



2018

Understanding Traditional Domestic Buildings in Pakistan – Lessons for Contemporary Design

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Understanding Traditional Domestic Buildings in Pakistan – Lessons for Contemporary Design

Abstract

After Independence in 1947, the quest for modernity was evident in the way Pakistan pursued western ideologies in its building design and construction. Architects from around the world were invited to envision the new face of the young nation. The capital, Islamabad was envisioned and planned by Greek Planner Constantinos Dioxidas who was invited by the Government of Pakistan. Modernity was viewed as a symbol of progress, replacing, discarding architectural traditions in the process. Unlike the modern ideology currently being practiced in the country, traditional domestic architecture of Pakistan is a response to local context, that considers the climate, availability of indigenous materials and craftsmanship, respect for local cultures and societies, and commonly held religious beliefs and traditions.

This paper analyzes traditional dwellings in Pakistan and the surrounding region to establish that traditional design can guide contemporary housing design in Pakistan. It draws upon the solutions found in historic domestic buildings to address contemporary challenges. The analysis proves that adoption of traditional building principles can be beneficial and sustainable and there are lessons to be learned from historic architectural buildings of Pakistan. The paper analyzes six residential buildings that incorporates aspects of traditional building; three historical pre-Partition buildings and three contemporary post-Partition projects and establishes the importance of adopting traditional architectural principles in contemporary context.

Keywords

Lahori Architecture, jharoka, Courtyard, Pakistani Architecture, Walled City of Lahore

Disciplines

Historic Preservation and Conservation

Comments

Suggested Citation:

Bhatti, Zara Shafiq (2018). *Understanding Traditional Domestic Buildings in Pakistan – Lessons for Contemporary Design* (Masters Thesis). University of Pennsylvania, Philadelphia, PA.

UNDERSTANDING TRADITIONAL DOMESTIC BUILDINGS IN PAKISTAN—
LESSONS FOR CONTEMPORARY DESIGN

Zara Shafiq Bhatti

A THESIS

In

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the
Requirements of the Degree of

MASTER OF SCIENCE IN HISTORIC PRESERVATION

2018

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ACKNOWLEDGEMENTS

This thesis is very special for me as it is a topic that has always fascinated me, but I never got the chance to fully delve into it. For making this thesis possible, I would like to thank - my Advisor, Pamela W. Hawkes, Professor of Practice at School of Design, for being my mentor, being patient, believing in me and telling me “this is my chance to highlight my world”.

- my family, especially Ami Abu who saw endless opportunities for me and always pushed me to pursue them

- Mr. Kamil Khan Mumtaz for being generous with his time and being the source of inspiration for this paper

- Mr. Azeem Dad Khan, Senior Architect at Walled City of Lahore Authority for providing data regarding residential buildings in the Walled City.

- my friend Noor Jehan Sadiq, for taking my untimely calls and listening to the same thing numerous times without complaining.

- And finally, all the other lovely people in my life (too many to name) who asked me what my topic was (even when it did not make much sense) and telling me “To go for it!”

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GLOSSARY

Baithak: A place for sitting in a traditional house, primarily used to entertain guests; a room or platform for male gatherings.

Barsati: A covered platform, room, verandah, or loggia on the roof serving as a shelter from rain

Bazaar: Traditional retail, commercial market

Chajja: Wooden balcony (usually stretching along the entire length of the façade) cantilevered, facing towards the bazaar

Dalaan: Room of moderate size, with one side colonnaded, opening into the courtyard.

Daricha: A window opening high on the wall.

Galli: Narrow lane, alleyway, branching out from main street

Haveli: Traditional houses in South Asia (mostly with a courtyard); a large urban dwelling; a non-imperial palace

Hurmuchi: red colored ochre paint applied to brick surfaces

Jali: Latticed Screens

Jharoka: A projected (usually oriel) window, enclosed structure supported on a cantilevered masonry work, and often supported by similar masonry above.

Mug: A central opening or light well over a covered courtyard or room opening to upper levels or roof.

Pukka-kalli, a highly polished plaster

Sahn: Courtyard

Shah Nashin

Teh-Khaana: Basement

ABBREVIATIONS

WCLA: Walled City of Lahore Authority

PEPAC: Pakistan Environmental Planning and Architectural Consultants Limited

INTRODUCTION

In the past half-decade, countries of the South Asian region have come together through conferences and seminars to address the issue of traditional architecture in conjunction with regional identity.¹ This thesis is a response to the critical discourse that is taking place in Pakistan and related contexts such as India, Bangladesh and Sri Lanka. Faced with the eager acceptance of western standards and designs, the local architectural community is confronted by the issue of traditional architecture and its usefulness. As we advance into the 21st century as a global village, the importance of culture and tradition is diminishing, especially in countries such as Pakistan, which have a history of colonization and stigmas attached to anything from the past.

When British established their rule in the subcontinent in 1858, a relationship of subjugation was established. They introduced foreign ideas to the masses as “better and more civilized”, and those ideas were willingly adopted to gain favor with and recognition by the ‘rulers’. This acceptance was not limited to language or clothing, but extended to lifestyle and architecture. Although the British established official system of governance in the Indian subcontinent in 1858, acceptance of British lifestyle was visible as early as the 1770s.²

“The Nawabs of Lucknow imported all sorts of European manufactures, including mirrors, lustres, framed European prints and Worcestershire china.”³

¹ The Aga Khan Award for Architecture held a Regional Seminar, “Regionalism in Architecture”, part of the series *Exploring Architecture in Islamic Cultures* at Bangladesh University of Engineering and Technology with Institute of Architects in Dhaka (1985). Speakers included professionals from Pakistan, India, Sri Lanka, Saudi Arabia, Algeria, UK, USA, Nepal, Turkey, and Egypt.

² Shahnaz Arshad, “Reassessing the Role of Tradition in Architecture” (Massachusetts Institute of Technology, 1988).

³ Arshad, “Reassessing the Role of Tradition in Architecture”. Pg. 25

Residential architecture was particularly influenced by the European concepts. The indigenous Bengali peasant hut was adapted to create a distinct architectural type, *the bungalow*, that became an institutionalized form of residence for the colonial officers.⁴ The bungalow was a European concept of “a house in the garden” that depended on sufficient space around the dwelling to separate itself from the indigenous culture. The bungalow style was developed in colonial settlements that were physically distanced from traditional settlements in the city such as the Walled City, hence becoming instrumental in dividing the society.⁵ Upper class population aspiring to gain high social status and prestige moved to these colonial areas while the rest retained their traditional lifestyle. This marked the beginning of “stigmatization of traditions”.⁶

Upon independence in 1947, Pakistan and India had the opportunity to establish new identities in the global community. To present themselves as modern and progressive, both countries invited western architects and tasked them with imagining the face of their new nation.⁷ Constantin Dioxidis was invited by the government of Pakistan to design the new capital, Islamabad, that would serve as a territory of centralized authority, disconnected from existing cities and conceptually from the past.⁸ Modern ideas in line with western thinking were encouraged and traditional practices were discarded. The goal

⁴ Anthony D. King, “Residential Space, the Bungalow-Compound Complex as a Study in the Cultural Use of Space,” in *Colonial Urban Development: Culture, Social Power and Environment* (New York: Routledge, 2007), 123–56.

⁵ Arshad, “Reassessing the Role of Tradition in Architecture.” Pg. 27-30

⁶ Arshad.

⁷ Le Corbusier was invited by Indian Government to design Chandigarh and Louis Kahn to design Sher-e-Bangla Nagar of Dhaka by Bangladesh in 1961. Kapila D. Silva and Amita Sinha, eds., *Cultural Landscapes of South Asia - Studies in Heritage Conservation and Management*, Routledge Research in Landscape and Environmental Design (Abingdon, Oxon: Routledge, 2017).

⁸ Farhan Karim, “The Modernist Historic Urban Landscape of Islamabad, Pakistan,” in *Cultural Landscapes of South Asia - Studies in Heritage Conservation and Management* (Abingdon, Oxon: Routledge, 2017).

was to establish a local identity, remove the remnants of the colonial past, and re-establish Pakistan in the global community.⁹ In the race to achieve all this, the new country lost contact with its own traditions. Over the past 60 years, architecture in Pakistan has been a product of mass media, modern technology, expanding economy, and rapid urbanization, with little or no connection to its own roots.¹⁰ The country has produced homogenous and repetitive forms of architecture, that are influenced by foreign standards founded on foreign lands¹¹ and the obsession of the country to divorce itself from its traditional and vernacular architecture has resulted in architectural banality, and loss of authenticity and cultural diversity that the region has enjoyed throughout its history.

Blind acceptance and implementation of the International Style is not the only problem faced by Pakistan's architectural community. These practices have created a division between the local context and the built environment. Architecture being created presently in Pakistan has little relation to cultural processes of the context and minimal connections to the past or present.

Any society constantly changes and transforms with time. To survive, it should respond to the forces of change and accordingly adapt. It is not just the style of architecture being practiced in Pakistan that is the problem, but also the rejection of Pakistan's culture and traditions, climatic needs and regional identity. The idea of preserving the past not only stems from romantic notions of nostalgia, but also is a response to the growing issues of

⁹ Robert Powell, ed., in *Exploring Architecture in Islamic Cultures: Regionalism in Architecture* (Concept Media Pte Ltd., 1985).

¹⁰ Powell.

¹¹ Kamil Khan Mumtaz, "Architecture After Independence," in *Architecture in Pakistan*, A Mimar Book (Singapore: Concept Media, 1985).

energy crisis, economic decline, resource depletion, global warming, and unsustainable practices. The fact that traditional cities have survived for centuries against natural and human elements is a strong indicator of lessons embodied in them that can be implemented for a better architectural future.

The thesis does not call for blind adoption of traditional practices. On the contrary, it calls for critical analysis of past buildings to extract concepts and techniques most relevant to the forces of today, discarding those that are obsolete and no longer applicable. If done creatively and with sensitivity, traditional buildings can become sources of inspiration for development of contemporary architecture that is responsive to local cultural processes.¹² It can aid in cultivating an environment responsive to the local context by harnessing lessons from tradition – a classic symbiosis of past and present.

Hassan Fathy, a renowned Egyptian architect and planner who devoted his life to studying, working on, and designing Egypt's vernacular architecture, called for evaluation of traditional elements to determine their success and relevance in present times. He advocated use of modern science and technology to assess these elements and modify or adapt them accordingly to fit contemporary needs.¹³ Fathy did not admire modern architecture and pursued alternative solutions to its ubiquitous acceptance. Fathy articulated *cultural authenticity* through his designs and rejected the International Style as he believed it to be a homogenizing concept that took away individuality.¹⁴ However he was

¹² Powell Robert and Iftikhar M. Khan, eds., *Regionalism in Architecture*, vol. 2, Exploring Architecture in Islamic Cultures (Singapore: Concept Media Pte Ltd., 1985).

¹³ Hassan Fathy, *Natural Energy and Vernacular Architecture: Principles and Examples with Reference to Hot Arid Climate* (University of Chicago Press, 1986).

¹⁴ J. M. Richards, Ismail Serageldin, and Darl Rastorfer, *Hassan Fathy*, ed. Karen R. Longeteig, Architects in the Third World (London, UK: Concept Media Pte Ltd., 1985).

not impervious to the technological benefits of International style. He encouraged architects to adopt objective scientific principles founded in western ideas for improved building performance. "There is nothing wrong for us to take from the West that which is suitable", he said.¹⁵

Traditional architecture rooted in the local context is the truest representation of a society. Fathy referred to it as *architecture for humans*; as it responded to one's psychological, physical, cultural, and physiological needs and hence cannot be restricted under the umbrella of internationalism that is confining the world to common living patterns.¹⁶

Study of past cultures and historical narratives identify teachings that have allowed humans to live in harmony with the natural habitats. Combined with modern science, it can advance traditional practices to their full, untapped potential.¹⁷ This would not only take us a step further in reclaiming our link to the past, but also help us answer the energy crisis that is being faced by nations globally, especially by developing countries such as Pakistan, where the energy resources are limited.

¹⁵ Ismail Serageldin, "The Egyptian Appraisal," in *Hassan Fathy*, (1985). Pg. 17

¹⁶ Ibid.

¹⁷ Fathy, *Natural Energy and Vernacular Architecture*.

METHODOLOGY

The thesis examines the importance and validity of traditions in building practices through historical study and graphical analysis. The Introduction has established a theoretical framework outlining the need for this study by focusing on the current state of architecture in Pakistan, and its detachment from traditional building practices. The following section discusses the challenges regarding traditional building practices, highlights their importance, discusses terminology for common occurring terms to establish an understanding for the reader, outlines the role of historic preservation of traditional buildings, and justifies study's focus on residential building typology.

“Historical, Geographical, and Climatic Context” outlines the history of Pakistan in the larger context of the sub-continent, with references to the climate, and diverse cultural influences upon the region, and how that impacted the domestic architecture.

The “Analytical Approach” provides the link to practice, focusing on analysis of traditional dwellings of Lahore. Based on the literature review, site visits, and archival and documented data¹⁸, a matrix is established to identify essential principles which characterize these structures. These principles include the tangible and intangible aspects of the traditional building elements and practices, highlighting their interconnectivity and overlap.

The next section is an analysis of case studies based on the matrix developed in the preceding section. The case studies are divided into two parts; historical (pre-1900s) and

¹⁸ Referring to the documentation of residential buildings in the historic district of Lahore conducted by the Walled City of Lahore Authority and provided by their Architectural Department as research material for this thesis.

contemporary (post 1950s), based on original work and data acquired through Walled City of Lahore Authority (WCLA), Kamil Khan Mumtaz Architects and published works of Charles Correa, and Raj Rewal. To prove the applicability of the study in the larger context of South Asia, contemporary case studies are taken from the neighboring country of India. The historical case studies are primarily focused on Lahore Walled City in Pakistan, as it is one of the oldest city centers in the subcontinent and has similar counterparts in other South Asian countries.¹⁹ These case studies include their graphical analysis as that is one of the primary of representation for studying dwellings.²⁰ Graphical analysis is used to communicate principles found in these buildings based on the developed matrix.

Following section focuses on highlight present day Pakistani society and its similarities and differences with the traditional society. The section also includes relevant suggested strategies derived from the matrix and critical analysis of case studies, that can be applied to contemporary design while addressing the demands of the modern society.

The paper concludes by summarizing the key findings raised in the beginning of the paper to reiterate their importance in the present time in Pakistan and other regions.

¹⁹ India and Pakistan gained independence from British Raj in 1947 and were declared as two separate nations. Prior to that, the entire region was referred to as the Indian Subcontinent, home to various cultures, religions, and languages.

²⁰ Jean-Paul Bourdier and Nezar Alsayyad, eds., *Dwelling, Settlements, and Traditions: Cross Cultural Perspectives* (University Press of America, 1989). Pg. 42

1. CHALLENGES

1.1. TRADITIONAL ARCHITECTURE AND ITS VALUE

The importance and validity of traditional architecture in establishing the regional identity is a well debated topic, especially in the south Asian region. Balkrishna Doshi, an Indian architect and winner of 2018 Pritzker Award pointed out in a seminar held by Aga Khan Award for Architecture in 1985, "What we constantly realize is the apparent contradiction about what we had and what we have now.... Fortunately, we are becoming aware of the consequences of our present-day actions and we are dissatisfied".²¹ The architectural community from the subcontinent has studied traditional architecture's evolution through time to answer the questions regarding its importance and values. They have come to realize the unsuitability of many western traditions introduced by the colonizing agencies and other development in the West in regards with local resources, climatic circumstances, and socio-cultural environment.²²

Since Independence, due to rapid urbanization²³, modernizing economy, and a lack of societal concern, the local architectural community has opted for techniques and forms that ignore the traditional solutions.²⁴ However, today's world has seen a decline in the continuity of tradition because of its association to the past. The stigma attached to it portrays tradition as backward and non-progressive and that is why it is easily replaced

²¹ Balkrishna V. Doshi, "Cultural Continuum and Regional Identity in Architecture," in *Regionalism in Architecture*, (Singapore: Concept Media Pte Ltd., 1985), Pg. 88.

²² Ibid. Pg.87

²³ Urban population growth (annual %) in Pakistan was reported at 3.1937 % in 2016, according to the World Bank collection of development indicators, compiled from officially recognized sources. "Urban Population Growth (Annual %) in Pakistan," accessed April 23, 2018, <https://tradingeconomics.com/pakistan/urban-population-growth-annual-percent-wb-data.html>.

²⁴ Doshi, "Cultural Continuum and Regional Identity in Architecture."

with new and modern ideas, as is obvious in the architectural community of Pakistan and surrounding countries.²⁵ The threat posed to traditional architecture is tangible and brings up questions concerning its longevity; will it vanish and exist only in museums and history books or will it adapt to the changing cultural and ecological demands of the 21st century?

It is imperative that tradition be looked at as a process of adaptation, continuity, to create linkages with the present and establish its importance in the future.²⁶ The value of traditional architecture lies in its innate capacity to be contextually responsive and its ability to act as a conduit for local cultural.²⁷ Its importance is due to the value it gives to its surroundings, creating an interwoven relationship with it. It is a tangible manifestation of society and culture.²⁸

However, the question remains; other than cultural rootedness, what benefits does traditional architecture offer to the modern society? It is the rawest form of sustainability in built environment. The concept of sustainability was highlighted in the United Nations Conference on Environment and Development “Earth Summit” 1992, but it has always been an essential part of the environments humans have created.²⁹ Traditional architecture has been sustainable because of its direct response to the climate, topography, socio-economic profile, religious beliefs, available resources, and traditional

²⁵ Aishwarya Tipnis, *Vernacular Traditions: Contemporary Architecture* (India: The Energy and Resources Institute Press, 2012). Pg. 1

²⁶ Ibid. Pg. 3

²⁷ Traditional architecture is often interchangeably used with the term vernacular architecture as both are results of cultural processes particular to a region. Because of the papers focus on the principles this architecture embodies, it will not delve into the technical (linguistic) difference between these two terms and treat them synonymously.

²⁸ Tipnis, *Vernacular Traditions*. Pg. 10

²⁹ Ibid. Pg. 20.

practices among other aspects. It was designed to mitigate the harsh outdoor climate while staying sensitive to the social constructs of the region.

Traditional architecture is valuable for both its tangible and intangible aspects reflected through its building elements and its design principles. Louis Kahn, a renowned architect, referred to traditional architecture as “the measurables and the unmeasurable – the physical and the symbolic or spiritual”.³⁰ Traditional Architecture is a physical reflection of its society, and its response to natural phenomena that holds lessons of environmental sustainability for us.

1.2. TERMINOLOGY

It is essential to this study to clearly define terms like traditional architecture, dwelling, contemporary, and culture as they relate to the objectives of this research and to construct the foundation for analysis. The following definitions include my personal interpretations and have been derived from literature review and established meanings.

DWELLING: used interchangeably with “house” and “home”, the term dwelling establishes a deeper meaning as a place of living. A dwelling is not just a structure, but presence of humans on earth where their process of living unfolds accompanied by experiences and memories and is influenced by forces like relationships, cultural ties, and familial bonds.

CULTURE: Behavioral and responsive patterns adopted and practiced by a group that were discovered and developed as a solution for mutual problems through interaction

³⁰ Doshi, “Cultural Continuum and Regional Identity in Architecture.” Pg. 90

between different members of the group to their environment. These solutions are perceived as the “right way” of living and are passed to future generations through teaching, practice, or verbal language.³¹

TRADITIONAL ARCHITECTURE: Often used interchangeably with vernacular architecture, both terms refer to built environment that is a direct response to cultural processes of a specific geographical area. However, traditional architecture can be considered as an overarching theme under which vernacular falls. Both imbibe the intangible values of a society and employ local techniques and indigenous materials. However, vernacular is usually referred to as architecture “constructed by the people”³² and is considered representative of regional identity.³³

CONTEMPORARY ARCHITECTURE: For this thesis, contemporary architecture would refer to architecture constructed after partition of Indian Subcontinent (1947), whether it incorporates traditional building practices or not.

³¹ “How Has This Term Impacted Your Life?” BusinessDictionary.com, accessed April 23, 2018, <http://www.businessdictionary.com/definition/culture.html>.

³² Bernard Rudofsky, *Architecture without Architects: A Short Introduction to Non-Pedigreed Architecture* (New York, USA: Doubleday & Company, Inc., 1964).

³³ The paper will primarily use the term “traditional architecture” but may utilize “vernacular architecture” at some instances.

1.3. THE ROLE OF PRESERVATION

The fields of architecture and historic preservation are intertwined. The latter was initially developed to conserve exemplary works from the past, primarily focused on the physical fabric and monuments. However, today it has evolved and expanded to address preservation of cultural and natural landscapes, and intangible heritage globally.

Preservation today is more than just what meets the eye, highlighting past techniques, social systems, cultural processes, climatic conditions, and historical events that informed the building design. Despite the limitations faced by the past builders regarding available resources and construction technology, they were able to produce architecture responsive to the local context. This has greatly influenced the perception of traditional buildings and has instilled respect and admiration for them.

The most potent combination of architecture and preservation is experienced when new design is introduced in historic settings. Then, the past serves as a stage on which the present is conceived. The most successful designers show keen sensitivity to the existing fabric and explore ways to highlight it through contemporary design. Many Preservation laws and design guidelines are based on the Venice Charter (1964) and calls for the new design to be representative of its time while being contextual and sensitive to the past.³⁴

However, despite the expanding role of preservation and its interdisciplinary nature, most design practices in general consider history and traditional practices only when the site is designated historic. Otherwise, the fields of architecture and preservation exist in parallel.

³⁴Article 12: Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.

ICOMOS, "International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter 1964)," 1964, https://www.icomos.org/charters/venice_e.pdf.

The thesis addresses this gap and offers strategies through which history can inform design in contemporary context.

1.4. WHY STUDY TRADITIONAL DWELLINGS?

“An entire past comes to dwell in a new house”

Gaston Bachelard,
*The Poetics of Space*³⁵

Traditional residential buildings are where majority of the world’s population live and develop their most basic relationship with the environment. These are the spaces where humans spend most of their time and have a sense of ownership. When urban sociologist Ray Oldenburg coined the term “third places”, he referred to home as the “first place”³⁶ indicating the priority of places in people’s lives. It is in the confines of the house where the individual and family life unfolds.³⁷ Amos Rapoport, a Polish architect and founder of Environment-Behavior Studies defines house as “an institution, not just a structure, created for a complex set of purposes.”³⁸ He said, “Building a house is a cultural

³⁵ William J. Glover, “An Urban Palimpsest: The Pre-Colonial Development of Lahore,” in *Making Lahore Modern: Constructing and Imagining a Colonial City* (Minneapolis: University of Minnesota Press, 2008), Pg. 1.

³⁶ According to Oldenburg, home is the first place, working space is the second place and third place refers to any place in our life other than home and work where we spend time. Ray Oldenburg, ed., *Celebrating the Third Place: Inspiring Stories About the “Great Good Places” at the Heart of Our Communities* (New York: Da Capo Press, 2002).

³⁷ Iftekhar Uddin Chowdhury, “Housing and Space Standards: Human Needs and Regional Factors,” in *Regionalism in Architecture*, vol. 2, Exploring Architecture in Islamic Cultures (Singapore: Concept Media Pte Ltd., 1985), 78–80.

³⁸ Rapoport, Amos, “Environment Behavior Studies - Past, Present and Future,” *Journal of Architectural and Planning Research*, JSTOR, 25, no. 4 (Winter 2008): 276–81.

phenomenon, its form and organization are greatly influenced by the cultural milieu to which it belongs.”³⁹

Since pre-historic times, humans have established shelters to protect themselves from the natural elements. With time, those shelters have evolved to obtain a deeper meaning, reflecting the changing needs and viewpoints as the society evolved. It is within this space that a person’s true identity is revealed, either by the architectonics of it or the way the space is used. Rapoport defines shelter as the passive function of a house; however, its primary purpose is provision of an environment most suited to the lifestyle of its inhabitants – “a social unit of space.”⁴⁰

The term dwelling fundamentally means “being on earth”, a term re-introduced by German philosopher Martin Heidegger about which he says, “building as dwelling... remains for man’s every day’s experience that which is from the outset habitual”.⁴¹ This indicates that it is not just a house or a roof over our heads but is the process of living contained in a built environment. This process is continuous, molding and shaping in response to the changing environment around it.

In a dwelling, humans are at their most private and vulnerable state. Dwellings are a form of fortification against the outside world an extension of one’s personal space. Influenced by the local culture and environment, dwellings reflect the social constructs, the intra-familial relationships, religious beliefs, economic profiles, existing traditions, and local

³⁹ Amos Rapoport, *House Form and Culture*, ed. Richard E. Dahlberg, Foundations of Cultural Geography (New Jersey: Prentice Hall, Inc., 1969). Pg. 46

⁴⁰ Rapoport, *House Form and Culture*.

⁴¹ Bourdier and Alsayyad, *Dwelling, Settlements, and Traditions*.

climate. This makes dwellings compelling structures to study to understand the principles and values of the past, and how they may influence today.

2. HISTORICAL, GEOGRAPHICAL AND CLIMATIC CONTEXT

2.1. GEOGRAPHY

Pakistan is located in the western extremity of South Asia, flanked by India on the east and Afghanistan and Iran on the west. It is bordered by China on the north and separated by mountainous ranges of Karakoram and Himalayas while the Arabian sea washes up against the shores on the south (Fig. 1). All shaped by the unique environment of the region, the country comprises of four provinces, each with its own distinct geography, culture, and language. The northern areas of Khyber Pakhtunkhwa are dominantly mountainous lands, extending down towards the plateaus of Baluchistan, and ending along the coastline in the south. The eastern province of Punjab is home to the mighty Indus River and its tributaries that dissect through the southern desert province of Sindh to end up in Arabian Sea. However, these regions do not exist in isolation. There is a constant exchange between the people of each region, allowing them to learn from and influence each other's cultures, and at times they are also influenced by the neighboring states, as it has been true for many centuries.⁴²

⁴² Kamil Khan Mumtaz, *Architecture in Pakistan*, A Mimar Book (Singapore: Concept Media, 1985).



