

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE
ENGINEERING AND TECHNOLOGY

**THE PAKISTANI COURTYARD HOUSE:
A COMPARATIVE STUDY OF SPATIAL CONFIGURATIONS USING
SYNTACTICAL ANALYSIS**

M.Sc. THESIS

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Department of Architecture

Architectural Design Programme

MAY 2015

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

**PAKİSTAN’IN AVLULU EVLERİ:
UZAMSAL KONFİGÜRASYONLARIN SENTAKS ANALİZİ
KARŞILAŞTIRMASI**

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To my husband and family,

FOREWORD

Although a Pakistani by birth, I have never lived in Pakistan for an extended period of time, spending almost all my life in the Middle East instead. After getting my Bachelor in Architecture degree from American University of Sharjah, I always had a yearning to understand the Pakistani architecture better also. I thank my thesis advisor, Prof. Dr. Alper Ünlü for having supported me in doing my thesis on Pakistani architecture, which also meant having to travel to Pakistan, seeing much of the historic and contemporary architecture in person, including the case study sites. I would also like to thank all the architects who supported me and answered my questions while in Pakistan, including Akeel Bilgrami, Najeeb Omar, Shahid Abdullah, Tariq Hasan, and Kamil Khan Mumtaz.

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Naveen Iftikhar ALI
Architect

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THE PAKISTANI COURTYARD HOUSE: A COMPARATIVE STUDY OF SPATIAL CONFIGURATIONS USING SYNTACTICAL ANALYSIS

SUMMARY

The domestic architecture is an oft-neglected aspect of urban society in Pakistan, even though a majority of architecture is in fact residential in nature. Furthermore, domestic architecture is the most important kind of architecture as people spend a majority of their times in these dwellings and draw upon them to provide for the most basic of physical and psychological needs. As there are a wide variety of different housings types in Pakistan, this thesis focuses on analyzing a particular type, the courtyard house, and compares that with what can be considered an ideal courtyard house layout using syntactical analysis methods.

In order to perform a study on residential housing, a strong theoretical basis is provided in Chapter 2, which covers topics such as social group theory, social change, changes in cultural ecology and individual behavior, territoriality, as well as changes in spatial organization, personal space, privacy and behavioral modes. Additionally, particular cases of Pakistani society are discussed in order to better understand how theory relates to the current situation in Pakistan. To highlight points of particular importance, social change theory refers to the idea that society moves forward by either dialectical or evolutionary processes that can be driven by cultural, economic, religious, scientific or technological forces. *Gemeinschaft* and *Gesellschaft* are two contrasting terms that best explain the transformation of the Pakistani society to its current form. *Gemeinschaft* is commonly translated as “community”, where a group of people is considered more important than the individual whilst *Gesellschaft* is translated “society” where the individual and his interests take priority over the needs of the community. Historically, Pakistani society was predominantly a *Gemeinschaft* one where people lived in large joint family structures in close proximity or in the same residence, having a common understanding of social interactions, values and beliefs. However, with the increase of capitalistic economy, more independent living, scattered families and large cities, *Gesellschaft* tendencies have progressively become more dominant in the social structure of Pakistan. The exchange of people, goods, information, ideas and mentalities has ultimately made the larger cities like Karachi and Lahore, centers of great change.

With regards to understanding the modern courtyard house, one needs to be familiar with the origins of the dwelling and the long and varied history of architecture that the house draws inspiration from. Therefore, Chapter 3 follows the developments of the first rural dwellings found in the Indian sub-continent, the adaptation of these houses as the needs of the rural man changed, the urban houses that took these rural houses as their basis and the courtyards which first started to appear at this time into more developed urban courtyard houses that were adapted to the urban lifestyle. These houses were then reformed to the haveli house-type – the precursor of the modern day courtyard house.

