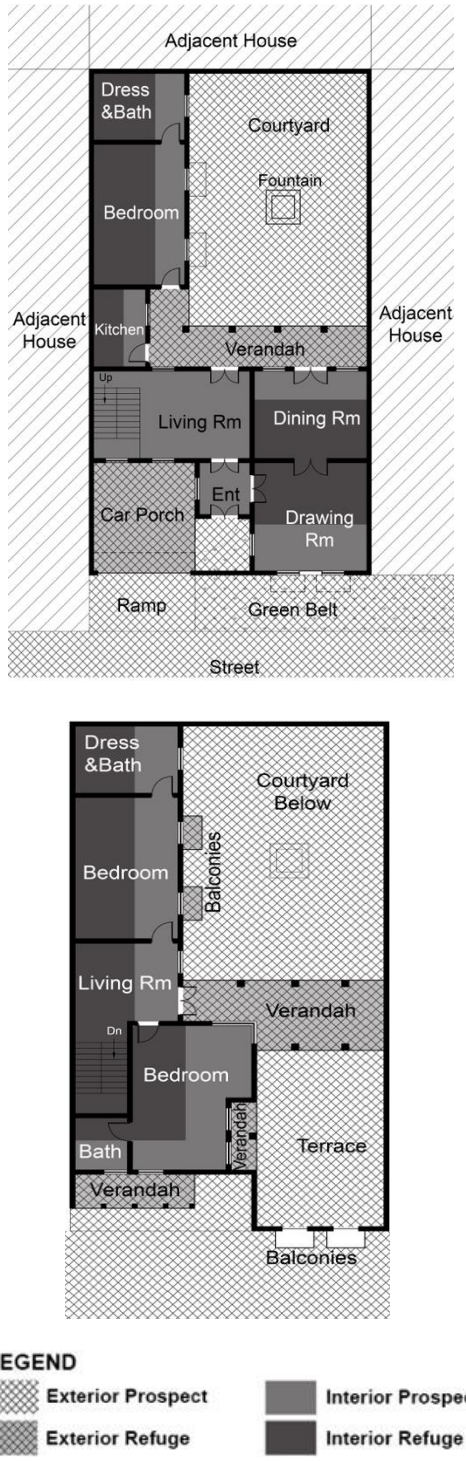


Fig. 22: Prospect and Refuge in Proposed Design [33]

The spatial polarities of prospect and refuge can be fully experienced in the house (Fig. 22). The prospect claiming spaces are the courtyard, street and the terrace. The shaded verandas and balconies provide outdoor refuge spaces from where the outdoor prospect spaces can be seen. Inside the house, the areas close to the windows have more light and provide outdoor views while

the ones away from these openings are dark refuge spaces.

Paths that bend and disappear around corners create mystery for the user. These bends shown in the diagram (Fig. 23) below with arrows. A sense of mystery is alive that can be experienced as a person moves inside the house. These bends allow a partial view of the next space making its presence felt but not completely disclosing what lies ahead.

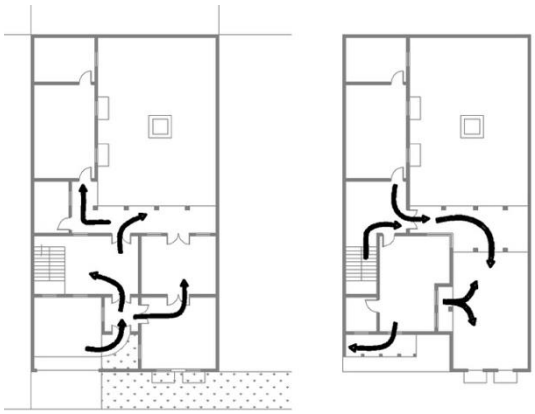


Fig. 23: Enticement in Proposed Design [33]

6.5. Final Thoughts

This new proposed design shows that the more sustainable courtyard house can be brought back and incorporated into the modern urban fabric. The design can be adopted by any typical housing development in Lahore with certain changes in the by-laws. Merging the traditional with the contemporary designs in this manner can bring "Deep Beauty" and sustainability back into the residential architecture of the city.

7. References

[1] The term "Deep Beauty Framework" (2014) was coined by Gary J. Coates, Department of Architecture, Kansas State University, Manhattan, KS.

[2] "Prospect and Refuge" theory was originally proposed by Jay Appleton in 1975. In 1991, Grant Hildebrand applied this theory to architecture of Frank Lloyd Wright. Later, it has been applied to many other architectural works by various researchers and has become a widely popular design theory. For further information see: Hildebrand, G. (1991), The Wright Space: Patterns & Meaning in Frank Lloyd Wright's Houses, Seattle: University of Washington Press.

[3] Historians agree that Lahore was founded by ancient Hindu rulers, and at the time of the first Muslim conquests of the Indian Subcontinent, the city was in possession of the Hindu Chauhan Dynasty (7th – 12th C). From c. 964 to 1001 CE, it was governed by the Hindu Shahi Dynasty (879-1026) until it was conquered by Sultan Mahmud of Ghazni (r. 998-1030) in 1021. It was at this time that Lahore evolved into a metropolis once it was made the Indian capital of the Ghaznavid Empire. For details see: Beck, S. (2006). India and Southeast Asia to 1800 (Ethics of Civilization Vol 2). World Peace Communications, Chapter 8. Retrieved August 2019, from http://www.san.beck.org/AB2-India.html#6

[4] Lahore was captured by the Zahir ud-Din Babur (d. 1530), the first Mughal emperor, in 1524. Yet, it was not until 1526 that the Mughal Empire of Hindustan was established after the decisive battle at Panipat. Till 1748, Lahore remained under direct Mughal governorship. The mid-eighteenth century was a time of chaos for the city, as it changed nine governors between 1745-1756, and was then ruled by the Marathas till 1761. See: Beck, S. (2006). India and Southeast Asia to 1800 (Ethics of Civilization Vol 2). World Peace Communications, Chapter 9 & 10. Retrieved August 2019, from http://www.san.beck.org/2-9-MughalEmpire1526-1707.html

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