Fig. 1: Map of Pakistan.
 Lambert Conformal Conic Projection; Standard parallels 23° 33' N 35° 44' N
 (Source: Pakistan Facts)

2.2. CLIMATE

Pakistan has a diverse climatic profile, with extreme temperatures through its area depending on the geography and topography of the region (Fig X). The climate varies from cold and snowy in the northern mountainous ranges to hot and dry near the coast in the south. The Asian Monsoon is the dominant influencer on the climate of Pakistan. The country has three seasons; cold winters (October to February), followed by hot summers (March to June) and monsoon season (July to September).⁴³

The cold season has warm and sunny days with chilly nights and occasional frost in the low-lying plains of Punjab, while the mountainous region of Khyber Pakhtunkhwa (KPK) and Balochistan receive heavy snow. Summers can be scorching, especially in the central and southern region, with temperatures reaching as high as 104°F⁴⁴ (See Fig. 3). During this time, humidity levels are low, sometimes accompanied by dust storms. Monsoon arrives in late June with thunderstorms, tempering down the temperatures but increasing humidity levels, making the weather quite unpleasant. Various parts of the country receive different amounts of rainfall; the central part (Lahore) receives heavy rainfall, while the south regions receive little to no rain. Throughout the year, different regions enjoy an abundance of sunlight up to twelve hours in summer and seven in cooler seasons.

The diversity of climatic conditions is one of the driving forces in how Pakistanis constructed their dwellings historically. Nowadays, due to availability of mechanical cooling systems, climate is no longer the deciding factor.

⁴³ "Climate of Pakistan," National Environment Agency, accessed April 24, 2018, <http://www.nea.gov.sg/weather-climate/climate/climate-of-cities-in-asia/climate-of-pakistan>.

⁴⁴ "Climate Information by City | Lahore," International Association for Medical Assistance to Travelers, accessed April 24, 2018, <https://www.iamat.org/country/pakistan/climate-data#null>.

Pakistan map of Köppen climate classification

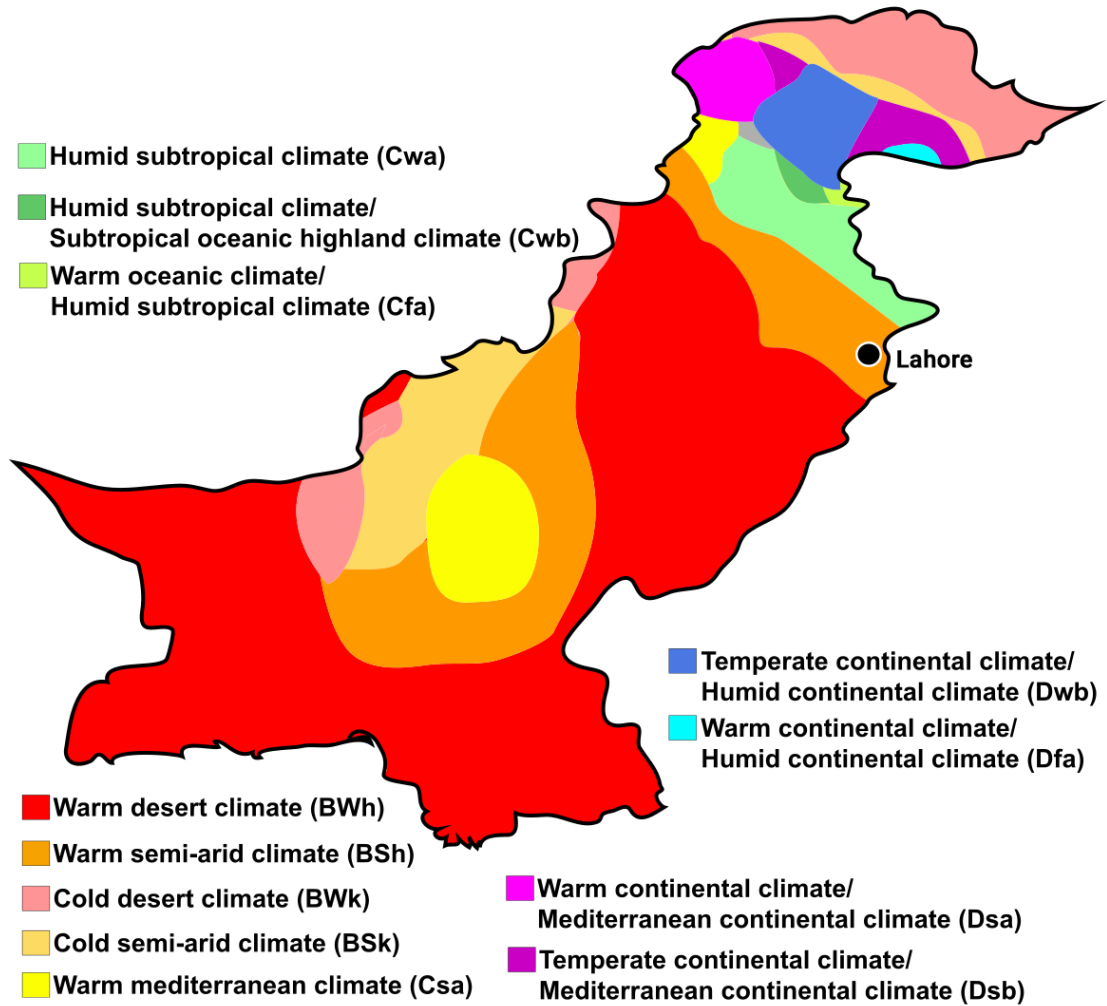


Fig. 2: Climate Classification of different regions in Pakistan, showing location of Lahore.
 (Source: Wikimedia Commons. Drawn by Ali Zifan, *Pakistan Map of Köppen Climate Classification*)

Lahore: Average Monthly Temperature, Precipitation and Humidity

Altitude: 214 m/ 702 ft | Monthly averages based on 30 years of data

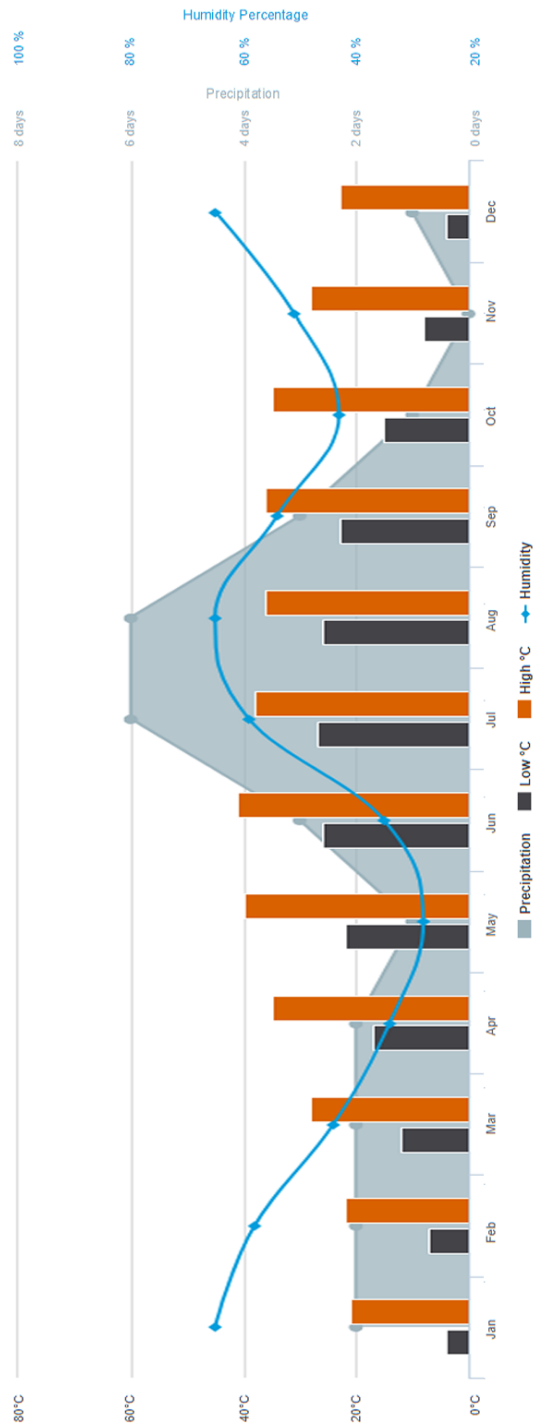


Fig. 3: Climate Data of Lahore showing Temperature, Humidity Levels and Precipitation (Source: 24 World Climate and Food Safety Charts, IAMAT. Drawn by: Highcharts.com).

2.3. EARLY COMMUNITIES, EARLY HOUSES

Pakistan is home to one of the oldest civilizations known to human kind, the Indus civilization. (Fig. 4) Archaeological remains found in the country date its history to 3300 BCE.^{45 46} Since then, Pakistan and its surrounding region have seen the rise and fall of the Muslim, Hindu, Buddhist, Sikh, and British empires. Each left behind its mark in built environment, a direct product of cultural influences.

Excavations in Pakistan and India have unearthed 129 sites belonging to developed and mature culture of Indus Civilization.⁴⁷ Mohenjo-Daro and Harappa were major cities of the time and most of the archaeological work has been conducted there (Fig.6).

Archaeological remains indicate carefully executed organization and hierarchy of spaces within the city and its private and public buildings, showing social, political, environmental, economic, and cultural influences of the region.⁴⁸

Investigations into the residential architecture of Indus Valley cities have revealed that most were introverted, courtyard layouts (Fig 5). Most of the houses were occupied by extended families with little to no variations between the layouts of the houses. With a courtyard (not always located in the center) surrounded by rooms, foundational evidence indicates a presence of staircase leading to upper stories and roof usage for domestic purposes; a practice still evident in many rural houses of the Punjab.⁴⁹ The roofs of the

⁴⁵ R. A. Guisepe, "Indus River Valley Civilizations," History World, accessed February 14, 2018, http://history-world.org/indus_valley.htm.

⁴⁶ Historical Evidence found in present day Mehrgarh in Baluchistan indicates human settlement older than Indus Civilization, dating 5500 BCE but was abandoned due to climatic changes. Kamil Khan Mumtaz, "Early Communities," in *Architecture in Pakistan*, A Mimar Book (Singapore: Concept Media, 1985), 6–17.

⁴⁷ Harappa – 1966, *Pakistan Archaeology* No. 5, 1968, p. 63

⁴⁸ Mumtaz, *Architecture in Pakistan*. p. 8-17

⁴⁹ Ahmed, *Ancient Pakistan - An Archaeological History*. p. 83-85

houses were flat and made of locally found and readily available materials such as wood, and mud plaster. The remains of the walls, about 5 feet in thickness, indicate temperature mitigation within the house, with privacy as a significant driver in the conception of the domestic layout. Thick walls are also evidences of structural and technological limitations present at the time.⁵⁰ With windows and entrances restricted to side alleys, the interior was not visible from the main street.⁵¹

John Marshall discusses the layout of a house in his book *Mohejo-Daro and the Indus Civilization*:

*"An average upper-class house had a central courtyard of the house, which was open to the sky and provided light and air to the (adjacent rooms. The principle of the open courtyard encompassed by chambers was just as fundamental to house-planning at Mohejo-Daro as it was throughout the rest of the prehistoric and historic Asia, and as it has continued to be in India until the present day."*⁵²

Study of domestic buildings of Indus Civilization has revealed that traditional uses and patterns in residences date back thousands of years.

⁵⁰ Walls were constructed thick to support structural weight and establish an uninterrupted flow of forces to the ground.

⁵¹ Naveed, Muhammad B. "Harappa: An Overview of Harappan Architecture and Town Planning." *Ancient History Encyclopedia*. Last modified December 13, 2014. <https://www.ancient.eu/article/695/>. Accessed February 13, 2018.

⁵² "What Was an Ancient Indus House Like?," accessed April 10, 2018, <https://www.harappa.com/blog/what-was-ancient-indus-house>.

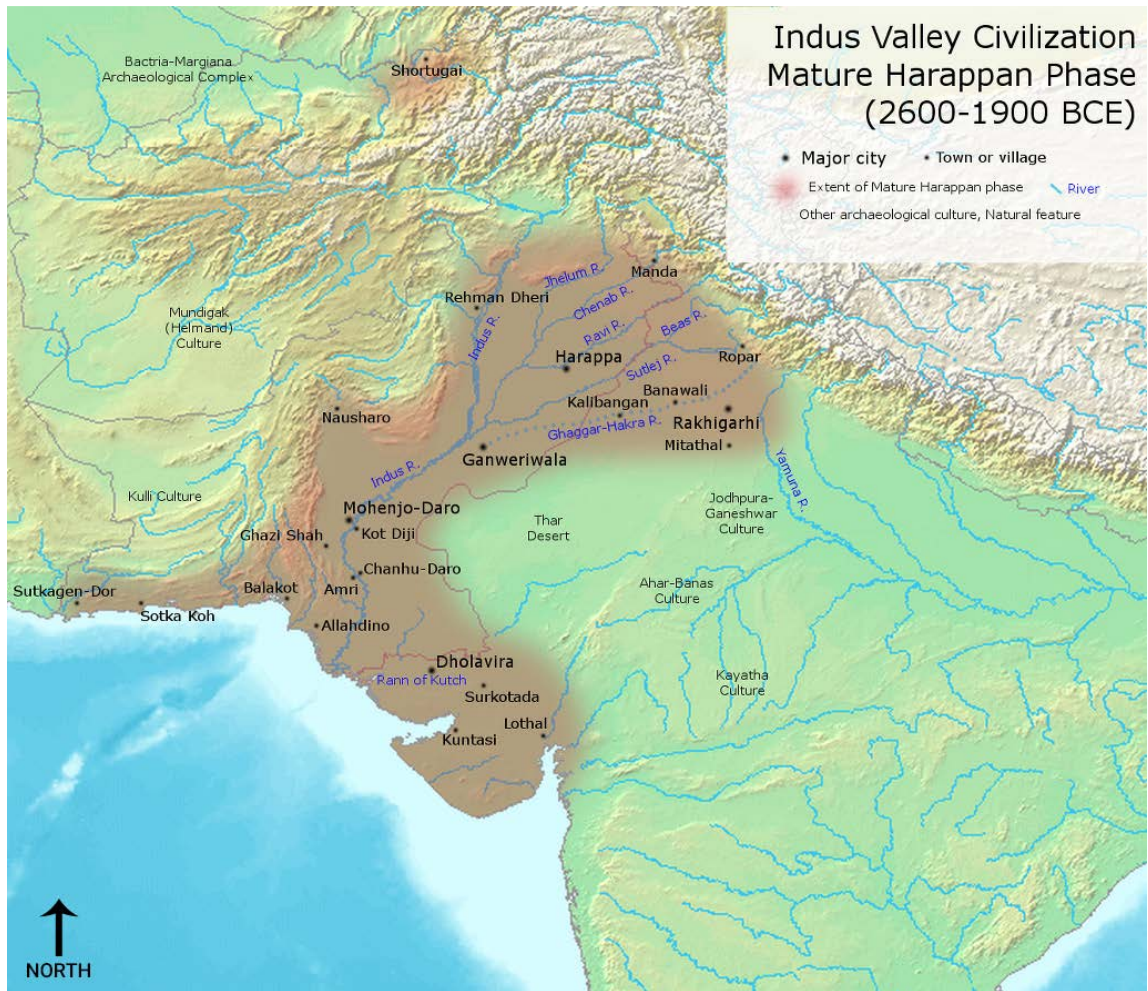
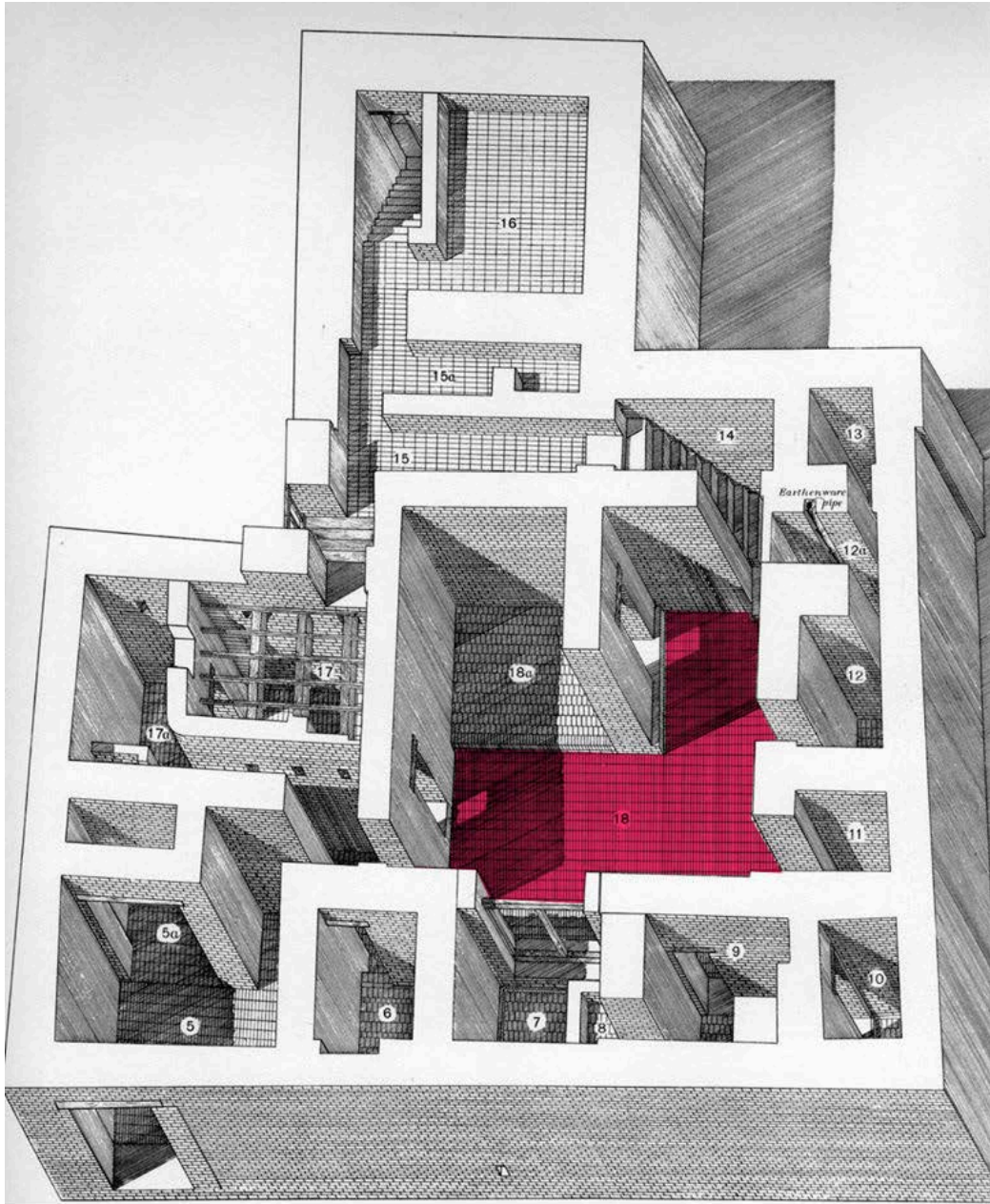


Fig. 4: Map of Indus Valley Civilization, Mature Phase (2600-1900 BCE) showing important city centers of the period and their location. (Source: Wikimedia Commons, the free media repository)



MAIN ENTRANCE

Fig. 5. Courtyard House of Indus Civilization. John Marshall, Mohenjo-Daro and the Indus Civilization, Plate IV showing an average upper-class courtyard house in Mohenjo-Daro. The labelled area indicates the central space in the house with an attached open room (use unidentified). (Source: John Marshall, Mohenjo-Daro and the Indus Civilization, Plate IV. Harappa.com)



Fig. 6. Excavations at the HR (Hargreaves) area of Mohenjo-Daro showing archeological remains of a courtyard typology residential unit. (Source: HR Area, Large Courtyard (Room 70), Harappa.com)

2.4. DWELLINGS OF THE WALLED CITY OF LAHORE

Two hundred kilometers north of Harappa, which was one of the important centers of Indus Civilization, lies the City of Lahore in the province of Punjab that is the focus of this paper. Referred to as “the cultural heart” of Pakistan,⁵³ Lahore has witnessed the rise and fall of many great empires throughout history. Its Walled City is the product of cultural influences from various eras, each leaving behind its significant mark on the face of the city. Lahore was historically favored because of its geographical location along the major trading routes through Indian subcontinent and Central Asia.⁵⁴

It was during the time of Mughal rule (1526-1857) that Lahore reached its zenith in architectural glory. (Fig. 7) Known for its beauty, bustling bazaars, meanderings *galis*, socially charged *mohallas*, rich architecture, and ages old traditions, it would be compared to other glorious capitals of neighboring empires. A common saying was “Ispahan is half the world, provided Lahore is not there.”⁵⁵

Today, it has one of the oldest historic cores in the region, with diverse examples of architecture, ranging from small scale commercial shops to monumental buildings and gardens. It is also the focus of several preservation campaigns by both national and international organizations, resulting in significant amount of archival data, documentation,

⁵³ Balvinder Singh, “The Tangible and Intangible Heritage of the Walled Cities of Amritsar and Lahore: Need for an Integrated Conservation Approach,” in *Portrait of Lahore – Lahore Nu Salam*, THAAP Conference (Lahore: THAAP, 2011). Pg. 77

⁵⁴ Ibid. Pg 82

⁵⁵ English translation from Persian: “*Ispahan nest a jehan, agar Lahore na bashad*”

Ispahan was the former capital of Persia, popularly known for its glorious days of the Saffavi kings. The inhabitants of Ispahan would sing praises of the beautiful city.

Mesrovb J Seth, *Armenians in India: From the Earliest Time to the Present Day* (New Delhi: J. Jetley, 2005).

and professional opinion. This availability of resources makes the Walled City of Lahore an ideal case study for understanding historic and traditional building practices.



Fig. 7. Mughal India under Emperor Akbar showing main centers with annexation dates (Source: Foundations of the Modern World)

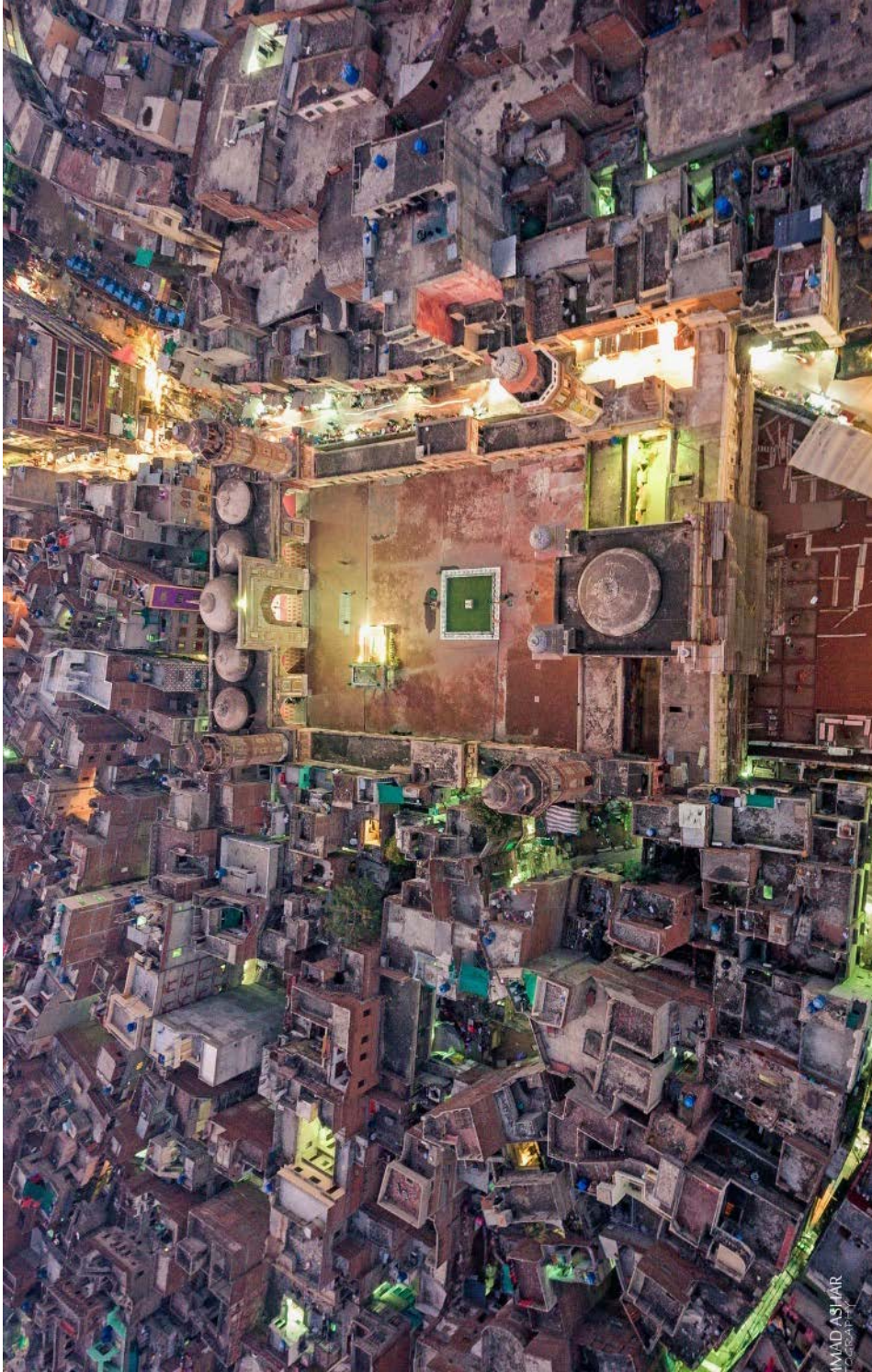


Fig. 8: Urban form of Walled City of Lahore; showing the highly dense area around the Wazir Khan Mosque. (Photography by Muhammad Ashar, "Bird's Eye View of the Wazir Khan Mosque, Walled City of Lahore")

“Jinay Lahore nai Vekhiya, Oe Jamiya nai”
One who has not seen Lahore, has not lived yet.

Famous Punjabi Saying
(originally used by Indian playwright Syed Asghar Wajahat for his play)

The historical part of Lahore, called *Puraana Shehar* (Old City), is like a palimpsest, a dense agglomeration with sparse vegetation. (Fig. 8) Meandering through the streets of the walled city, one is reminded of the distinct remnants of the past that laid claim to it. The city bears the traces of its history, especially through its complex assemblage of streets, neighborhoods, and dwellings that have survived through time. In 1883, a gentleman with the name of C. Purdon Clarke gave a lecture on “Domestic Architecture of India” to The London Society of Arts which was based mostly on his personal observation of residential structures in the Old City of Lahore (Fig. 9).⁵⁶ His comments and observations highlighted the effective way these structures handled and mitigated the extreme temperatures of the Punjab through sizing of fenestration, orientation of the site, and building mass.⁵⁷ Of equal importance were the social relations he observed during the construction of these dwellings. He said, “Each house came about through “the enterprise of the owner, rather than through speculation or government initiative.”⁵⁸ According to Clarke, it was “living tradition” where materiality and the forces of culture are intertwined describing it as a ‘way of life’.⁵⁹ He said, “[The charm of these houses] is not easily translatable. A vast sweep of brickwork, pierced here and there with an opening,

⁵⁶ William J. Glover, “Changing Houses: Rethinking and Rebuilding Townhouses and Neighborhoods,” in *Making Lahore Modern: Constructing and Imagining a Colonial City* (Minneapolis: University of Minnesota Press, 2008), Pg. 100.

⁵⁷ Glover, “Changing Houses”, Pg. 100

⁵⁸ Glover, Pg. 100

⁵⁹ Ibid.

filled with perforated terracotta... tiny details give an air of space and size by contrast, which looks quite splendid in the sunlight".⁶⁰

In the Walled City, most of the houses pre-date the British era and are called "cheek by jowl" structures (Fig. 10) because they have no space between them.⁶¹ Each structure has its own exterior wall rather than sharing a common party wall with the adjacent property. Dwellings were constructed starting from the property edge, with no space for sidewalks or buffer space to separate the building from the street. The individual plot lines marked the boundaries of these structures, creating a perimeter for the elongated bazaar street. Most residences utilized *galis* (narrow lanes) on the interior of the block for private entrances. While the shapes and sizes of the houses vary, similar patterns can be observed throughout the city; a rectangular lot with a small central courtyard (lot size permitting) with a narrow frontage, approximately 18 feet depending upon the maximum span of the beam and property lines.⁶² Most of the houses has multiple uses, with shops fronting their main façade on the bazaar level, a *baithak* (seating area for guests) on the same floor and a *sehan* (courtyard) with *dalaans* (verandah on one side) on the perimeter. If lot size permitted, the ground level also had *kotris* (storage rooms) and a *dehri* (entrance foyer) for the private entrance.⁶³

As individual structures, these houses have introverted characters, each operating on its own. Flushed to each other, they form the perimeter for the bustling bazaar street, keeping

⁶⁰ Ibid. Pg 101

⁶¹ William J. Glover, "Making Lahore Modern: Urban Form and Social Practice in Colonial Punjab (1849-1920)" (University of California, 1999).

⁶² William J. Glover, *Making Lahore Modern: Constructing and Imagining a Colonial City* (University of Minnesota Press, 2008).

⁶³ Ibid. Pg.108

it shaded and cool. The balconies opening towards the bazaar also serve as social spaces, visually connecting to the opposite buildings and used by residents for socializing. These dwellings function independently and collectively to serve an individual family unit and the social group at large. (Fig. 11)

The rich history and multi-generational occupation of the traditional dwellings makes *Puraana Shehar* an ideal area of study. Great variety exists in their form, styles, construction time, and lot sizes, providing a wide range of factors to establish a pattern to inform the principle matrix in the following section. As a result of preservation attempts by Aga Khan Trust for Culture and the area's own governing body, the Walled City of Lahore Authority, the city structures have been well documented, hence providing substantial material for historical analysis.

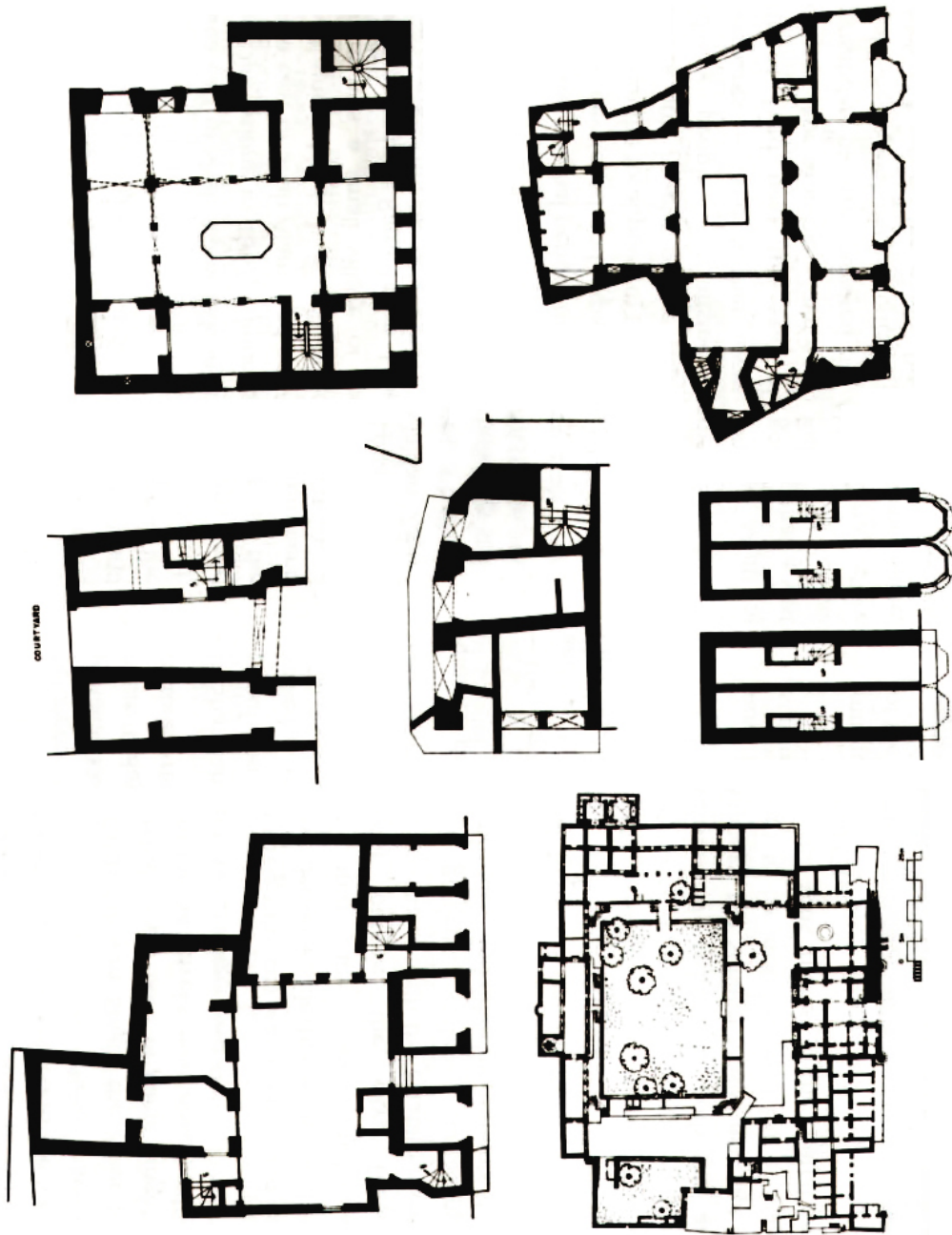


Fig. 9: Traditional house layouts in the Walled City of Lahore, showing dwellings that belonged to various eras and were built for inhabitant for different economic profiles. The larger houses are Havelis that were occupied by High ranking officials whereas the narrow, elongated ones were homes to the lower income population. Despite the difference stakeholders, these houses were constructed in accordance with the local context, making most of the available resources. (Source: The Walled City of Lahore, publication by PEPAC)

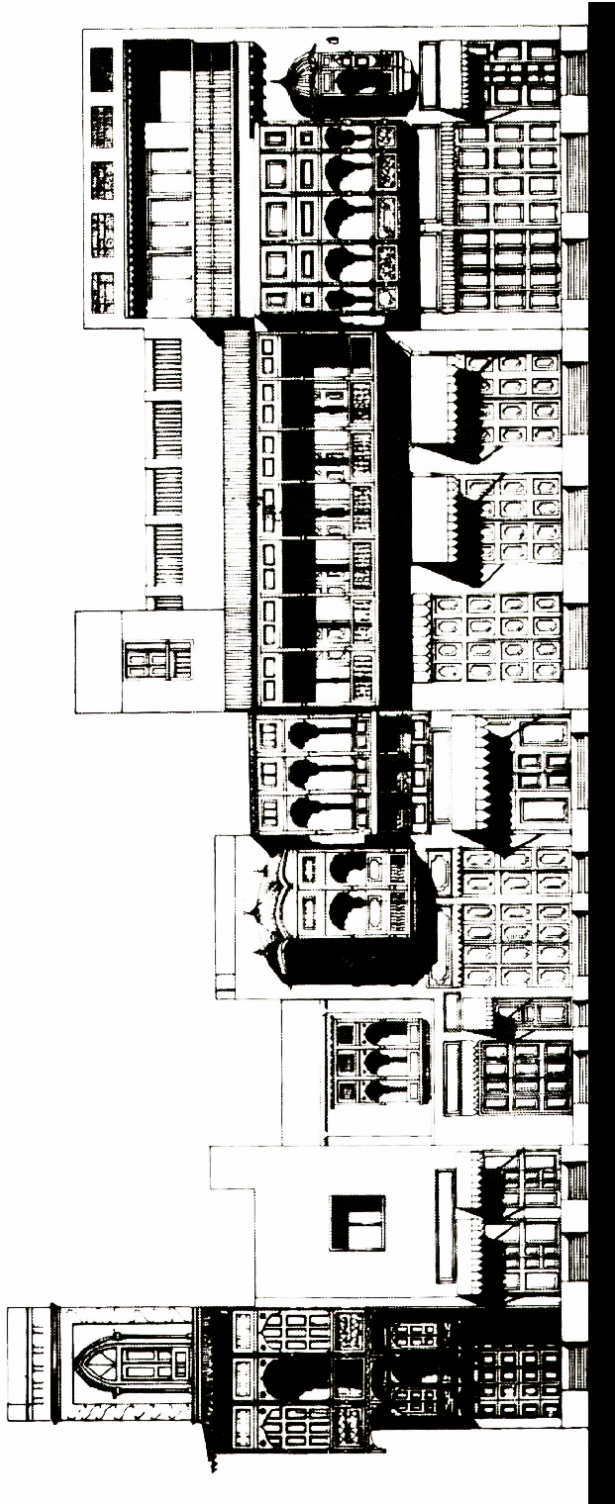


Fig. 10: "Cheek by Jowl" dwellings of Walled City of Lahore. The houses have no space between them and are constructed flushed to each other. (Source: The Walled City of Lahore, publication by PEPAC)

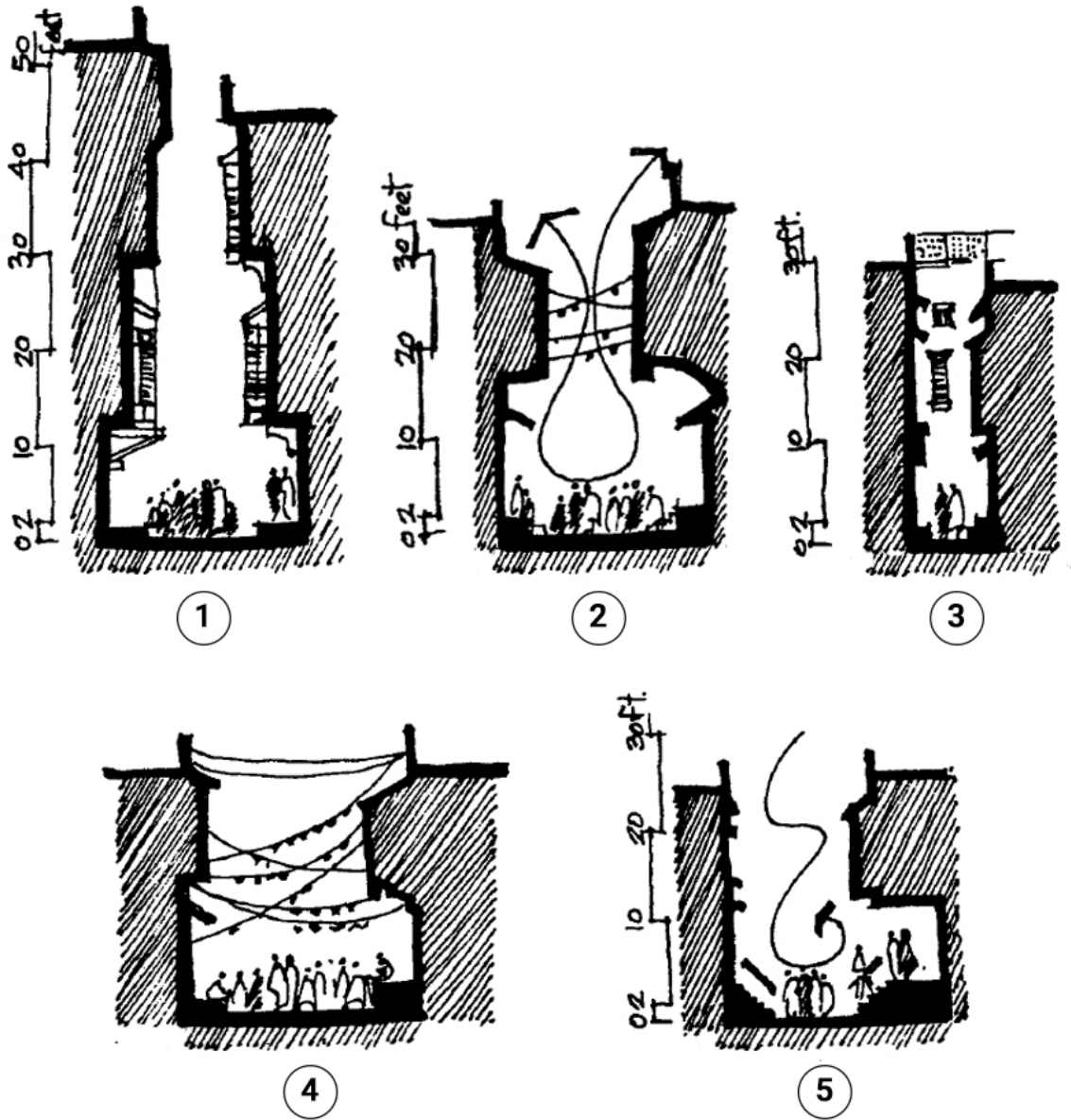


Fig. 11: Cross sections of streets of Walled City of Lahore showing various profiles that exist in the historic center. The sections show how the buildings on both sides of the street keep it shaded, cool and ventilated. The proximity of the buildings allows for the balconies on upper levels to be used as socializing space. These (Source: Ellahi M. Ishteeaque, from "Contemporary House Design: A Lesson from Lahori Traditional Architecture")

3. ANALYTICAL APPROACH OF TRADITIONAL ARCHITECTURE

3.1. MATRIX – AN INSTRUMENT OF ANALYSIS

“The responsibility of modern architect is to analyze elements of change, apply modern techniques to modify methods established by our ancestors and then develop new solutions to satisfy modern needs.”

Hassan Fathy
Natural Energy and Vernacular Architecture

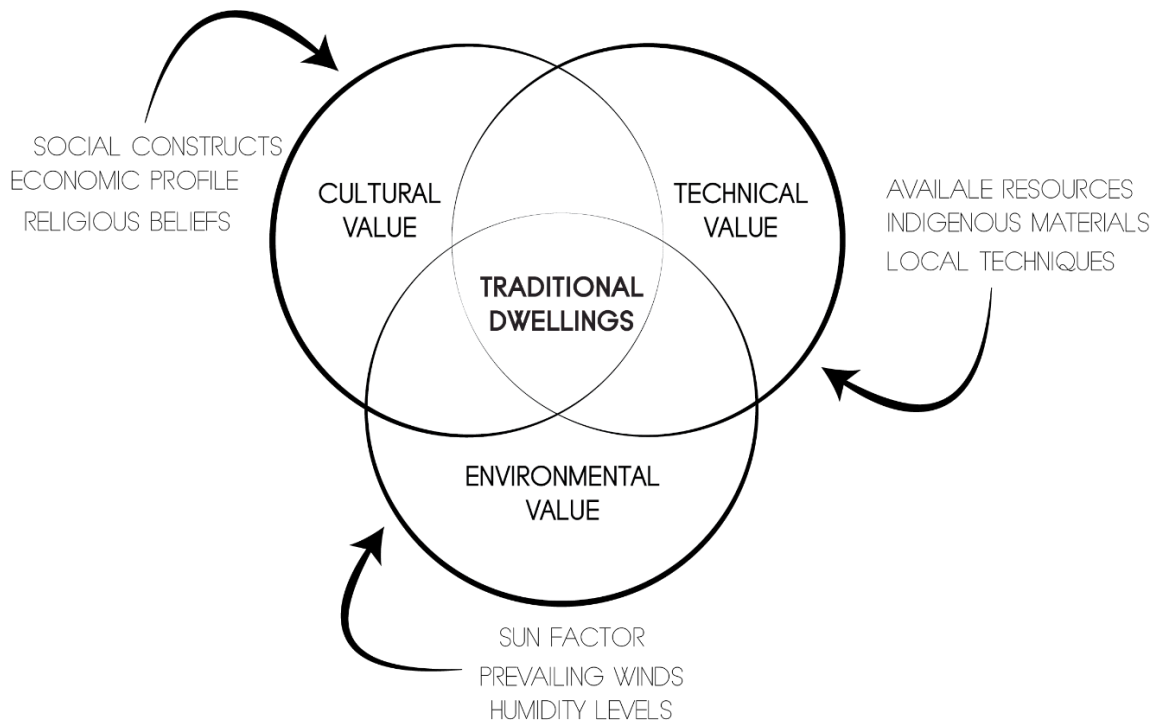


Fig. 12: Principles and values inherent in Traditional Dwellings

The purpose of studying dwellings in the Pakistani context is to derive principles that can be applied to contemporary design. This section highlights those design principles and values inherent in traditional architecture and how they have addressed a range of factors such as climate, society, history, technology, identity, community relationships etc. (Fig. 12) In the past, the beliefs and abilities of the local community were an integral part of the

design process and was evident in the final product. The keen understanding of the immediate context and the available resources resulted in dwellings rooted in the local context.⁶⁴

There are two ways to explore the benefits of traditional building practices; through its principles and values and through scientific analysis. While the latter is not within the scope of this thesis, it will make references to published work of architects who have explored this criterion through physical and aerodynamics analysis of houses of the past, with similar features as those found in the Indian subcontinent.⁶⁵

Traditional architecture is primarily comprised of three dimensions; cultural, technical, and environmental. These are interconnected through the building elements in traditional architecture as each element is representative of at least one of these dimensions.

Cultural values are a primary dimension highlighted in traditional architecture because they speak to the socio-economic reality of a place, locally held traditions and beliefs, religious values, behavioral patterns, and social constructs. ICOMOS Charter for Built Vernacular Heritage (1999), has referred to traditional built heritage as “the face of a community”⁶⁶. It is the natural process of inhabitation practiced by local communities, that possess the capacity to adapt to the changing needs of the society.

⁶⁴ Sherine S. A. Aly, “Modernization and Regionalism: Approaches for Sustainable Revival of Local Urban Identity,” *Procedia Engineering* 21 (International Conference on Green Buildings and Sustainable Cities, Egypt: Elsevier Ltd., 2011), 503–12, www.sciencedirect.com.

⁶⁵ Fathy, *Natural Energy and Vernacular Architecture*.

⁶⁶ ICOMOS, “Charter of the Built Vernacular Heritage - International Council on Monuments and Sites,” ICOMOS Documentation Center, October 1999, <https://www.icomos.org/en/faq-doccen/179-articles-en-francais/ressources/charters-and-standards/164-charter-of-the-built-vernacular-heritage>.

The technical values can be viewed as a creative dimension as it represents techniques, and construction methods and how the local builders work with the available resources to achieve optimum solutions. Traditionally, local materials were utilized for construction, today however, imported materials are being used that are not responsive to the local climate, and require technological expertise unavailable in the region. Technical is one aspect where a complementary relationship of tradition and contemporary can be developed by constructing hybrid solutions. With today's advancements, traditional materials can be evaluated and adapted for better performance and higher efficacies.⁶⁷ For example, using insulated cavity brick construction and utilizing hybrid wall systems can significantly improve thermal performance of the building.⁶⁸

The environmental value is equally crucial because of the eminent risks of global warming and insensitive construction threatening the ecological balance. One of the lessons to be learned from traditional architecture is the people's ability to create comfortable spaces harnessing natural elements in response to the regional climate.

Combining these three values, a matrix was developed to analyze traditional solutions and suggest how their latent knowledge could be utilized to address contemporary issues. It is an appraisal of conditions under which these practices are valid technically, environmentally, socially, and economically. Through this, principles incorporated in

⁶⁷ Serageldin, "The Egyptian Appraisal." Pg. 21

⁶⁸ Scott Wiley, "New Study Highlights the Thermal Benefits of Bricks" (Australia: Enviro Development Professional), accessed April 25, 2018, http://www.envirodevelopment.com.au/03_eneews/newsletter.asp?ID=94&varAccessCode=7kch6d3u.

traditional practices identify foundations for understanding and developing contemporary solutions, in line with environmental, social, and economic needs of today's society.

The matrix is then applied to historical and contemporary case studies to demonstrate how the values influence each other. Application of traditional principles in contemporary settings is not an alien or recent concept. Architects such as Hassan Fathy of Egypt have devoted their life's work to understanding and harnessing the principles and values embodied by traditional architecture and incorporating them in contemporary design.

3.2. UNDERSTANDING THE MATRIX

The matrix explores the different principles and values embodied in traditional architecture though their physical manifestation in form of building elements, recognizing that these are not isolated but are interdependent.

Study of traditional buildings has revealed repetitive use of various architectural elements in different regions with related environmental, cultural, and technical conditions. While the language changes with geography and culture, the use remains similar. The "verandah" of Indian subcontinent becomes a "*takhtabush*" in Arab countries, "loggia" in Italy and "lanai" in Hawaii. This shows the influence of cultural exchanges in the past and how regions have learned from others and adapted and improved upon them.

3.3. PRINCIPLES AND VALUES

3.3.1. ENVIRONMENTAL VALUE

The importance of climatic considerations as determining factors in architecture form a widely accepted concept.⁶⁹ Environmental value is especially critical in developing countries such as Pakistan, where the energy crisis, in form of load shedding is on the rise, and cost associated with use of mechanical systems is too high for most of the population. An environmentally responsive structure is climatically sensitive and is not constructed from materials or construction methods that are harmful to the natural ecology.

Before modern technology, people devised ways to create comfort based on the natural sources of energy at their disposal.⁷⁰ Building elements of traditional edifices harnessed natural sources of light and ventilation to provide adequate protection against heat and ensure cooling to the inhabitants. While cultural and technical aspect also defined the way these buildings were construed, one observes environmental factor as the primary influencer from broad aspects such as site orientation to minute details such as perforation size.

“Shelter is of supreme importance to man. It is the prime factor in his constant struggle for survival. In his efforts to shelter himself against the extremes of weather and climate he has, over the ages, evolved many types of dwellings, one of which is the court house”⁷¹

The use of material and texture along with design of open space are indicators of human's interaction with natural elements to create a comfortable microclimate in their homes.

⁶⁹ Rapoport, "Alternative Theories of House Form" in *House Form and Culture*. Pg. 18

⁷⁰ Fathy. "Architecture and Comfort". Pg. 37

⁷¹ Rapoport, *House Form and Culture*. Pg. 19

Each region has its own climatic implications and each site demands more specific study. The takeaway from this principle is how to harness natural phenomena of heat, light, wind, and humidity, and use these specifications in conjunction with cultural and technical values.

3.3.2. CULTURAL VALUE

“Even when the physical possibilities are numerous, the actual choices may be severely limited by the cultural matrix, this limitation may be the most typical aspect of the dwellings and settlements of a culture”

Amos Rapoport
*House Form and Culture*⁷²

Culture plays a crucial role in the built environment of a region as it is expressed in the planning and design of traditional towns and dwelling.⁷³ In the Indian subcontinent’s cultural context, nobody is alone, and everyone is part of the larger community. Similarly, the buildings are not devised in isolation but in relation to the total environment to create a unified whole. As a group, they create an organization of social public spaces and streets shared by the local community. Balkrishna Doshi says, “It is necessary to talk about physical environment in terms of culture. The house form of India, has behind it centuries of traditions. In the house plans, it is difficult to perceive this immediately, but seen through the minute activities and functions carried out, it can be felt that there is a powerful sense of identity.”⁷⁴

⁷² Rapoport. Pg. 47

⁷³ Tipnis, *Vernacular Traditions*. Pg. 10

⁷⁴ Doshi, “Cultural Continuum and Regional Identity in Architecture.” Pg. 89

The building design is determined by the socio-cultural forces such as religious beliefs, familial relationships, social structure, economic profiles, and interaction between individuals.⁷⁵ These factors are intangible, unseen but mutually understood and shared across masses. They form the building blocks for the anthropological study of a society and how they are reflected in the built environment. In a dwelling, one can observe kinship patterns. The introverted planning of these houses is a direct manifestation of various levels of privacy. The emphasis on open spaces surrounded by rooms indicates the interconnectedness of the familial relationships. The social distancing of private spaces from public establishes the proximity patterns practiced by the region. The flexible functionality of rooms in these dwellings reveal the capacity to change as ownership is handed from one generation to another. The spatial hierarchy is an indicator of space usage and the dwellers perception of social and personal space.⁷⁶ Irrespective of time and location, dwelling designs are reflective of local context and provide an important sociological reinforcement for organization of space and space usage.⁷⁷

3.3.3. TECHNICAL VALUE

“Form develops as man learns to master more complex building techniques, and all forms are part of a progressive development in a series of almost inevitable steps.”⁷⁸

Amos Rapoport
House Form and Culture

The technical value of this matrix is the 'How' dimension; how traditional architecture achieves its distinct form while maintaining the link to environmental and cultural values? It

⁷⁵ Rapoport. Pg. 47

⁷⁶ Ibid.

⁷⁷ Ibid.

⁷⁸ Rapoport, *House Form and Culture*. Pg. 24

may not be the determinant in form realization (does not decide what is to be built) but is a primary facilitator.⁷⁹ The technical value establishes a direct link to the land by using available indigenous materials. It also reflects the restrictions imposed because of the available resources, labor force, and construction techniques, and how to creatively manipulate them to utilize their full potential. Understanding this aspect of the matrix is imperative for sustainable construction so that new designs can utilize locally available materials rather than introducing ones that would be detrimental to the environment and human comfort in the building.

This dimension also serves as the 'meeting point' for historical and contemporary needs. Hybridized solutions that utilize traditional principles can be realized through modern science applications. For example, traditional houses in Walled City of Lahore were primarily made of bricks called *lahori* or *lakhauri* bricks with thick exterior walls to support structural loads.⁸⁰ While present day houses in Pakistan are still typically constructed with brick, they can also incorporate modern day solutions of insulation and structural reinforcement to permit flexible design of spaces and establishing human comfort inside.

3.4. BUILDING ELEMENTS

The building elements are expressions of environmental, cultural, and technical values and form the fundamental building blocks of traditional architecture. The following chart illustrates how traditional building elements embody these values. Each one is dependent

⁷⁹ Ibid. Pg 25

⁸⁰ Glover, *Making Lahore Modern*, 2008. Pg. 121

on the other and possess active and passive qualities, but they are components of a larger system and function efficiently as part of the overall arrangement.

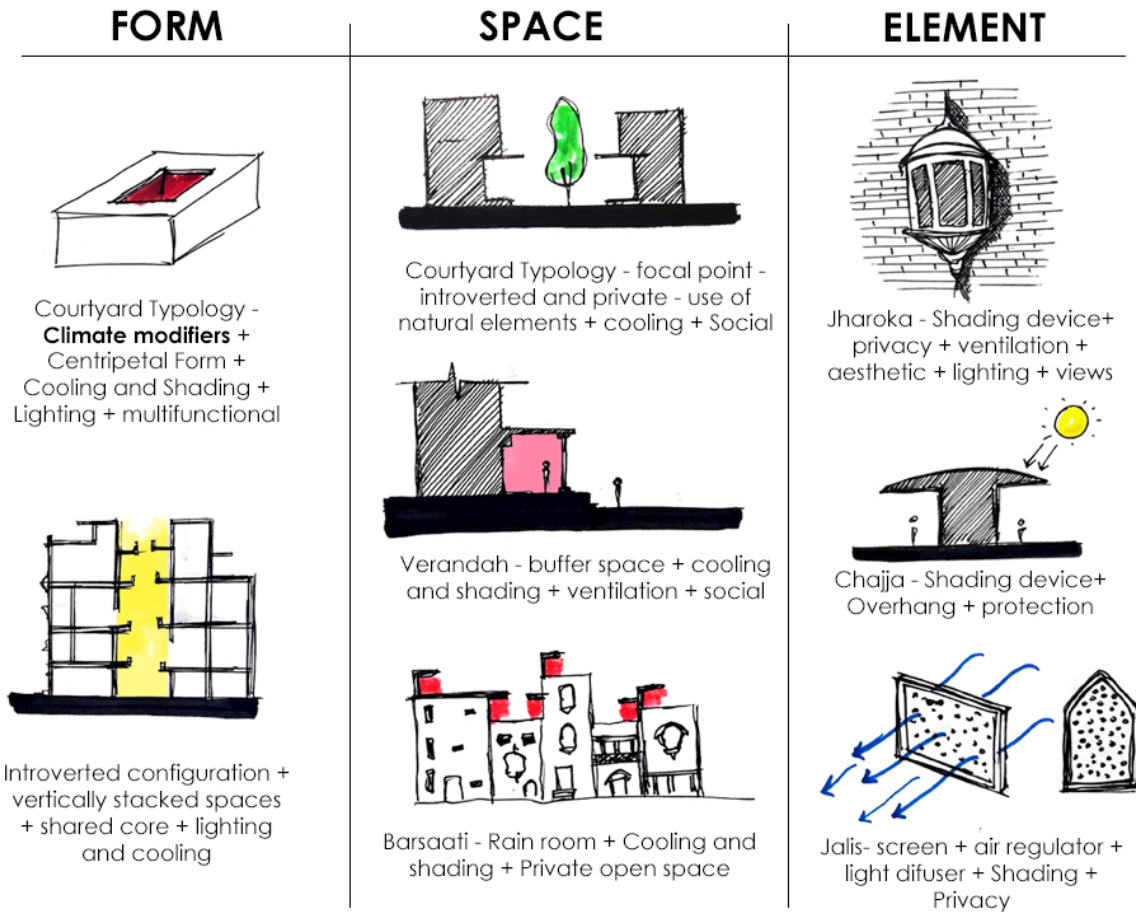


Fig. 13: Form, Space and Elements work in harmony to create contextually responsive dwellings. The first column highlights how the form of a dwelling contributes to maintaining the cultural connections while providing environmental comfort. The second column refers to spaces that can be included in a dwelling to respond to local needs. The third column highlights specific building elements that work on the same principles as form and space but are smaller in scale.

Orientation and Shading Devices:

Sun is the major source of heat. Thus determining the sun's position at all times of the day, in conjunction with prevailing winds is essential to site planning to establish optimal orientation (Fig. 14).⁸¹ For hot regions like Pakistan, aligning the long side from east to west provides maximum protection from direct sunlight during most hours of the day.⁸² In this orientation, the north façade receives glare free daylight in summer, as the sun is at high angle, and protective shading devices can be placed on the south façade to prevent sunlight from entering the interior spaces or heating up the wall surface.⁸³ The winter sun at a low angle heats up the wall and warms maximum interior space by penetrating through the southern façade. While the north to south orientation utilizes prevailing wind direction more efficiently, there are alternate solutions to capture the breeze and cool the insides spaces. This provides flexibility to designers, helping them to focus on orienting the building with respect to the sun.⁸⁴ (Fig. 15)

Social structures and religious beliefs of the context also inform building orientation although climatic needs are dominant. In the context of the Indian subcontinent, the social ties weighed heavier than religious because of the diversity of faith in the population. While some Muslim homes are influenced by religious requirements (such as indoor spaces oriented towards the *Qibla*, facing the holy city of Mecca according to Islamic faith), the buildings mostly respond to social needs. The bazaar facing façade would be considered the main one because that is where the social life of the community existed, even if the

⁸¹ Fathy, "The Sun Factor". Pg.42-45

⁸² Ibid.

⁸³ "Form & Orientation," *NZEB* (blog), accessed April 1, 2018, <http://www.nzeb.in/knowledge-centre/passive-design/form-orientation/>.

⁸⁴ Fathy.

main entrance was located at the rear. This indicated the desire to stay connected with the public life from within the private spaces of a home while maintaining the intimacy of the interior. Unlike other sides, the bazaar facade would be highly decorative and ornamented with projected *jharokas* and *chajjas*, displaying intricate woodwork. Traditionally, individuals and families in South Asian and similar contexts did not view themselves as isolated units but significant parts of the larger community, hence it was imperative to maintain that link with their social context even through their private settings (See Fig 16 and 17).

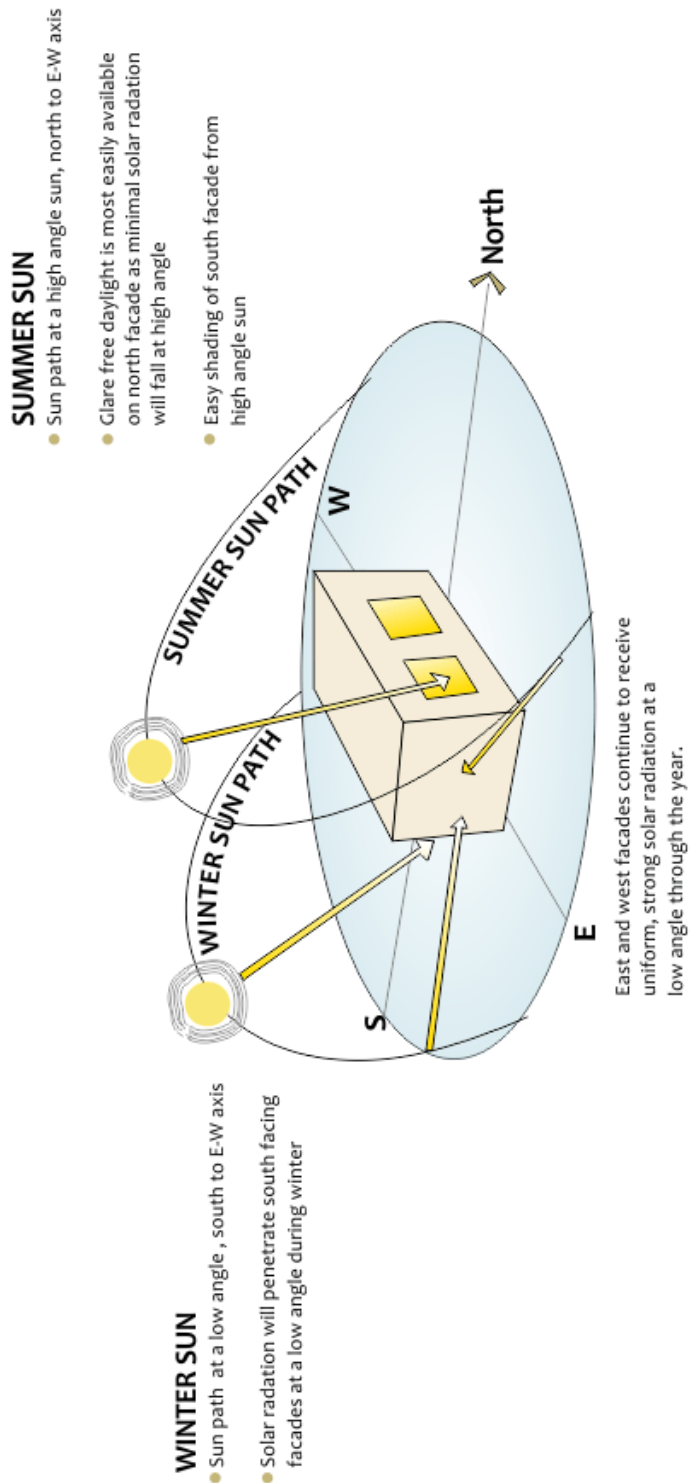


Fig. 14: Buildings should respond to solar orientation of site. Solar paths determine levels of penetration and consequently, heat gain and loss in a building. (Image Source: nzeb.com)

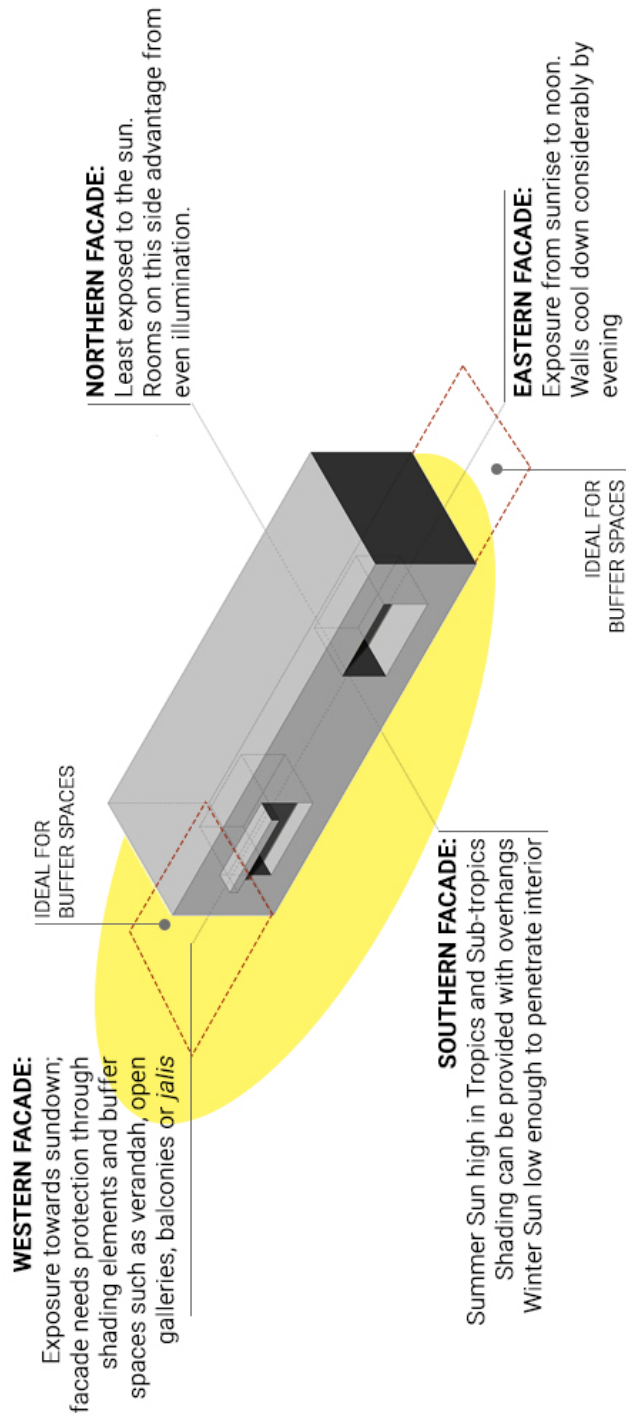


Fig. 15: Illustrative summary of building showing how each side receives sun and should incorporate different building elements (such as Chajja and verandahs) in regard with the orientation (Source: Author)

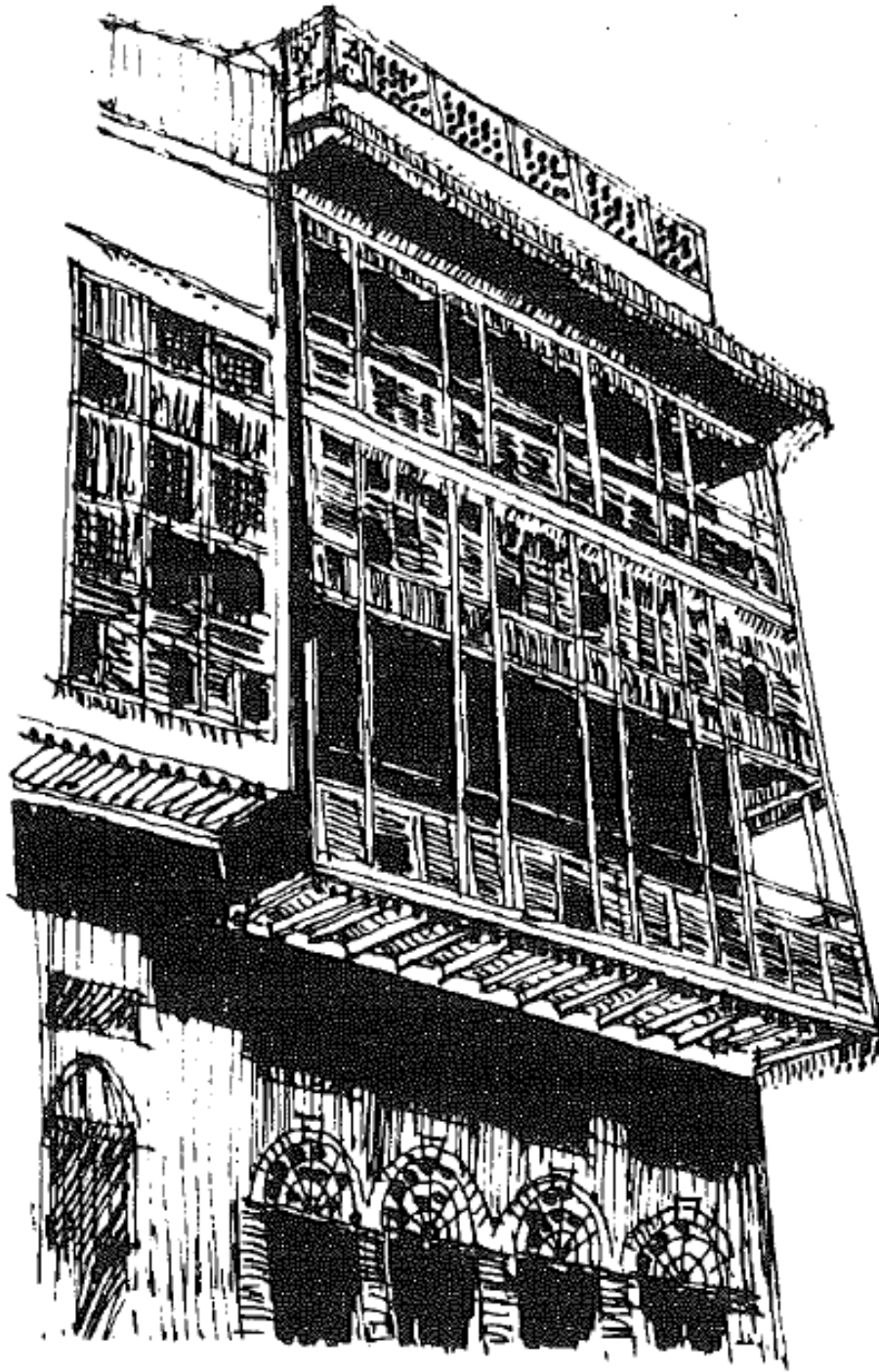


Fig. 16: Wooden Balcony or Chajja in Lahore, Pakistan. (Source: Ellahi M. Ishteeaque from Journal Article "Desert Design in Traditional Context")

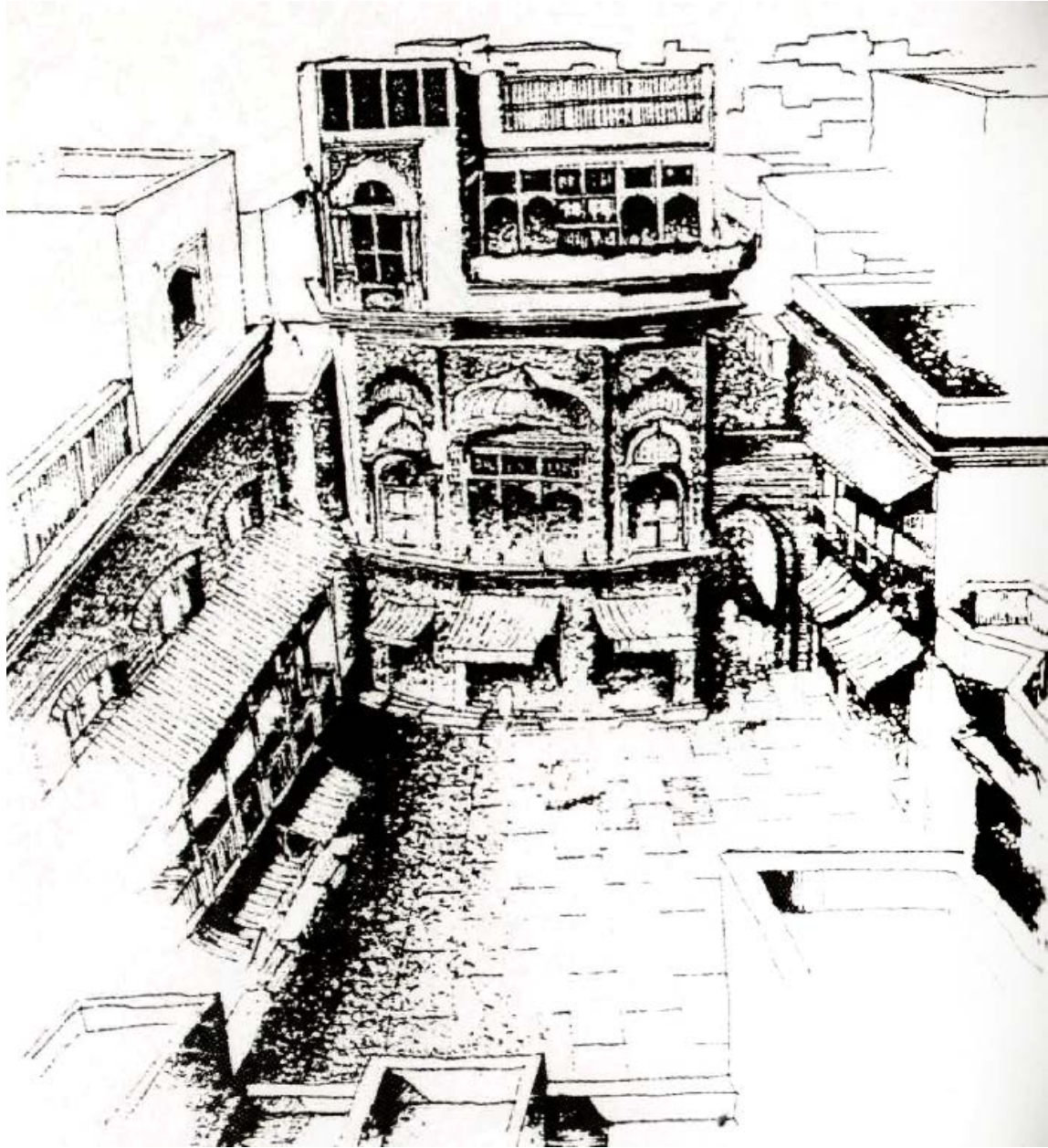


Fig. 17: Sketch of a Cul-de-Sac in Walled City of Lahore. The Buildings and houses group together and form a "public courtyard" used by residents of the surrounding dwellings for different purposes: socializing, religious gathering, cultural festivities etc. In some walled cities in the Indian subcontinent, this space is sometimes gated. (Source: The Walled City of Lahore, publication by PEPAC)

Building Massing and Spatial organization

Building massing is the volumetric spatial organization of spaces, their relationships, and their function as “protective” layers for each other. Analyzing massing aids in understanding how climatic, social, and technical values define organizational patterns prevalent in traditional buildings and how they can be implemented in contemporary design.

The courtyard is one of the most “climatically protected” spaces in the house because of the clustering of rooms on its perimeter acting as “buffers” to the open space. The stacking of the peripheral spaces provides shading to the courtyard and benefits from the cool air set in motion by the convection current. However, these spaces surrounding the courtyard are not primarily dependent on it to gain comfort. Their placement in proximity with each other and connection through multiple entryways (on all three axes) creates a protective volume. Dwellings that do not follow courtyard typology are dependent on vertical stacking of spaces to create a cool interior environment. They exploit their volumetric relationship to create semi open spaces in form of *barsaatis*, *chajjas*, *baithak* and *dalaan* to manipulate their microclimate. Traditional houses with limited footprint have multiple levels to utilize stack effect and evaporative ventilation to improve indoor air quality.⁸⁵

⁸⁵Samra M.. Khan, “Traditional Havelis and Sustainable Thermal Comfort,” *International Journal of Environmental Studies* 73, no. 4 (May 13, 2016): 573–583, <https://doi.org/10.1080/00207233.2016.1179015>.

The exterior walls in traditional homes range from 18 inches to 2 feet and sometimes are shared between adjacent lots.⁸⁶ Because they are buffered by each other, it reduces their exposure to sun, protecting them from direct solar gain. A principal factor of traditional design is the high thermal mass of the exterior walls that mitigates extreme outdoor temperature and keep the inside air lower.⁸⁷ However the massing of the house or careful use of fenestration are not the only factors keeping the house comfortable. These are enhanced through inhabitants' active participation within the house such as seasonal migration and opening and closing of windows.⁸⁸

The spatial organization of traditional buildings has its roots in cultural beliefs of the context as well. The spaces are always inward looking to maintain privacy and intimacy of the dwelling. The close packing of these units with its own is an urban manifestation of privacy.⁸⁹ These dwellings establish the spatial hierarchy by placing public spaces on the periphery of the structure, and transitions into more private spaces as towards the core of the house. The building massing also allows for multiple entryways and exit to allow freedom of flow and movement while maintaining the privacy. For example, private spaces would be connected with each other and sometimes to semi private ones but would not have a direct link to public spaces of the house without providing a buffer space in

⁸⁶ Ellahi M. Ishteeaque, "Contemporary House Design: A Lesson from Lahori Traditional Architecture," *International Journal for Housing Science and Its Applications* 23, no. 2 (January 1999): 85–95.

⁸⁷ Ibid.

⁸⁸ Ibid.

⁸⁹ Ardalan and Bakhtiar, *The Sense of Unity*.

between. The entrance will never directly open into the domestic spaces of the house and would have a transition to for visual protection.⁹⁰

Traditional dwelling functions as a well-oiled machine responding to the climatic conditions as well as the social constructs of the region. Studying them both in plan and section, reveals how they perform for optimum thermal comfort and usage of space.

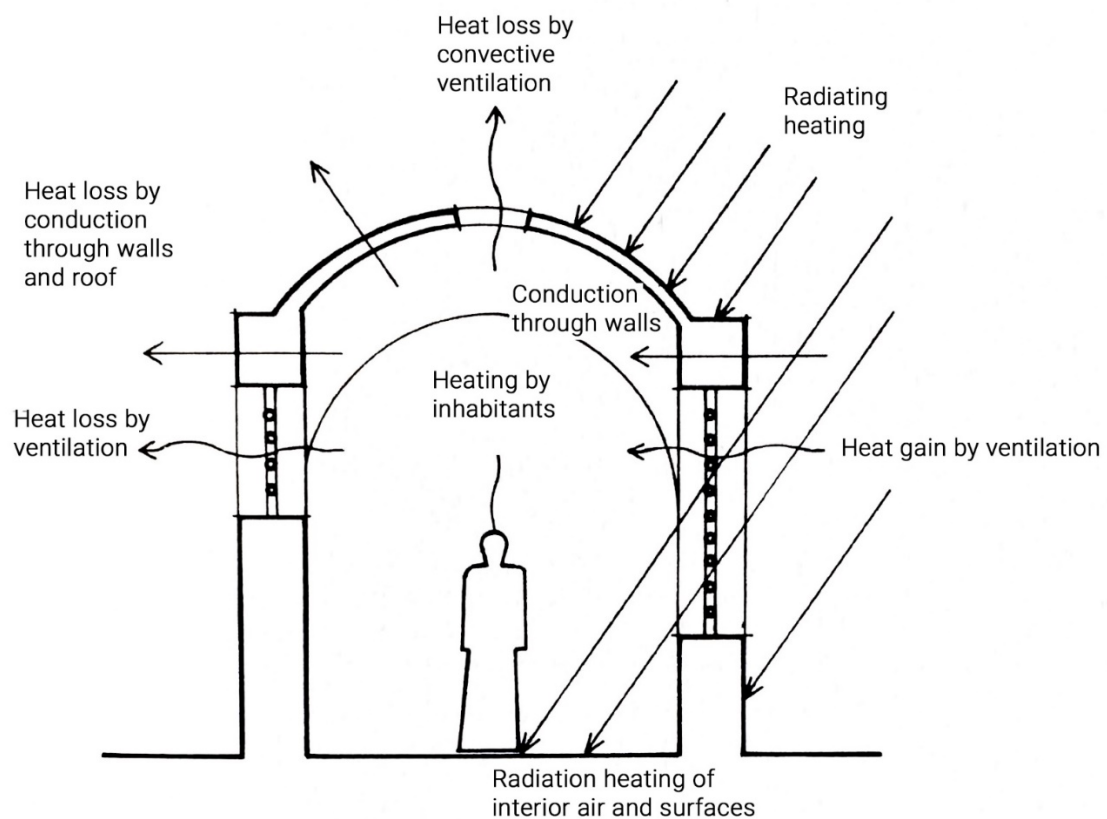


Fig. 18: Diagrammatic Representation of Heat gain and loss in a building (Source: Natural Energy and Vernacular Architecture)

⁹⁰ Ellahi M. Ishteeaque and Fahd A. AlSaid, "The Story of the Courtyard House: Middle Eastern-Arab Case Study," *International Journal for Housing Science and Its Applications* 27, no. 3 (January 2003): 213–44.

Courtyard

“To cross a desert and enter a house around a courtyard is a pleasure beyond mere photogenic image-making, it is the quality of the light and the ambience of moving air, that forms the essence of our experience. Architecture as a mechanism for dealing with the elements...”

Charles Correa⁹¹

Usually the central space within a dwelling, a courtyard is a well-adapted, climatically protected and a functionally balanced space that has environmental and cultural values.⁹²

In the context of Indian subcontinent, a courtyard surrounded by rooms, defines the typology of a haveli. Its biggest advantage is the privacy it affords the inhabitants, providing a safe space for rest, play, worship, and other household activities. Because of its functional ambiguity, it is also sometimes used as an extension space for kitchen, living room, or other domestic programs. In traditional practice, a courtyard would be protected from outside views through a meandering entrance to maintain its physical and visual privacy and security.⁹³ (Fig. 20)

The courtyard plan serves as a centripetal force, connecting people with nature by serving as an inner garden, that is usually accompanied by a waterbody such as a fountain.⁹⁴ It acts as the focal point towards which the interior of the house is oriented, surrounded by rooms to create a well-knit ensemble. (Fig 19). The courtyard typology is an interlocked combination of outdoor and indoor spaces where an exterior space has characteristics of an interior one.⁹⁵

⁹¹ Hassan-Uddin Khan, *Charles Correa, Architects in the Third World* (1987). Pg.10

⁹² Ellahi M. Ishteeaque, “Desert Design in Traditional Context - A Delineation on Pakistan,” *Arabian Journal for Science and Engineering* 17, no. 4A (1992): 431–44.

⁹³ Ibid.

⁹⁴ Ardalan and Bakhtiar, “The concept of traditional forms” Pg. 68

⁹⁵ Ishteeaque and AlSaid, “The Story of the Courtyard House: Middle Eastern-Arab Case Study.”

Courtyards have survived for so long in traditional dwellings because of their ability to provide thermal comfort. Mostly found in hot arid areas in the world, starting from the shores of Indian Ocean in the east all the way to the shores of Atlantic Ocean in the west, courtyards can be considered 'microclimate-modifiers' that mitigate heat, channel cool breezes, and adjust humidity levels.⁹⁶ In hot zones, the diurnal swing is significant that is the difference in temperature of day and night, with low levels of humidity. The courtyard utilizes air movement by convection to establish a comfort zone. During the night, warm air rises and is gradually replaced by cool air. The cool air accumulates as night advances, seeping into surrounding rooms, keeping the courtyard cool until late in the day.⁹⁷ Hence, a courtyard acts as a reservoir of cool air (See Fig. 26).⁹⁸

The climatic functioning of the courtyard can be improved to achieve better results than its traditional predecessors by exploiting other building elements. For example, by inserting a verandah to act as a buffer space between the courtyard and rooms, inner facing fenestration to utilize cool winds (especially if the courtyard is a garden as vegetation has a cooling effect on air) (Fig. 21), arrangement of rooms oriented towards the central space, optimal width to height ratio⁹⁹ to keep half of the courtyard in shade throughout the day, and selection of material such as brick tiles on floor of the court to encourage evaporative cooling.

⁹⁶ Swasti Sthapak and Abir Bandyopadhyay, "Courtyard Houses: An Overview," *Recent Research in Science and Technology* 6, no. 1 (n.d.): 70–73.

⁹⁷ Fathy, "The Sun Factor in Air Movement". Pg.62-63

⁹⁸ Ibid.

⁹⁹ Appropriate courtyard elevation for optimal shading results in summer and winter should be at least 20 feet. Markus Bulus et al., "Examination of Courtyard Dimensions and Proportions In Universiti Teknologi Malaysia Buildings," *International Journal of Real Estate Studies* 11, no. 2 (2017).

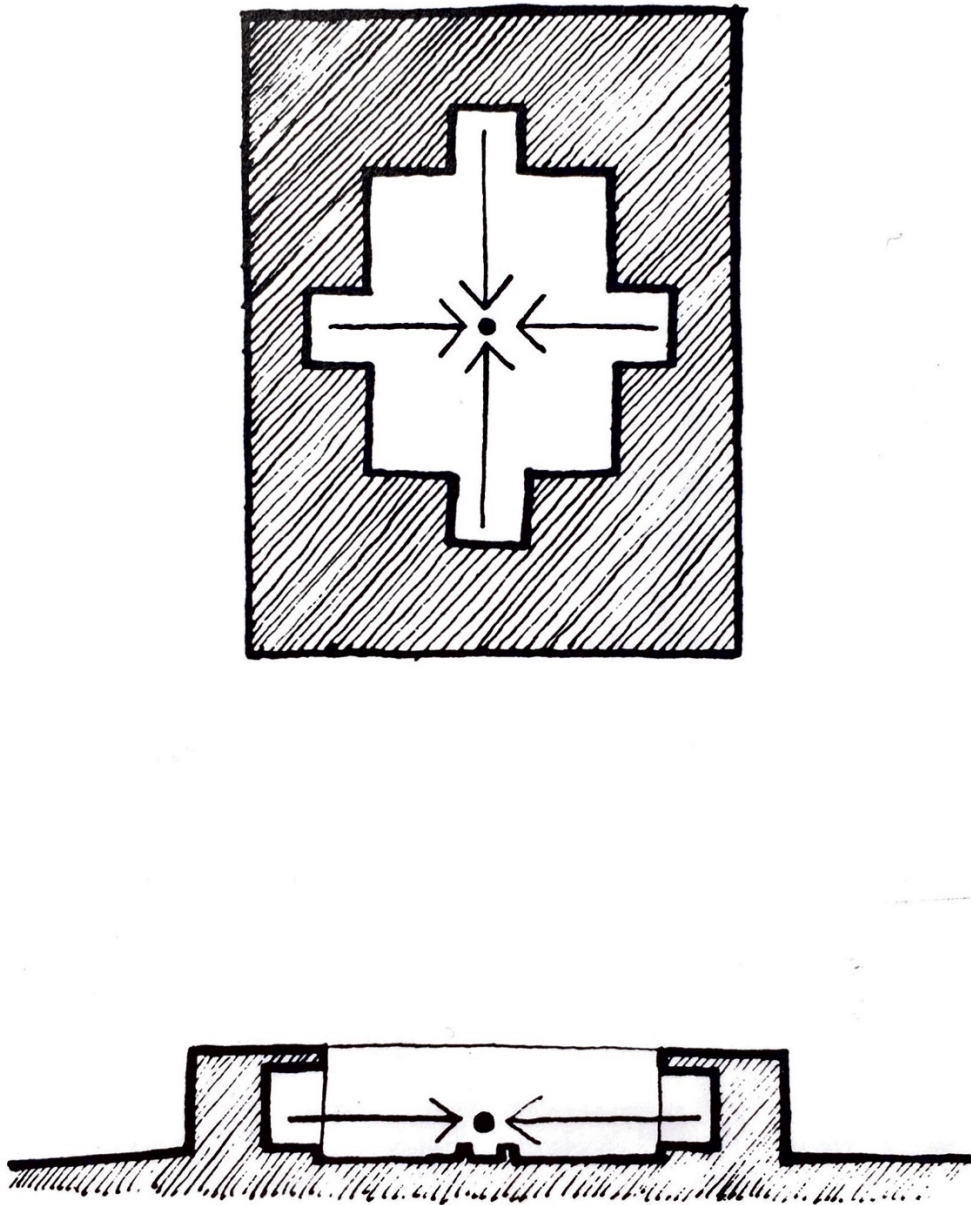


Fig. 19: Schematic drawing of a Courtyard, illustrating it as a centripetal force and the dwellings orientation towards it. This representation is a cultural aspect where houses were introverted and inward looking to maintain privacy (Source: The Sense of Unity)

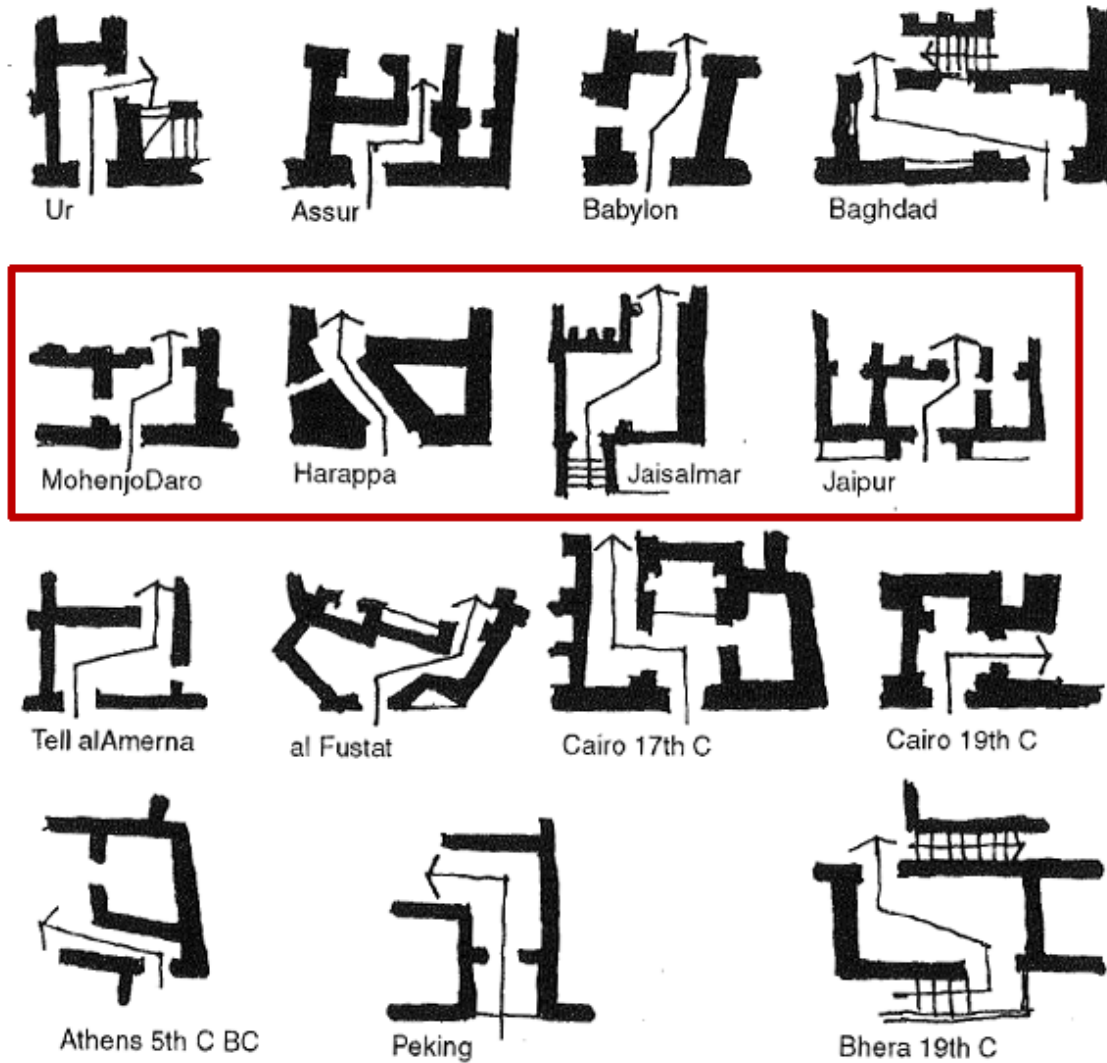


Fig. 20: Design of entryways in courtyards houses. The entrances rarely led directly into the bosom of the house (the courtyard); there was always a physical barrier between the two to protect the privacy of the dwelling. The picture shows courtyard house typology from various locations around the world, with each having the private entryway feature. The outlined diagrams belong to the South Asian cities. (Source: M. Ellahi Ishteeaque from the "Story of the Courtyard House: Middle Eastern-Arab Case Study")

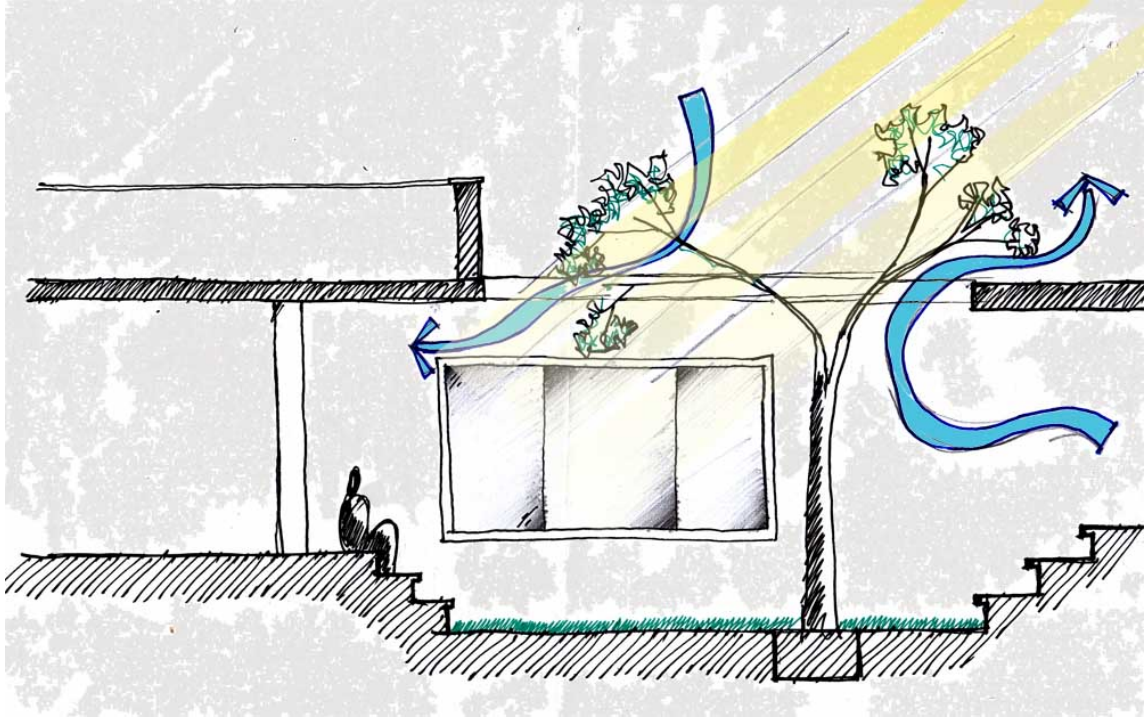


Fig. 21: Conceptual sketch of a courtyard as a climate modifier, utilizing wind, sun and vegetation (Source: Jaikeshav Mishra)

Fenestration

“Jahangir imposed the ritual of the *jharoka* – a glimpse, for it was to be first time, since the Mughal Conquest of India around a 100 years ago, a personal viewing of the Emperor by any subject in the empire.”¹⁰⁰

Indu Sundaresan (*The Twentieth Wife*)

Careful consideration is given to openings in traditional buildings in terms of their placement, materiality, size, and orientation. The purpose of an opening is to introduce light, let in air and offer views. In climates with hot temperatures, finding balanced combination of these functions can be challenging. Modern techniques such as venetian

¹⁰⁰ Indu Sundaresan, *The Twentieth Wife, Feast of Roses, and Shadow Princess* (Washington Square Press, n.d.).

blinds and brise-soleil helps in deflecting direct solar gain up to one-third, which is a significant improvement but not adequate in hot temperatures.¹⁰¹

Traditional building practices offer social and environmental solutions in form of *jharokas* (Fig. 22), *darichas*, *jaalis* and *chajjas* (Fig. 23) which perform five functions; controlling light penetration and diffusion, controlling air flow, reducing temperature of incoming air, increasing humidity of air current, and ensuring privacy.¹⁰² Openings are carefully placed depending on the wind and sun direction and to establish, an uninterrupted flow of air for cross ventilation. (See Fig)

Covered with latticework, called *jalis*, *jharokas* are the most commonly found traditional openings that offer cool winds, diffused lighting, and privacy. The overall latticework in *jail* is divided up into different sizes with larger perforations on top for better air flow¹⁰³; and, smaller on bottom, to provide protection from direct sunlight and solar glare by diffusing it, resulting in ambient interior light.¹⁰⁴ (Fig. 25) Carved out of wood, the *jalis* absorb, retain and release water,¹⁰⁵ which helps in cooling down the air that passes through the wooden *jali*.¹⁰⁶ On hot days, release of water by wood, helps dampening the dry air, making the environment pleasant. To enhance the cooling, plants and small water containers were usually placed inside the *jharoka* to encourage evaporative cooling.¹⁰⁷

¹⁰¹ Fathy, "The Sun Factor" in *Natural Energy and Vernacular Architecture*. Pg 47.

¹⁰² Ibid.

¹⁰³ Ayesha Batool, "Quantifying Environmental Performance of Jali Screen Facades for Contemporary Buildings in Lahore, Pakistan" (University of Oregon, 2014), https://issuu.com/ayeshabatool/docs/batool_ayesha_thesis_3rd.

¹⁰⁴ Fathy, *Natural Energy and Vernacular Architecture*. Pg. 47

¹⁰⁵ Fathy. Pg. 48

¹⁰⁶ Pavitra S. Kumar, "Traditional Perforated Screen of India: Study of Its Origin, Purposes and Behavior" (Architectural Association, 2014).

¹⁰⁷ Batool, "Quantifying Environmental Performance of Jali."

In addition to these decorative yet functional elements, traditional households have *darichas* as well. Their primary purpose is to act as outlets for warm air collected in the higher part of the room. It is effective when placed above eye level to prevent direct solar glare and to evacuate heated air.¹⁰⁸ None of these elements are cooling devices on its own (i.e. produce chilled air) but are designed to create cool interior environment.

Fenestration also ensures visual privacy from the outside while providing views to the inhabitants from within along with a sense of security.¹⁰⁹ (Fig. 24) Presence of artfully crafted *jharokas* and *jalīs* is also an indicator of high social status of the owner and expert craftsmanship.¹¹⁰

¹⁰⁸ Fathy, *Natural Energy and Vernacular Architecture*.

¹⁰⁹ Fathy.

¹¹⁰ Batool.

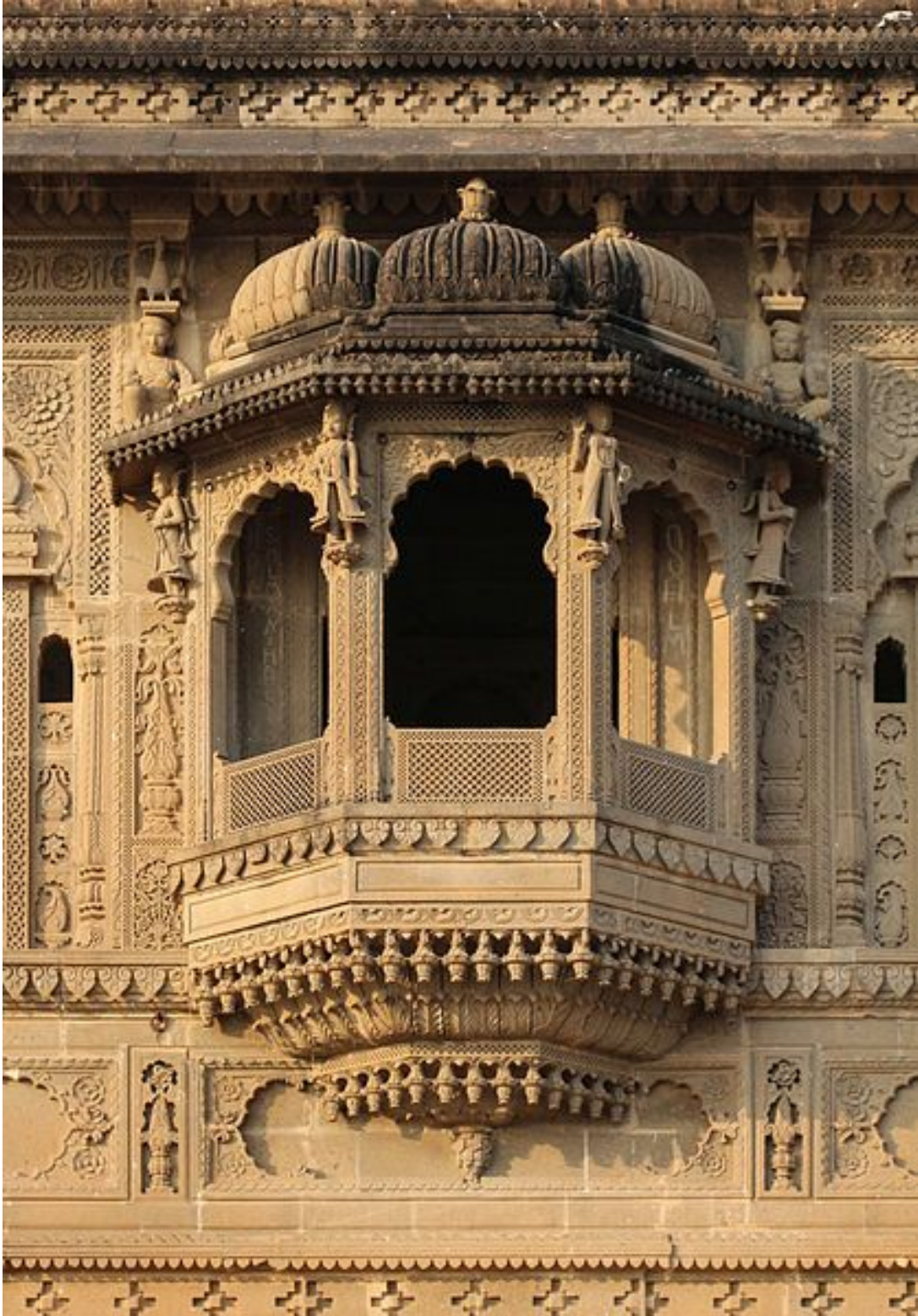


Fig. 22: Jharokha - stone overhanging enclosed balcony used in Mughal architecture. Maheshwar Fort, India (Photograph by Bernard Gagnon, Source: Wikipedia)

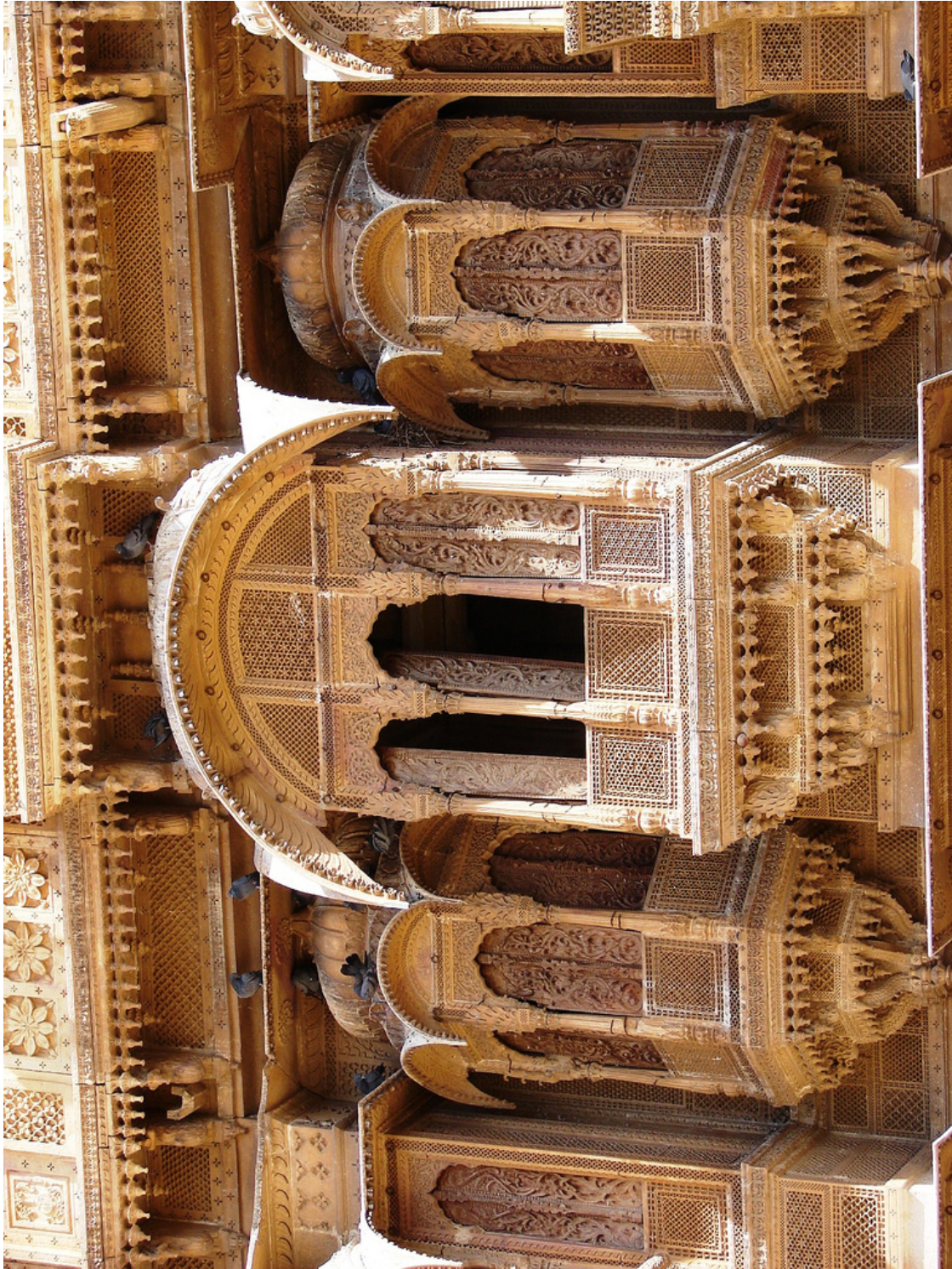


Fig. 23: Chajja over the Jharoka At Patwan ki Haveli, Jaisalmer, Rajasthan, India – Shading device to cast shadows. (Photograph by Asis K. Chattarjee. Source: Flickr.com)

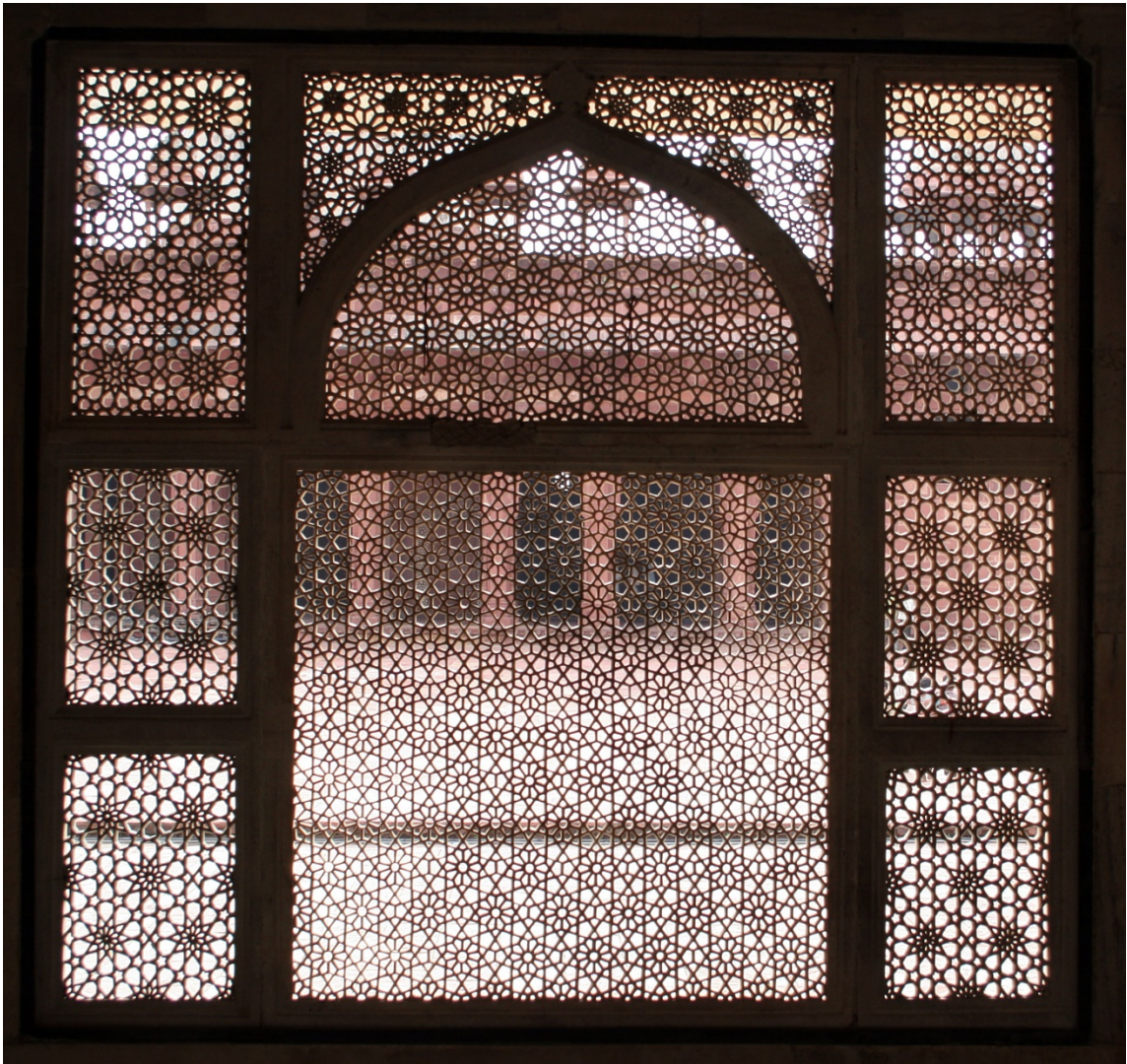


Fig. 24: Jali screen Salim Chisti Tomb, Fatehpur Sikri, India. View from the inside through a perforated screen. (Source: Reflections of India)



Fig. 25: House of Zaynab Khatun (1468-1713). Sun filtering through the mashrabiya window casts patterns on the floor. The interior space is adequately illuminated while also protected from direct harsh sunlight, providing a comfortable environment for the user. (Photography by Helen Romberg)

HOW VENTILATION WORKS

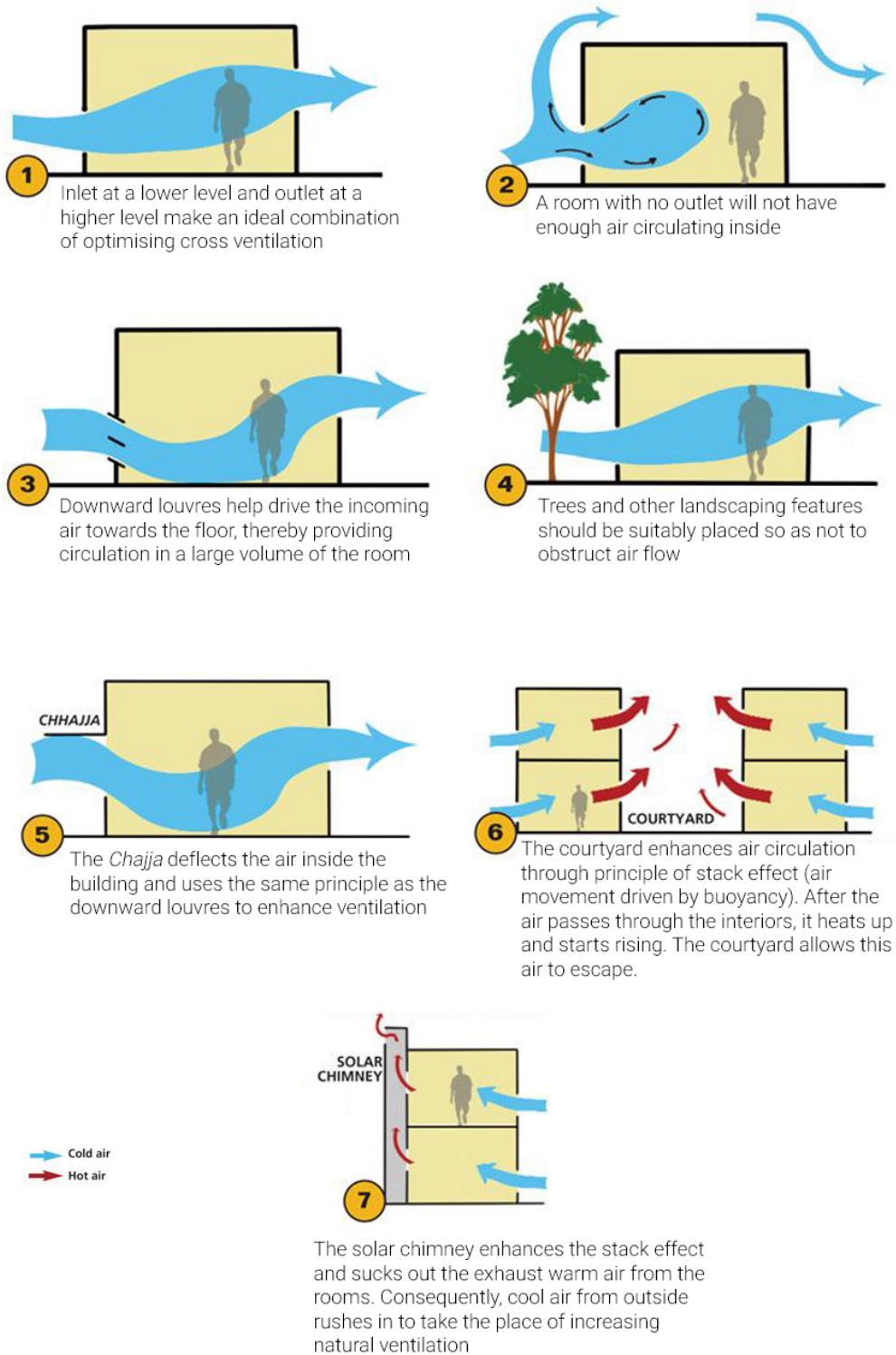


Fig. 26: How ventilation works. (Source: Downtoearth.org.in)

Construction and Materials:

Understanding the properties of material and energy in relation to climatic phenomena helps in creating comfortable designs. Forming the skin and bones of a structure, materials influence the rate of thermal conduction and resistance, moisture retention, radiation along with absorptivity and reflectivity, and temperature mitigation.¹¹¹ Availability of material and existing construction techniques are interrelated as one cannot be utilized if expertise to implement it does not exist.

In the South Asian context, materials that have been traditionally used are wood, mud, brick and terracotta depending on the availability. Choice of material defines the comfort level in buildings as they are the first layer of protection from sun radiation, prevailing winds, and rain. Different materials have different properties regarding heat absorption, conduction, reflection, and moisture retention and how it all transmits to the inside spaces. Heat flow from outside to interior space is dependent on the wall area and thickness, temperature difference (inside vs outside) and rate of global heat transmittance.¹¹² To decrease heat transmission, thermal transmittance should be reduced by increasing thickness of wall and covering it with surface materials that have high resistance and low thermal conductivity. (Fig. 27).

Clay is one of the most frequently used material in the Pakistani region especially in central and southern parts. Many homes have been constructed using adobe, molded, extruded, sunbaked and kiln-dried bricks depending on the availability. Used in conjunction with traditional lime, it is further enhanced by mixing in cow dung, eggshells,

¹¹¹ Fathy. Pg. 11-20

¹¹² Fathy, "Architecture and Comfort" in *Natural Energy and Vernacular Architecture*. Pg. 38-39

and other organic material.¹¹³ Use of surface materials like lime or light-colored bricks assist in reducing heat absorption and reflects it back into the environment.¹¹⁴

A study conducted by The University of Newcastle's Priority Research Centre for Energy has concluded that brick as a building material is most suitable for areas with large diurnal temperature shifts because of its thermal capacitance.¹¹⁵ Available at affordable rates in South Asia, it can be manufactured in ways to improve its performance in creating cooler interiors by adjusting its properties such as density, permeability, and porosity. On site, it can be constructed in a two-wall system with internal partition to interrupt or reduce heat flow to interior spaces. (Fig. 28) Brick is also a sustainable choice because of its durability and longevity, and inherent thermal mass that reduces reliance on mechanical means of air-conditioning in homes, saving energy consumption and reducing carbon footprint.

¹¹³ Tipnis, *Vernacular Traditions*. PG. 37

¹¹⁴ Wiley, "New Study Highlights the Thermal Benefits of Bricks."

¹¹⁵ Wiley.

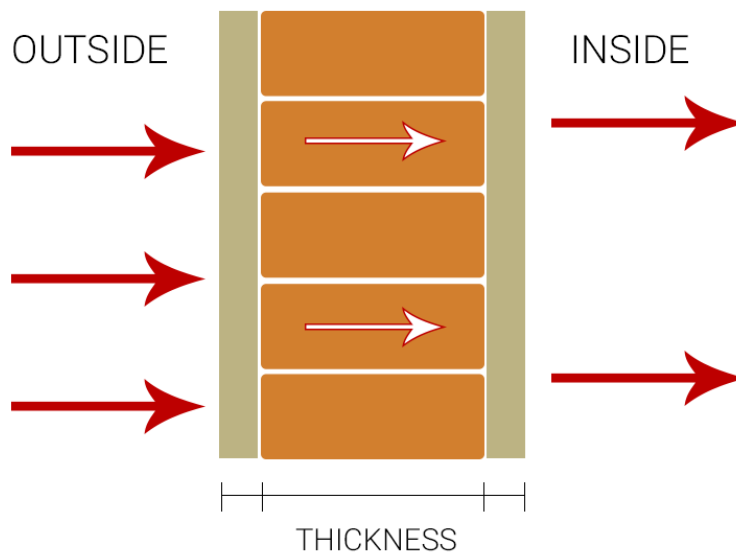
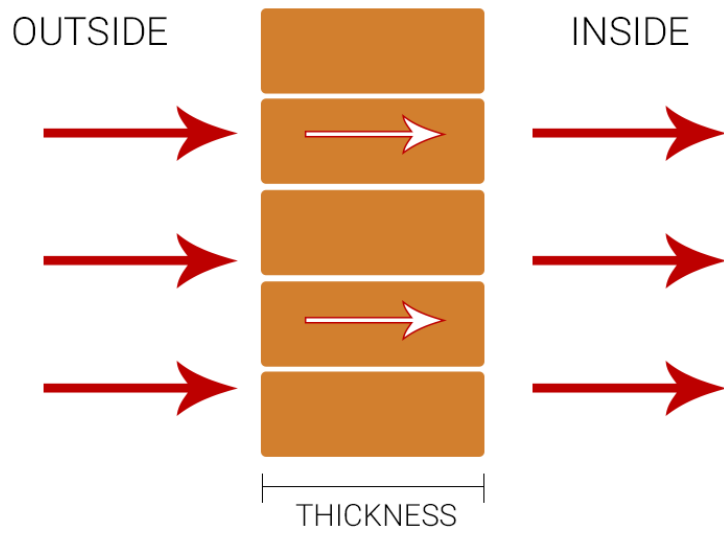


Fig. 27: Diagrammatic representation of heat flow with and without composite materials. As the thickness of wall increases, heat transferred is reduced. Traditionally, lime was used as surface material to weather proof and protect the wall from getting heated. (Drawn by Author. Adapted from Natural Energy and Vernacular Architecture)

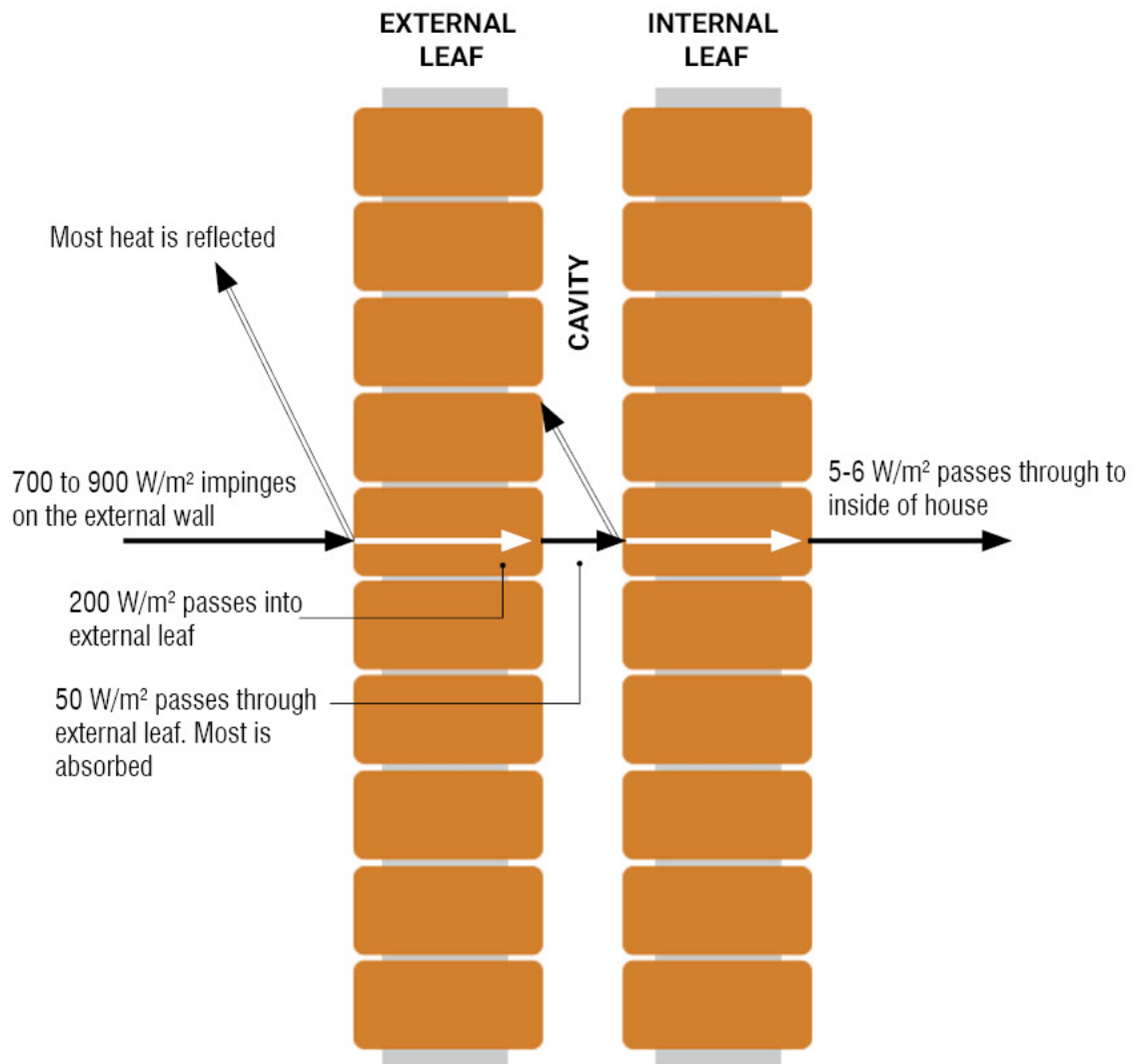


Fig. 28: Heat flux through a west facing, cavity brick wall in summer. (Drawn by Author. Adapted from Energy Efficiency and the Environment: The Case for Clay Brick by Think Brick Australia)

4. TRADITIONAL DWELLINGS

The aim for studying the historical case studies is to analyze the workings of these principles whereas the contemporary case studies are 'proofs' from present time of how architects have employed these principles in their designs. Historical case studies have been selected from properties located in the Walled City of Lahore that have been documented by Walled City of Lahore Authority and Pakistan Environmental Planning and Architectural Consultants Limited.

The selection was made based on economic profile of the owner (during construction), time of construction, plot size and architectural influences. The diversity of the case studies selected will help in observation of similarities and differences between these properties to establish a pattern of traditional practices and building elements.

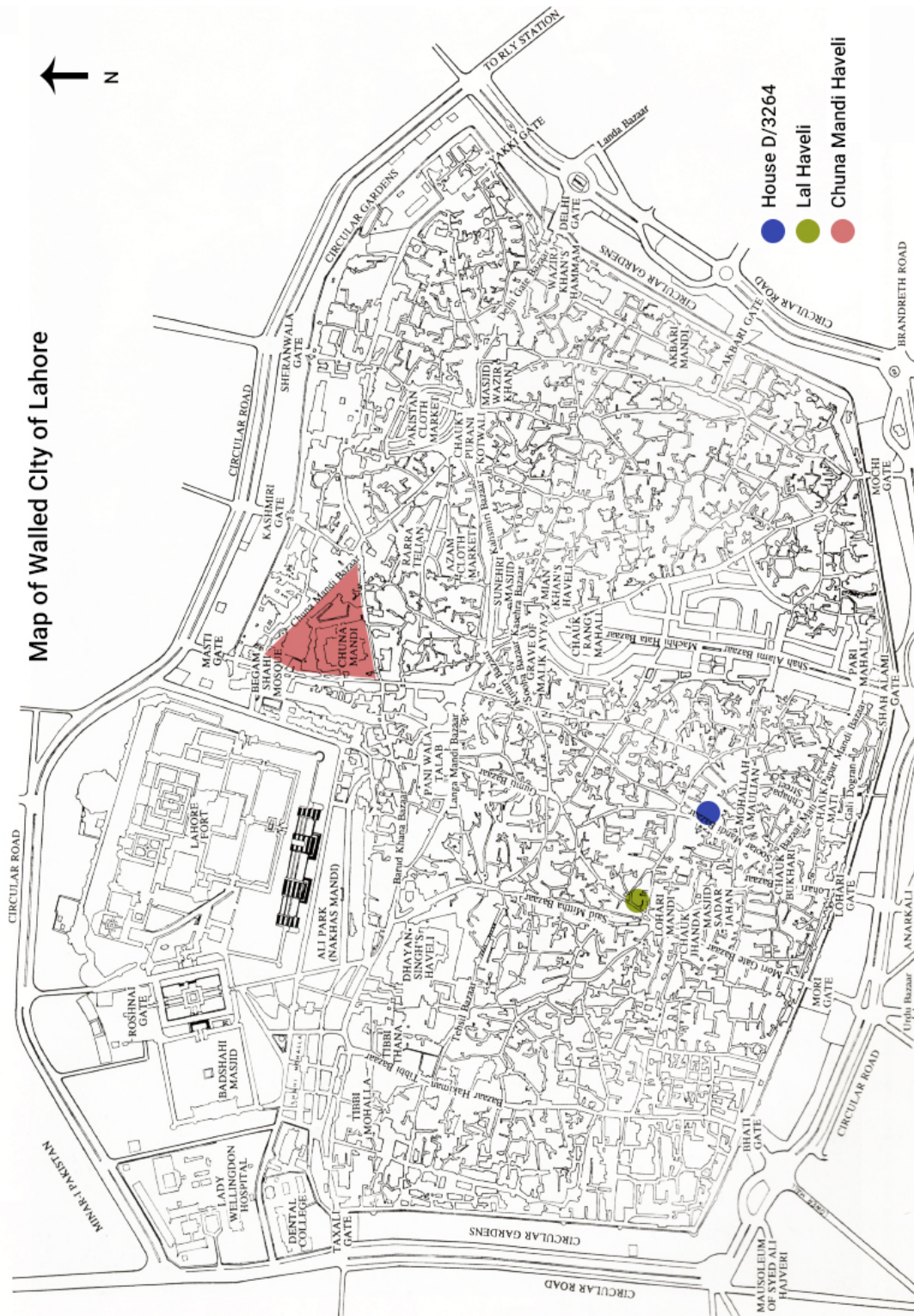


Fig. 29: Location Map of Traditional Case Studies. (Source: The Walled City of Lahore, publication by PEPAC)

4.1. LAL HAVELI, LOHARI MANDI BAZAAR Lahore, Pakistan

Identified as property number D/749 by The Walled City of Lahore Authority, Lal Haveli literally means 'Red' Haveli and gets its name from multiple paint layers of *hurmuchi*, or red ochre paint on its façade. It was selected for the paper because of the challenge it posed as an irregular plot shape and it is one of the few extant examples in the Walled City where one observes a juxtaposition of styles and different influences. It is considered one of the best-preserved examples of cut and chased, brickwork along with its plaster moldings on a historical residential building within the Walled City.¹¹⁶ According to local tradition, a Kashmiri *Maharajah* built the structure for his courtesan, Daru so the residence is also referred to as Mai Daru's haveli.¹¹⁷

The haveli is constructed on an irregularly shaped lot with the only straight façade facing the bazaar street. It is abutted on all its sides by other residential buildings forming a group of structures with a remarkable height along the street line. The street façade of the haveli has undergone tremendous changes; the western façade used to be a *baithak* (A place for sitting in a traditional house, primarily used to entertain guests) with windows facing the bazaar that has now been converted into a series of shops (this involved removal of ornamental wooden doors and windows along with arched masonry work to install concrete lintels).¹¹⁸ Like other buildings in the Walled City, it had a central courtyard space despite the irregularity in its plot shape. The central courtyard is a double height space with a mezzanine level accommodating another room above the shop that has

¹¹⁶ Sevckenko and Makhdum, "The Lal Haveli" in *The Walled City of Lahore*. Pg.119

¹¹⁷Ibid. (The exact date of the building is unknown; visual observations place it in the late 19th century.)

¹¹⁸ Ibid. Pg. 120

fenestration facing the bazaar side and the courtyard side. The courtyard (referred to as hall in the drawings) is surrounded by *dalaans* acting as buffer spaces for the central part of the house.

The haveli has an introverted plan that has multiple stairs leading to first floor¹¹⁹ but only one that leads further to other levels of the residence. This conscious effort to eliminate access demonstrate the division of private spaces from public and semi-public in a vertical manner. The ground floor repeats itself on the first floor, where the bazaar facing rooms have intricate *jharokas* overlooking the street below, allowing access of views from within but not from the exterior.

This haveli is a testimony of two cultural expressions coming together. The decorative and ornamented work reflect high Sikh period but the use of English brickwork (larger in size than traditional brick) relays the inclination of the masses to adapt to new cultural influences while staying true to their traditions. Various architectural expression observed in the structure relates to the experimentation at the time with new modes of construction, spatial organization and materials while achieving proper composition and proportions prevalent in such structures. This indicates that use of traditional practices along with new ones was practices in the past as well.

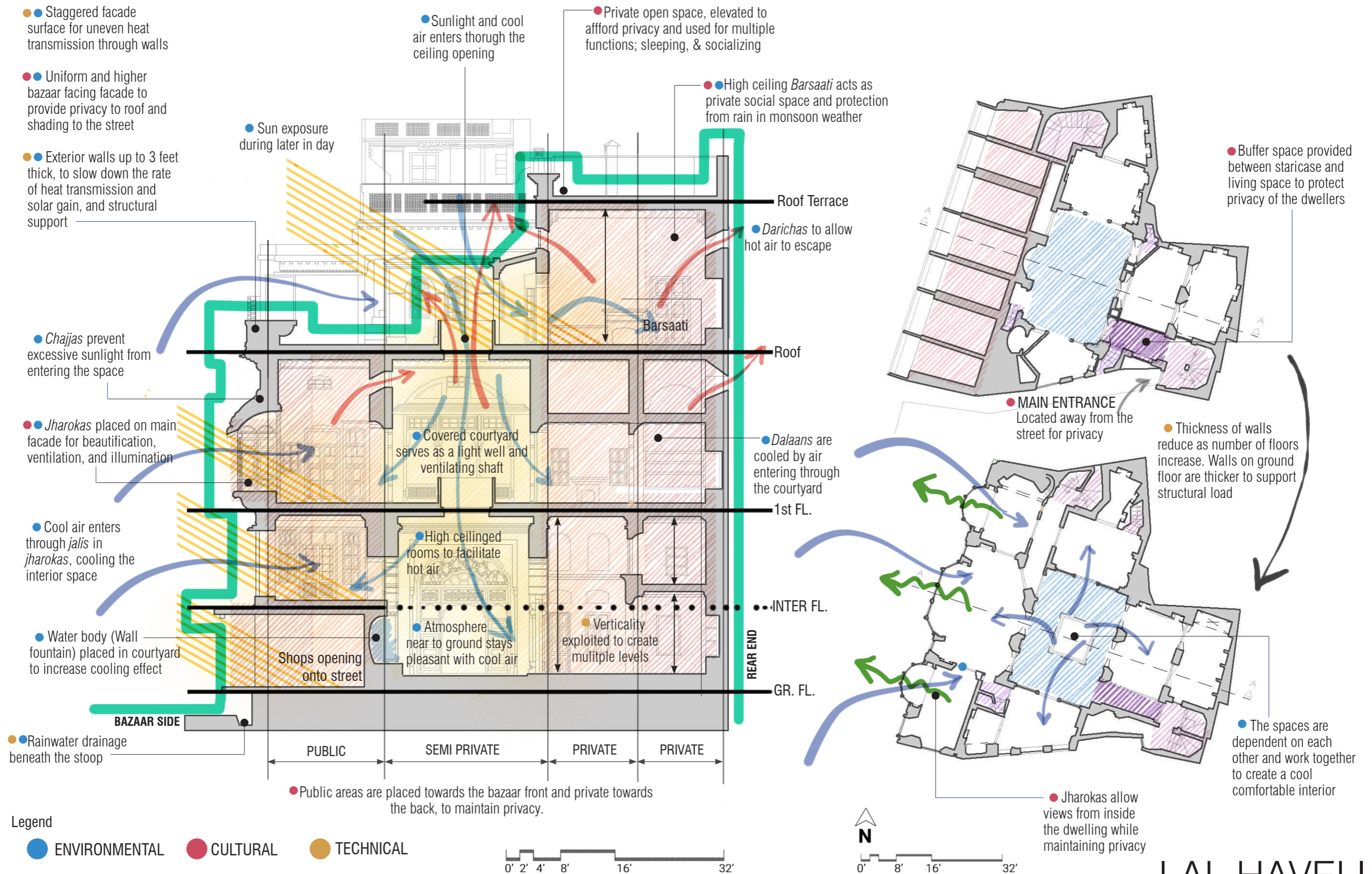
¹¹⁹ In USA, this will be the second floor.



Fig. 30: Main Facade of Lal Haveli (Source: News.pk)



Fig. 31: Entrance to Lal Haveli (Source: News.pk)



Source: Margaret Sevckenko and Rashid Makhdum, eds., *The Walled City of Lahore* (Lahore: Lahore Development Authority, 1993).
 Courtesy of Walled City of Lahore Authority
 Author: Zara Shafiq Bhatti

LAL HAVELI

LAHORE, PAKISTAN

4.2. HOUSE NO D/3264

Lahore, Pakistan

(Late 19th Century – Exact date is unknown)

Known for its ornamental work on the façade in form of floral frescos and carved wood, House no D/3264 is one of the best-preserved structures in the Walled City of Lahore. It is a unique example because of its octagonal light well called a mug, vertically connecting its different levels which has not been found in other historical residences of the city.¹²⁰ It is one of the larger houses, approximately covering an area of approximately 1650 square feet¹²¹ and belongs to the Non-Muslim period, most probably Sikh.¹²² According to land revenue records from 1940, the residence was occupied by Hindus who migrated to India after partition.¹²³

The building is four stories connected through a central courtyard that performs as a lightwell. The structure has a commercial front facing *Sootar Mandi Bazaar* (main street) with a narrower entrance on the basement level. The main entrance is located on the south eastern end of the structure, about 11 feet above the bazaar level, leading to the ground floor lobby dividing the residential space from commercial sectionally. The lobby opens into the courtyard, surrounded by *dalaans* on three sides and an enclosed room on the fourth side (possibly a modified *dalaan*).¹²⁴ Repetitive floor plans are observed on first and second floors, connected with two winding staircases on opposite ends of the structure. These lead to terraces with *barsatis* on the periphery. The façade is simpler in

¹²⁰ Sevchenko and Makhdum, "House No. D/3246" in *The Walled City of Lahore*. Pg. 149

¹²¹ Area calculated through AutoCAD drawings generated.

¹²² Sevchenko and Makhdum, "House No. D/3246". Pg. 149

¹²³ Ibid

¹²⁴ Ibid. Pg 150

comparison with other residences in the vicinity. It is made up of fair faced brickwork with traditional small brick units laid out with limestone mortar.¹²⁵

The case study is significant because of the preference given to the interior space compared to the exterior, which is treated as utilitarian, with little attention given to its decoration. The sectional analysis of the structure shows the vertical connection created through the internal courtyard, creating a link between different levels visually and environmentally. The clustering of rooms around the lightwell is an intelligent approach to control the climate within the residence and utilize the stack effect to create a cooler comfortable environment. The elevated terraces provide an outdoor space for residents offering them a connection to the bazaar while respecting their privacy. The height of the building establishes a strong architectural presence in the bazaar; because the upper two floors are semi open with *barsaatis*, the building does not come off as a monolithic block. It steps back in its elevational profile to avoid dominating the street façade on both sides.

¹²⁵ Ibid. Pg. 151-152



Fig. 33: House D/3264 - Street Facing Façade (Source: The Walled City of Lahore, publication by PEPAC)

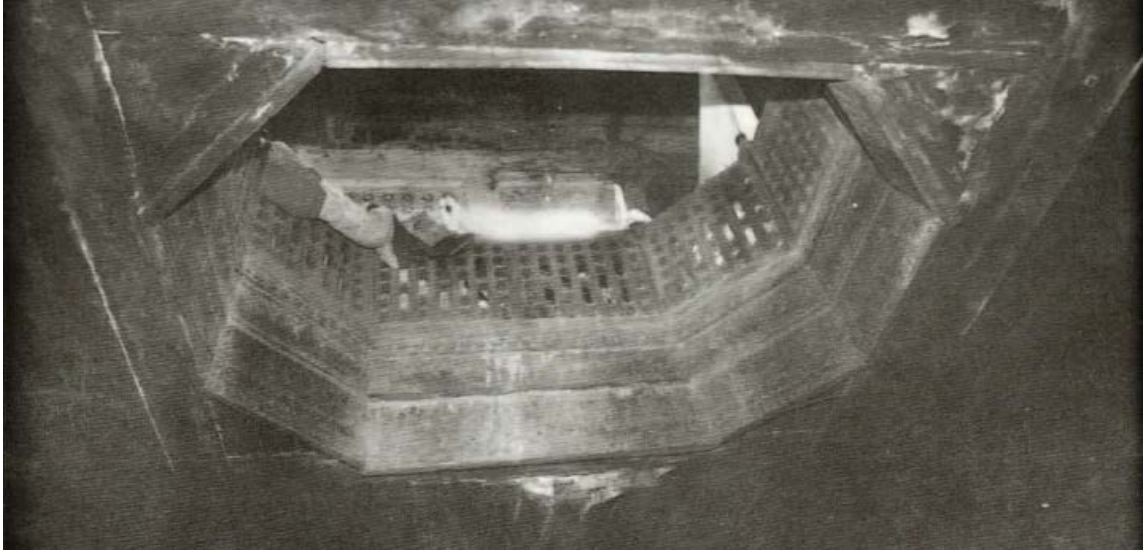
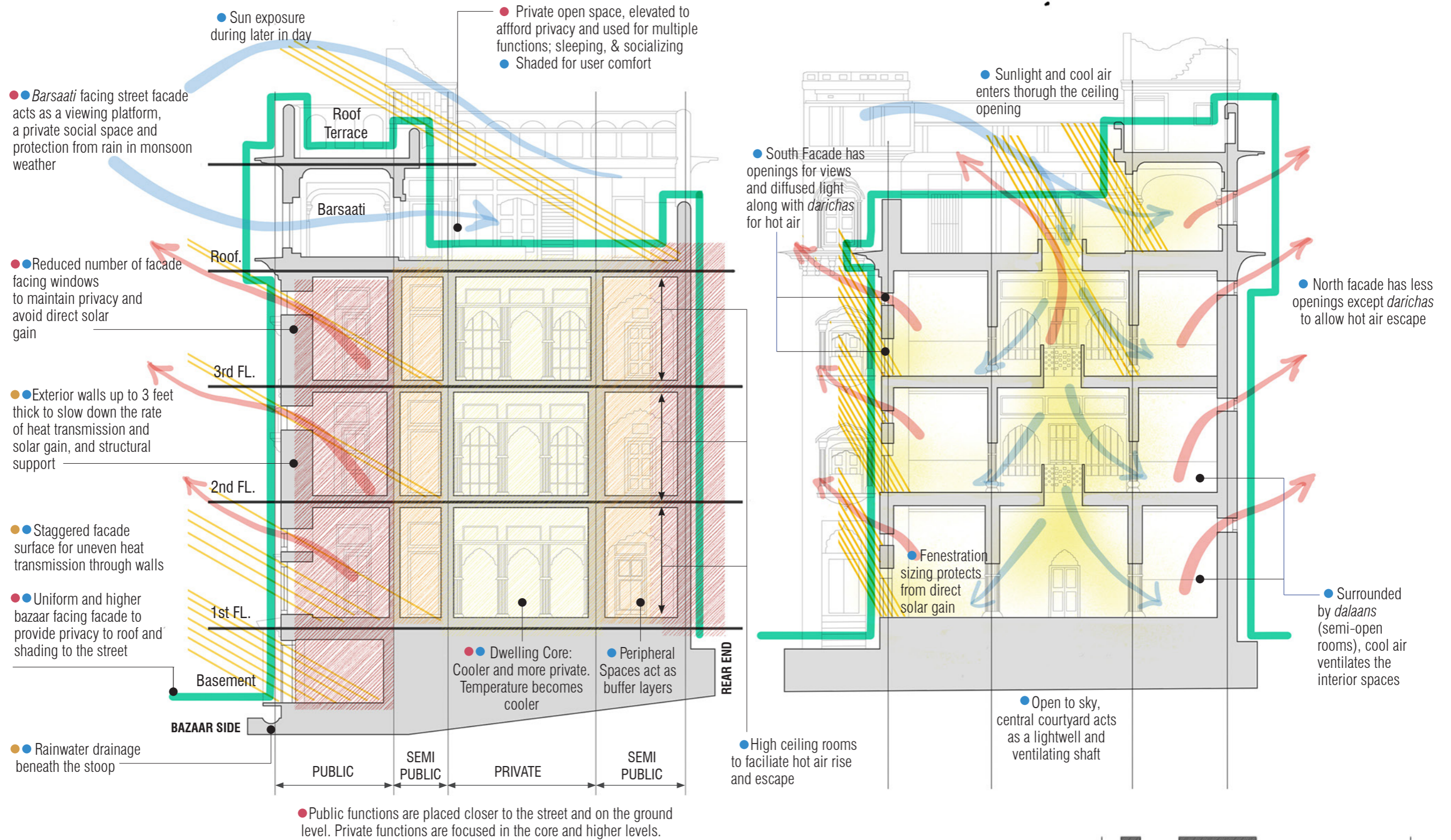


Fig. 34: Octagonal Mug in House D/3264 (Source: The Walled City of Lahore, publication by PEPAC)



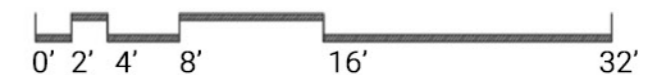
Fig. 35: Window Detail on South Facade of House D/3264 (Source: The Walled City of Lahore, publication by PEPAC)



Legend

- ENVIRONMENTAL
- CULTURAL
- TECHNICAL

Source: Margaret Sevckenko and Rashid Makhdum, eds., *The Walled City of Lahore* (Lahore: Lahore Development Authority, 1993).
 Courtesy of Walled City of Lahore Authority
 Author: Zara Shafiq Bhatti



HOUSE D/3264

LAHORE, PAKISTAN

4.3. Haveli Jama'adaar Khushal Singh
Lahore, Pakistan
(circa 1817)

Located on east side of Moti Bazaar, Haveli Jama'adaar Khushal Singh is part of Chuna Mandi Haveli complex that consists of two more havelis, covering approximately 2.7 hectares.¹²⁶ Haveli Khushal Singh covers approximately 28% of that area. The haveli complex hails from the Sikh period (1799 – 1849) of the subcontinent and is believed to have been built by one the influential courtiers of Maharaja Ranjeet Singh.¹²⁷

With a typical domestic plan reminiscent of several other residential architectural layouts prevalent in the subcontinent, the haveli is constructed with a dominant central open space, the courtyard, covering an area of 28,700 square feet approximately. The large size of the space is indicative of its importance in the local culture and its multi-purpose use by the inhabitant's. It was used for domestic purposes such as cooking, drying of spices alongwith holding social functions.

“As one enters the gateways, one gains access to an expansive *maidan* [open space]. Further east are houses for the servants to live in. Next to the northern gate, on the inner sides, are houses and *kothis* [bungalows] and on the side of the Chuna Mandi Bazaar are double-story buildings. The tall entrance *darwaza* [gate] of the larger haveli is magnificently constructed”¹²⁸

Entrance to the courtyard is gained through a gateway that performs as a semi-public buffer space by being the first point of entry. The courtyard also serves as an indoor garden with various plantings to provide shading, and cool the air entering the rooms

¹²⁶ Sevchenko and Makhdum, *The Walled City of Lahore*.Pg. 69

¹²⁷ Sevchenko and Makhdum.

¹²⁸ Ibid. Pg. 73

through it. As the plan is introverted, the rooms open towards the courtyard, hence the landscaped area not only facilitates in cooling the breeze, but also provides pleasant views to the dwellers. Verandahs, *jharokas* and *Chajjas* have been employed on the walls surrounding the courtyard to allow illumination and air circulation of inner spaces. The inward-looking layout also ensures privacy and a sense of security from the the bazaar outside, efficiently protecting the dwelling from noise, dust, and urban commotion of the street. The construction of the complex is completed using local brick and covered with lime to protect it from solar radiation. The exterior walls are 3 feet thick, protecting the spaces inside from immediate heat gain.

While the haveli employs several environmental values to acquire optimal user comfort, its priorities incline more towards fulfilling cultural expectation of the time. For example, the haveli is highly decorative, supporting ornamentation from different eras¹²⁹ on both inwards looking walls, and facades facing the street. Unlike other traditional dwellings, the haveli has a prominent, double height entrance, emphasizing the entry point without compromising its privacy, whereas other examples attempted to makes their entrances less conspicuous.

The Khushal Singh Haveli is a relevant example because of the high economic profile of the owner and its enormous size. While the design incorporates elements that symbolizes wealth and power, the haveli, simultaneously, is conscious of the environmental needs of the context as well.

¹²⁹ As the haveli changed hands, the new owners implemented their own style on the existing building.



Fig. 37: Sikh Architecture at Khushaal Singh Haveli. (Source: Awais Jibran)



Fig. 38: Arcaded area surrounding the courtyard at Khushaal Singh Haveli (Source: Awais Jibran)



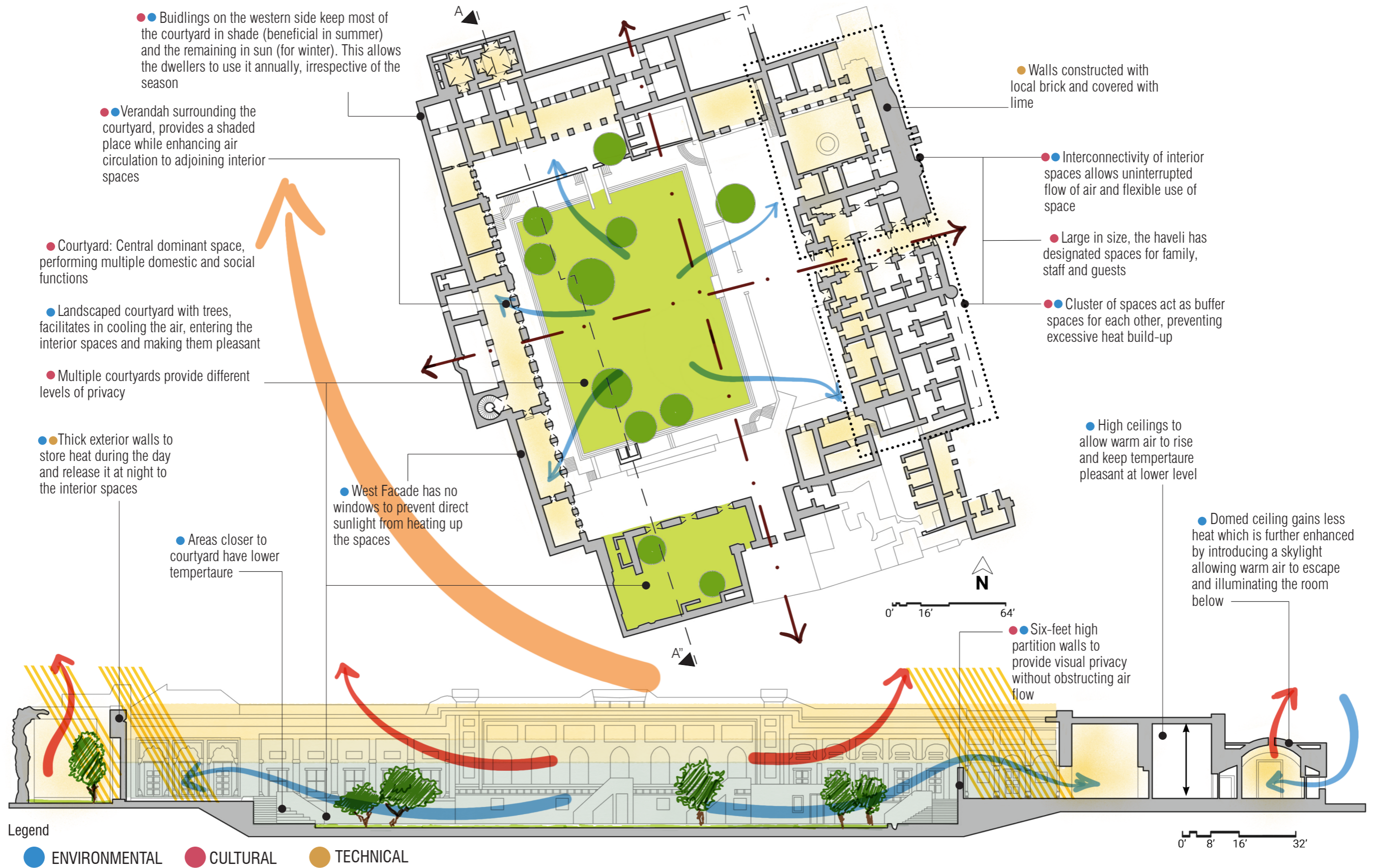
Fig. 39: Fresco work on the inside at Khushaal Singh Haveli (Source: Awais Jibran)



Fig. 40: Restored Jharoka of Khushaal Singh Haveli (Source: Awais Jibran)



Fig. 41: Historical Door of Khushal Singh Haveli still in use. The upper story shows arcaded areas, verandahs that facilitate in ventilation and visual connectivity (Source: Awais Jibran)



HAVELI KHUSHAAL SINGH

LAHORE, PAKISTAN

Source: Margaret Sevckenko and Rashid Makhdum, eds., *The Walled City of Lahore* (Lahore: Lahore Development Authority, 1993).
 Author: Zara Shafiq Bhatti

5. REFLECTIONS

Analysis of traditional dwellings of Lahore illustrates priorities that were given to environmental, cultural, and technical values in the past. Most of the dwellings were constructed with a focus on creating a comfortable interior environment for the user. Placement of rooms and fenestration facilitated air circulation while illuminating the interiors. Since these dwellings were constructed prior to access to electricity, they heavily dependent on utilizing natural resources such as sun and wind and using local construction materials. The use of brick was popular because of its cooling properties and availability.

Traditional dwellings had privacy as a prominent factor, that dictated the way the rooms opened and connected with each other, and user movement. The entrances of the houses were usually placed on the private side of the street and rarely faced the entrance of the opposite building. The dwelling respected their cultural demands along with incorporating the environmental needs. Even before sustainability was a known concept, these houses were practicing it without having a detrimental effect on the environment or compromising user needs and hence are great inspiration for contemporary design.

6. CONTEMPORARY USE OF TRADITION

“Houses in Lahore were well adapted to the climate and convenience of the people. No doubt (that) there were many knicks-knacks (present in English houses) which could be introduced into (Indian) Buildings (that) would tend greatly to the comfort and convenience of the people.”¹³⁰

Sir Ganga Ram
(London’s Society of Arts 1883)

This thesis proposes that a combination of tradition and modernity should be established.

To prove the statement, case studies from different periods have been analyzed. The traditional ones were studied to gain an understanding of principles that responded to the contextual demands. The contemporary ones have used these principles as their underpinning.

These case studies have been chosen based on the design ideology of the architect and their contextual rootedness. Each architect discussed has an established reputation for studying and incorporating traditional principles in their designs. Charles Correa has been referred to as one of “India’s greatest architects” and has been awarded the RIBA Royal Gold Medal (1984) and Aga Khan Award for Architecture (1988).¹³¹ Kamil Khan Mumtaz is an influential architect from Pakistan whose design ideology has been born out of traditional building practices which is evident in all his projects. He is known in the subcontinent for his endless work in search for a contemporary, appropriate architecture for Pakistan responsive to climate, economy and materials rooted in the indigenous culture. Raj Rewal is one of the leading architects of India who has been recognized for

¹³⁰ Glover, “Changing Houses.” Pg. 100

¹³¹ “Charles Correa: India’s Greatest Architect,” ArchDaily, May 15, 2013, <http://www.archdaily.com/373265/charles-correa-india-s-greatest-architect/>.

his work on domestic and international platforms. He has designed contemporary buildings, steeped in Indian traditions while utilizing innovative modern technology.¹³² His many accolades include Lifetime Achievement Award (2001) by Institute of Engineers (India) and Chevalier des Arts des Lettres award, 2005 by the French Government.¹³³

These case studies are tangible proof of how traditional principles can be adapted to meet contemporary demands. Each one of these case studies exhibit one or more principles discussed previously.

¹³² "Raj Rewal - Great Buildings Online," accessed April 24, 2018, http://www.greatbuildings.com/architects/Raj_Rewal.html.

¹³³ "Raj Rewal," *Wikipedia*, April 10, 2018, https://en.wikipedia.org/w/index.php?title=Raj_Rewal&oldid=835671086.

6.1. RAMKRISHNA HOUSE by Charles Correa
Shahibhag, Ahmedabad, India
1963

“We must understand our past well enough to value it... Architecture is not just a reinforcement of existing values – social, political, economic. On the contrary, it should open new doors – to new inspirations.”¹³⁴

Charles Correa

Charles Correa was one of the pioneer contemporary architects from India who believed in learning from the past to reach better solutions for the present. His work was never an imitation or recreation of historical buildings but studied traditional structures to create a context-responsive architecture.¹³⁵ He criticized modern architecture because of its reliance on mechanical cooling systems and its ‘alien nature’ in the Indian context.¹³⁶ He strived to develop sustainable ideas, responsive to the local climatic conditions and economically attainable by to the masses. His motto was “Form follows Climate” which I believe was not restricted to just the changing weather but also the social, economic, cultural, and political climate of the region.

Ramkrishna House was developed on his prototype called “tube house” that Correa designed as a sustainable low-income model, harnessing air movement to create comfortable interior environment. It was an economical and space-efficient model. Ramkrishna Hosue was developed on similar principles but represented the other end of the scale in cost and size. Built for mill owners in 1962, the house is designed along the east-west axis orientation, optimal for the Ahmedabad climate. Surrounded by green

¹³⁴ Khan, *Charles Correa*.

¹³⁵ Ibid.

¹³⁶ His use of term alien refers to the “foreign nature” of the mechanical systems in the Indian Context.

space, the structure was divided in to four zones; family, guest, cooking, services, each catering to needs varying from public to private. Correa exploited different floor levels to achieve privacy without introducing too many walls, while establishing visual links between different zones, both vertically and horizontally. Because all the walls do not extend to the ceiling, Correa was successful in circulating air from outside courtyards to interior spaces. Moreover, volumes were arranged to allow warm air to rise and escape, setting up convection currents of natural ventilation, a practice prevalent in traditional buildings through courtyards or lightwells as noted in traditional case studies. The house was constructed with exposed brick and concrete, with external walls up to 18 inches thick, facilitating in establishing a comfortable interior.



Fig. 43: Ramkrishna House (now demolished) by Charles Correa based on his "Tube Housing" design concept. (Source: Wink Brand Design)



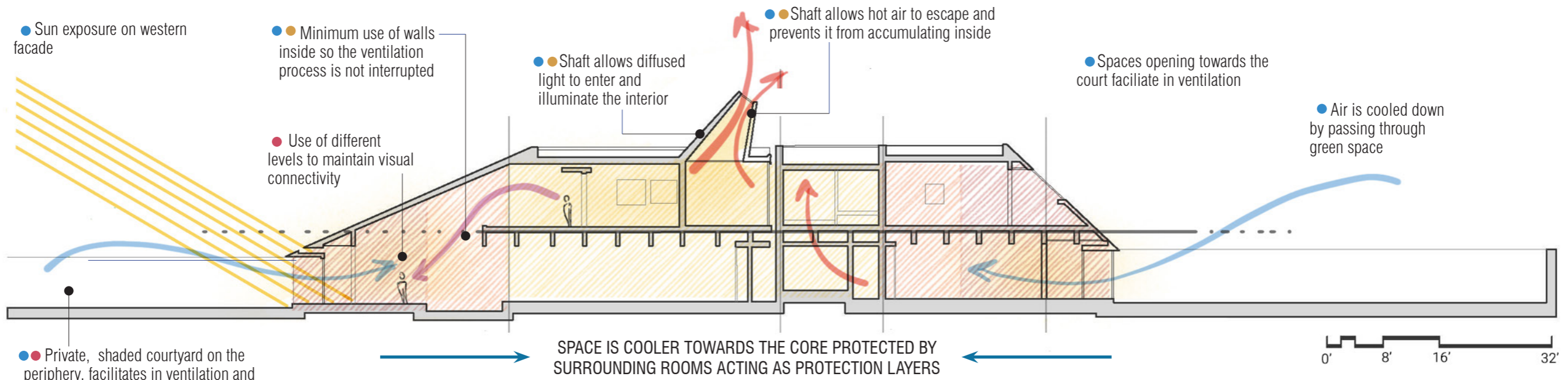
Fig. 44: Shaded entrance to Ramkrishna residence (Source: Hassan Uddin Khan)



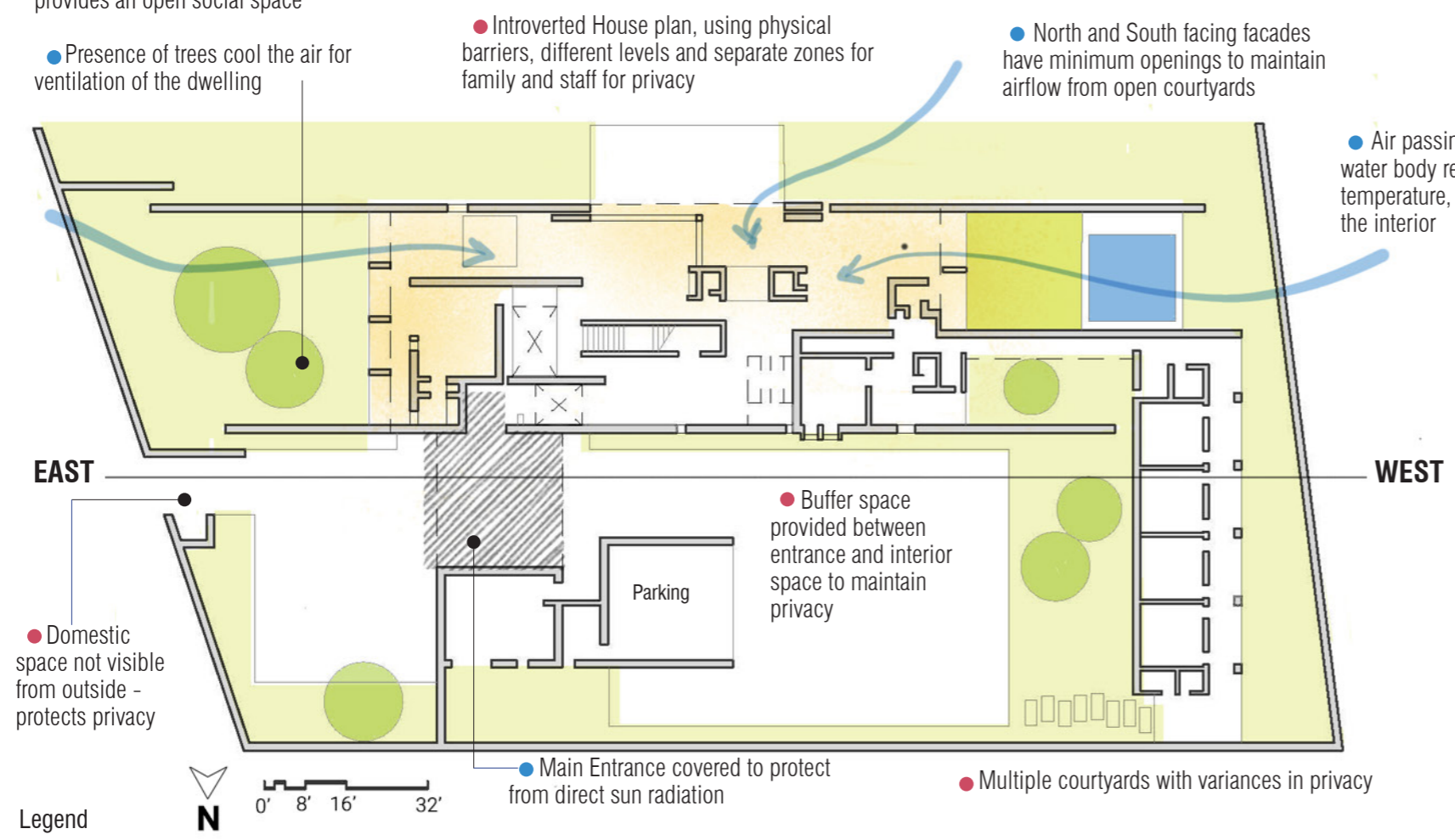
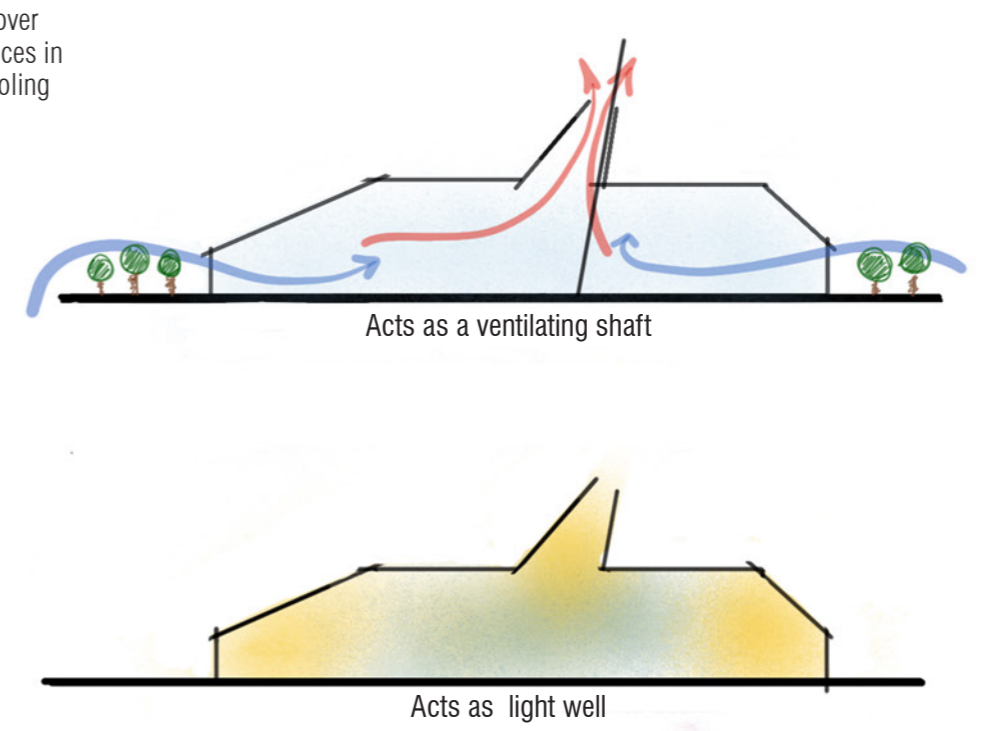
Fig. 45: Interior view of Ramkrishna Residence, showing visual connectivity (Source: Hassan Uddin Khan)



Fig. 46: "Tube House" concept of using a roof opening to illuminate and ventilate interior spaces (Source: Hassan Uddin Khan)



FOCUS ON CLIMATE RESPONSIVE DESIGN WHILE ACCOMMODATING RESIDENTS NEED FOR PRIVACY



- Legend
- ENVIRONMENTAL
 - CULTURAL
 - TECHNICAL

Source: Khan, Hassan-Uddin. *Charles Correa. Architects in the Third World*. London, UK: Concept Media Pte Ltd., 1987
 Author: Zara Shafiq Bhatti

RAMKRISHNA HOUSE

AHMEDABAD, INDIA

6.2. FRENCH EMBASSY STAFF QUARTERS by Raj Rewal
Chanakyapuri, New Delhi, India.
1967

“I have looked at the traditional architecture of north India to explore the underlying principles that could have relevance to our time”¹³⁷
Raj Rewal

Raj Rewal, like his older compatriot Correa, was a Western trained architect who questioned modernization in the traditional context of Indian culture. He critiqued Modern architecture in relation to the Indian context and strongly believed that an appropriate combination of the two is possible for better solutions.¹³⁸ He devoted his life's work incorporating historic precedents with contemporary building's expression.¹³⁹ He said, “Traditional Indian architecture has responded in the past to functional requirements concerning climate and community needs, and has evolved by trial and error through the centuries, a method of modulating space and light. I have, nevertheless, leaned on the modern architectural movement for structural logic, vigor and versatility.”

This case study was chosen because the project is considered one of the successful examples by Rewal where he achieved the combination between the past and present. It was his first multiple unit housing project that has strong indications of his western training and his traditional beliefs. The design is based on the studied Rewal conducted in f Jaipur of juxtaposed masses and winding streets, making this case study is essential to the paper. This housing project embodies the principles of traditional practice rather than recreating the historic building elements.

¹³⁷ Brian B. Taylor, *Raj Rewal* (Ahmedabad: Mapin Publishing Private Ltd, 1992).

¹³⁸ Ibid.

¹³⁹ Ibid.

The housing is an 8-unit project, with each unit about 650 to 750 square feet in area. The design is based on cluster typology, juxtaposing the units to create outdoor spaces with maximum connection to the interior while maintaining each unit's privacy. The housing focuses on four concerns:

- The hot climate of the region combined with the traditional Indian lifestyle to provide for courtyards: A traditional Indian family utilizes verandas and other open spaces to carry out domestic work and sometimes, use it as sleeping quarters on hot nights.
- Natural ventilation as the driving factor to ventilate interior spaces through verandahs, roof terraces and *jalis*. Due to the low economic profile of the user, dependency on mechanical systems for cooling is not possible.
- Protection of indoor spaces from direct solar gain by providing varied sizes of openings, depending on the façade.
- Providing each family with privacy by erecting walls up to 6 feet around open spaces as privacy is highly prioritized by Indian culture.

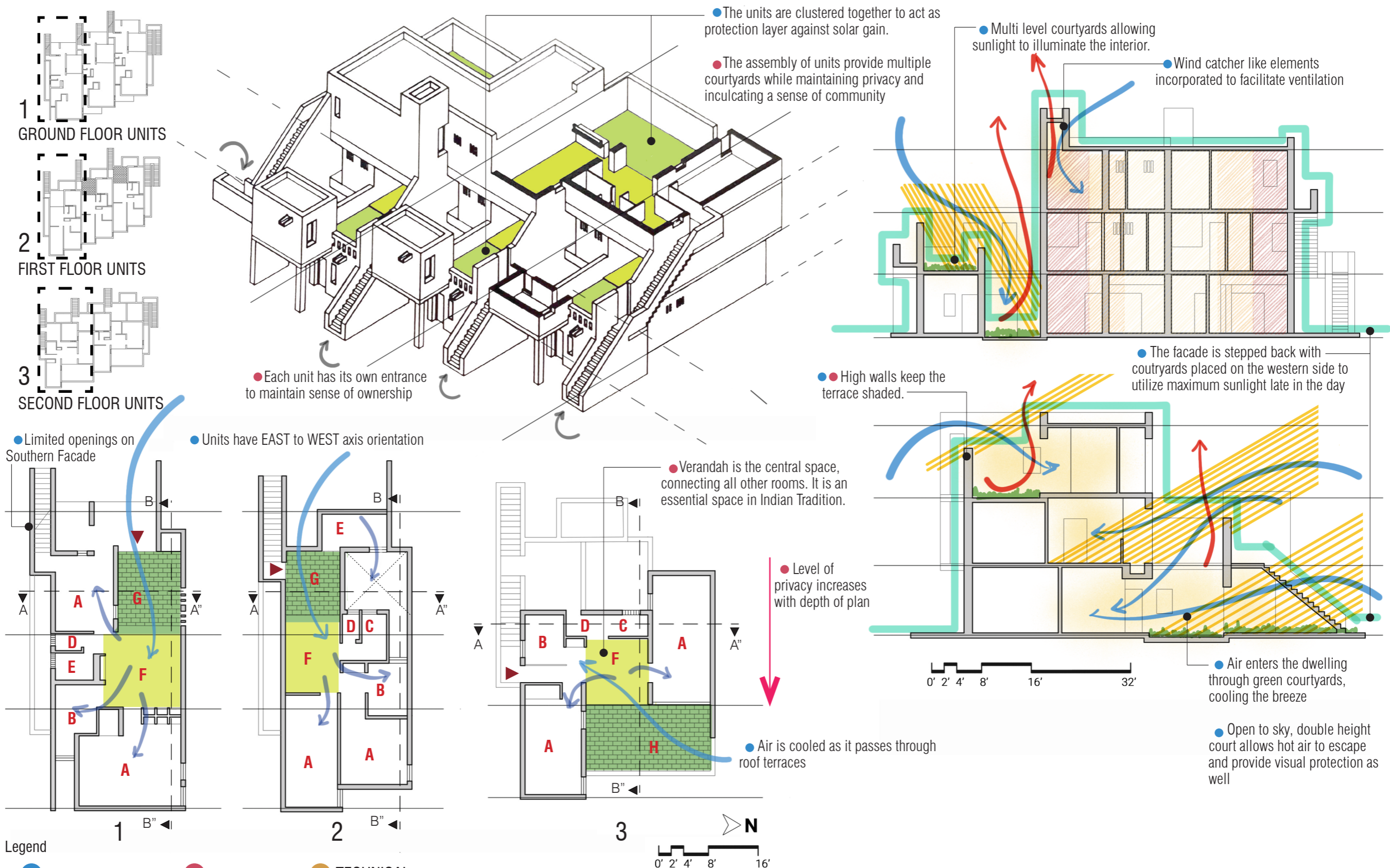
The clustering of units provides a protective layer to each unit and increases the building mass. The design is primarily climate conscious and has strived to incorporate the traditional lifestyle of the Indian working class. The architect has shown in-depth understanding of the contextual climate, keen sensitivity to the economic profile of the inhabitants by creating a passive design dependent structure and thoughtfulness towards the cultural environment prevalent in the region.



Fig. 48: Housing for French Embassy Staff by Raj Rewal (Source: MoMa)



Fig. 49: Western Facade of French Embassy Housing. (Source: Rajrewal.in)



FRENCH EMBASSY STAFF HOUSING

CHANAKYAPURI, NEW DELHI, INDIA (1967)

Source: Brian B. Taylor, *Raj Rewal* (Ahmedabad: Mapin Publishing Private Ltd, 1992).
 Author: Zara Shafiq Bhatti

6.3. BINA JAWAD RESIDENCE by Kamil Khan Mumtaz
Lahore, Pakistan
2015

"I think it is also a matter of continuing a tradition. In a contemporary sense, when you speak of tradition, we think of something which is already dead and buried, literally closed up in a museum. But for me, tradition is something which is alive, and to keep it alive you must practice it every day. You have to look at your environment, your situation, and your context."

Kamil Khan Mumtaz

Kamil Khan Mumtaz is the pioneer architect in the conservation of architectural heritage in Pakistan. One of the leading figures in Pakistan's architectural community, his design ideology seeks appropriate contemporary architecture through the revival of traditional building practices and design, responsive to the local context. His philosophy extends into the realms of architectural education too as he is a staunch advocate of traditional style of teaching; that is establishing the relationship of Master and Apprentice. Recipient of *Sitar-e-Imtiaz*,¹⁴⁰ an honorable civilian award granted by the Government of Pakistan, his tireless efforts focus on advocating, protecting, and reviving the architectural heritage of Pakistan.

This case study was selected on basis of an interview in which he stated that this residence was one of his most successful attempts at achieving his ideology.

Commissioned in 2008 and completed in 2015, Bina Jawad Residence is also called the "Har Sukh Mansion"¹⁴¹. In this design, Mumtaz has experimented with reinterpreting traditional construction systems while exploring traditional form and style.¹⁴²

¹⁴⁰ Awarded to individuals for "especially meritorious contribution to the security or national interests of Pakistan, world peace, cultural or other significant public endeavors".

¹⁴¹ The complex has a Cultural Arts Teaching School called "Har Sukh"

¹⁴² Zarminae Ansari, "Reinterpreting Traditional Structural Systems," ed. Maria Aslam, *ArchWorks*, Architecture Design Art, 2016, <https://archnet.org/publications/10784>.

The case study is an ideal example of how traditional low technology construction methods have been employed without complete dependence on modern science. Reminiscent of traditional havelis, it is a successful example of contemporary flat and ribbed domes made with local brick and covered with *Pukka-kalli*, a highly polished plaster to maintain a comfortable micro climate and reduces the overall building's carbon footprint.¹⁴³ The domed ceiling allows for larger spans without depending on steel reinforcement and concrete.¹⁴⁴

Because of the dual nature of spaces (residence and teaching center), the design clearly demarcates them upon entrance, maintaining privacy. The double height rib-arched entrance opens into a large landscaped area with living quarters grouped around a private courtyard on the left and public buildings on the right. The private courtyard allows air to circulate the residence, maintaining a comfortable environment on the interior. The building also utilizes verandahs covered with *jharokas* as connecting spaces in both public and private sections, providing visual privacy. The heightened walls employ convection currents and stack effect to achieve proper ventilation, warm air escape, and natural lighting into the dwelling. The traditional principles observed in the dwelling respects the family's privacy, while avoiding complete dependency on mechanical systems by utilizing environmental values.

¹⁴³ Ansari.

¹⁴⁴ Ibid.



Fig. 51: Har Sukh Mansion on the outskirts of Lahore. A multi-functional complex, accommodating residential apartments for a joint family and a cultural arts center featuring amphitheater, design studios, dance classes etc. (Source: Architecture Design Art)



●● Internal private courtyard with high walls to provide shade and visual protection from the public functions of the complex

●● The high ceilinged spaces employ convection currents and stack effect to achieve proper ventilation, and warm air escape

●● Walls constructed with local brick and covered with *Pukka-kalli*, to maintain a comfortable micro climate and reduces the overall building's carbon footprint

● The domed ceiling allows for larger spans without depending on steel reinforcement and concrete

●● Interconnectivity of interior spaces allows uninterrupted flow of air and flexible use of space

● Residence surrounded by landscaped area, bringing down high summer temperature of Lahore through evaporative cooling

●● Verandahs on both levels allow visual connectivity, foesting familial ties and cross ventilation of interior spaces

● High placed windows illuminate the interior spaces without exposing the user to harsh direct sunlight and allows warm air to escape.

● Tempertaures are lower closer to courtyard level

● High walls to keep the coutyard private

Legend

- ENVIRONMENTAL
- CULTURAL
- TECHNICAL

0' 2' 4' 8' 16' 32'

BINA JAWAD RESIDENCE

LAHORE, PAKISTAN (2015)

Courtesy of Kamil Khan Mumtaz Architects
 Author: Zara Shafiq Bhatti

6. DEMANDS OF “TODAY’S” PAKISTANI SOCIETY and RECOMMENDED STRATEGIES

Since partition, Pakistani society has changed a lot in terms of daily routines, family relationships, economic profiles, and acceptance of technology. However, this change is not sudden. It started paving its way when the traditional society was exposed to colonial legacy that became something to look up to (as pointed in historic narrative). The next phase of the change was upon independence and when the profession of architecture took wings in Pakistani context. In the mid-1950s, most of the architects practicing in Pakistan were trained from Western institutes and carried Modern ideologies. That is why Modern movement was felt so strongly in the upcoming urban and architectural designs. While Dioxidas designed the capital, Louis Kahn was invited to design the Capitol Complex in Dhaka, which was then East Pakistan, because modern architecture was synonymous to progress and development. Residential architecture followed closely behind, as it became a status symbol to live in a modern house.

Today, the society is still practicing these norms as they have adapted to the modern ideology. Traditionally, practices would conform to the user, the prevailing environment, and the local context. However today, it is the reverse; it is the user conforming to the practice. Unfortunately, architecture has ‘modernized’ more than the Pakistani society.¹⁴⁵ While the living environments symbolize modernity, they fail to fulfil user requirements. One argument could be that while the society is still adapting, it has still not fully let go of its traditional roots. While today's Pakistani aspires to have a full-length window, capturing

¹⁴⁵ Arshad, “Reassessing the Role of Tradition in Architecture.” Pg. 115

outside views, they are forced to draw the curtains to protect their privacy and to feel secure.

DEDUCTIONS

The purpose of analyzing these case studies was to call for a serious reconsideration of traditional principles. They have survived for so long and have continuously proven to be valid in environmental and cultural aspects and have important lessons to inform contemporary design. Following are the strategies derived from traditional principles and values that can be (and have been) employed in contemporary design to create responsive, sustainable architecture, that belongs to the local region. The proposed strategies are general and could be applied to different cases, irrespective of the economic profile of the user.

ORIENTATION

Presently, designs of the house and their orientation are dependent upon the plot size and facing. It is common practice in Pakistan to always orient the main façade towards the street, irrespective of the sun factor or prevailing winds. It would be ideal to discard the attachment to street facing houses and give preference to sun movement to illuminate spaces and wind capture for internal ventilation.

OUTDOOR and BUFFER SPACES

In Pakistani context, owning a land is a symbol of power and status. It is a commonly held belief that bigger land should always translate into a large house, with spacious rooms. To accommodate that, users are less inclined to incorporate outdoor open spaces in their dwellings, creating enclosed volumes dependent on mechanical means of cooling. Using traditional elements such as verandah, courtyard, or *barsaatis* can contribute to a well-

ventilated interior and allow accumulate warm air to escape, while simultaneously providing outdoor green spaces within the dwelling to improve users' mental and physiological health.

SPATIAL ORGANIZATION

Spaces in contemporary Pakistani dwellings are being designed to exist as independent entities, functionally and spatially unlike the traditional examples, where spaces were based on an open plan. In contemporary designs, that concept has been reversed. The rooms are now enclosed volumes with specified functions whereas traditional houses catered to multi-functionality of the space.

Contemporary designers should strive to dispel the rigidity associated with functionality of the rooms to create more flexible spaces, allowing the user freedom of choice in their use.

FENESTRATION PLACEMENT

Privacy is still a dominant factor in Pakistani culture. Dwellings are extremely intimate spaces that should not be viewed by an outsider, unless invited. Currently, contemporary designs include placing glass windows on every façade irrespective of its orientation. This allows views of inside from the outside, forcing residents to cover their windows with blinds or curtains, making the purpose of it redundant. Moreover, because of the spatial organization of rooms, path for cross ventilation is not established and dependency on mechanical cooling systems increases.

If traditional practices of interior open spaces could be introduced, along with placing windows to facilitate air circulation, optimal comfort level could be achieved in contemporary designs.

LOCAL MATERIALS

Application of indigenous materials along with modern technology can help create comfortable spaces that are not entirely dependent on heating and cooling systems. Earth related building materials such as brick are available abundantly and at affordable prices. Modern technology has modified these materials to improve their performance. For example, raw earth material converted to compressed earth blocks and mixed with a small percentage of cement, yield high load bearing capacity that has improved compressive strength and water resistance.¹⁴⁶ Also, manufacturing of these materials consumes about four times less energy than conventional fired bricks.¹⁴⁷

¹⁴⁶ "Traditional Building Materials and Design," ClimateTechWiki, accessed April 30, 2018, <http://www.climatetechwiki.org/technology/traditional-building-materials-and-design>.

¹⁴⁷ Ibid.

7. CONCLUSION

The purpose of the research paper is more than just to inform contemporary design in Pakistan. It is a harbinger to several rising issues, currently faced by both communities of Architecture and Preservation in the country.

Pakistan is becoming one of the most populated countries globally with a total population of 200,813,818 and Punjab makes up 52% of that.¹⁴⁸ The country is also facing a huge influx of migration towards urban centers with 38.4% of its population already residing in cities.¹⁴⁹ Urban centers are in high demand for housing to accommodate this large inflow. As a result, real estate business and land developers such as Bahria Housing Scheme, Defence Housing Authority (DHA), Askari Housing etc. have initiated housing projects across the country. While these projects are mostly focused on new construction on empty lands, this movement has also made landfall in the historic centers. Privately owned historical structures are facing demolition to make way for multi-unit housing or commercial plazas because of profitability. In new construction, the architecture community is faced with non-contextual, insensitive designs and in historic centers, unsupervised destruction of physical fabric threatens loss of heritage. These come with the added risk of losing the last vestiges of craftsmanship that is no longer or very rarely practiced by the laborers of Pakistan. The nation is confronted with the threat to both its tangible and intangible heritage.

This paper is not an answer to this large-scale problem but is a starting point. It is a call to action for professionals to realize the eminent danger of losing our heritage, our traditional

¹⁴⁸ Pakistan of Bureau of Statistics, Government of Pakistan – Accessed on February 13, 2018

¹⁴⁹ Ibid.

building practices for banal and unimaginative architecture. We are building stifling claustrophobic boxes that are not breathable structures, solely dependent on air-conditioning in a country that faces daily electricity blackouts for a minimum of 8 hours in a day. It also ignores the rural population that makes up 60.78% of the total population that do not have economic means to afford such living.¹⁵⁰ The solution to providing them with affordable housing, independent of mechanical systems lies in studying these endangered traditional dwellings.

Traditional dwellings paid equal importance and attention to their aesthetic, social and functional aspects. Unrestrained use and dependency of mechanical systems has given birth to an energy crisis in developing countries like Pakistan which they do not have the capacity to cope with it. Other countries globally have initiated serious efforts to return to natural resources and they can learn a lot from these traditional buildings that have been harnessing natural sources of energy (sun and wind) in their vernacular architecture.

Combined with the modern technology, new venues of research and application can be explored to come up with innovative and creative ideas that are not environmentally taxing or a threat to our heritage.

Examples discussed in the paper highlight the abundance of opportunities available in our traditional architecture. These buildings are just a starting point in achieving a sustainable way of living. A comprehensive understanding of traditional structures combined with application of modern science will help in revitalization of architecture. To achieve that,

¹⁵⁰ "Rural Population (% of Total Population) in Pakistan," accessed April 10, 2018, <https://tradingeconomics.com/pakistan/rural-population-percent-of-total-population-wb-data.html>.

traditional principles and values must be respected, understood, and applied according to the demands of the modern society.

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