In greater detail, the rural house was the first prototype for the material aspects such as the house plan and non-material like customs and traditions. It became an established norm for the house to be divided into 3 parts: (1) the back with the hearth, (2) the central space and (3) the verandah. There was an amorphous use of space where each room could be adapted according to the needs present at the time due to a relative lack of furniture. This fixed pattern was seen through all stages of all development in both the rural and urban houses. The changes in layout in the urban house were brought about by the rise in commercialization, facilitating the introduction of the internal courtyard, and the Khadki room at the front of the dwelling to receive clients and business associates. Other key changes made to the residence were that the rear no longer contained the hearth and so became a place for storage and sleeping; and the ground floor was further divided into 8 parts which consisted of: a three-part rear, a two-part front, the central open courtyard and two extra rooms on one side of the courtyard.

Majority of Muslim and Hindu urban dwellings were indistinguishable with the exception of an added wing in Muslim houses. These wings consisted of the women's area, hearth and various services and were primarily added due to the increased consideration for privacy in light of the observance of 'Purdah' whereby gender segregation was required. Continuing on with this theme, when expanding, the focus remained on growing laterally as higher floors were considered as breaching the privacy neighbors, however when additional floors were added, they contained shed-like rooms with the remaining floor functioning as an open terrace.

In terms of the third stage of development, havelis are essentially a grand version of the common urban house. The architectural features remained the same – only increasing in dimensions and numbers, underlining the conservatism present in the domestic architecture. The haveli remained more or less rural apart from the refinements in decorative elements and changes in function. Additionally, the upper floors had generally the same layout of rooms as the ground floor, which was similar to the rural house. The difference between the two being that in the rural there were no windows whereas in the haveli, they were present in abundance – all fitted with bars for security purposes. As the number and sizes of rooms increased, it allowed the house to be easily partitioned into separate areas for different members of the family.

Following the development of rural, urban dwellings and havelis, it became essential to examine the contemporary residences being built in Pakistan. Keeping in mind that current architects are now returning and focusing on the revival of courtyard houses that were once commonly occurring, the intention of this thesis was to syntactically analyze the contemporary courtyard houses and compare the various spatial configurations with an ideal courtyard house.

In order to conduct the analysis, "Syntax2D" software was used to study the floor plans of various spatial configurations, using visibility graphs. A total of 7 plan samples were chosen from Karachi based on 2 types of courtyard houses: (1) Single central courtyard typology and (2) Multiple courtyard typology. The intent of the thesis was to explore the relationships between spaces to observe how integrated or segregated they are; which spaces and activities are connected to the courtyards and whether there are any particular reasons for them being situated where they are as well as to learn the nature of the courtyards – the purpose they serve and whether these functions change from floor to floor. Therefore, the ground and first floor plans were analyzed within each typology and then the mean results of Type 1 and Type 2 were compared and contrasted together syntactically, sociologically and

functionally. The data collected included the Isovist Area, Isovist Perimeter, Circularity, Connectivity, Mean Depth and Integration. Furthermore, each floor plan was divided into 4 categories: (1) Courtyard Area: consisting of courtyards, verandahs and related spaces; (2) Bedroom Area: including bedrooms, bathrooms, dressing rooms and related spaces; (3) Living Area: Formal and informal living rooms, dining room, entrance hall and related spaces; and (4) Services Area: containing grease and main kitchens, servant quarters, storage and related spaces. The measurements were then documented for each room by taking averages of all cells that lay within the confines of each room and were recorded in a tabular format to evaluate.

Based on the research and knowledge gathered, the hypothesis was that the contemporary courtyard houses following the single central courtyard typology would have a better connectivity and be more compact in comparison to the multiple courtyard typology with non-central, dispersed courtyards which would have a deep plan, causing spaces to be more segregated and isolated from each other.

Chapter 5 compares and contrasts the case studies of Type 1 and Type 2 residences in regards to the 4 categories. When looking at the “Courtyard Area”, the courtyards in Type 1 function as the traditional courtyards in that they are multipurpose spaces located centrally with intermediary spaces around it. In Type 2, the courtyards begin to serve different functions for different spaces such as for views alone, ventilation or storage of items. The courtyards begin to lose their importance within the house and start becoming intermediate to tertiary spaces as adjacent spaces begin to define the role of the courtyards and so at times, they merely become pockets of green spaces - located on the periphery of the dwelling appearing in all shapes and sizes. Saying that, both Type 1 and 2 courtyards maintain the ability to internalize the dwelling, allowing for more private spaces by internalizing the aesthetics and functions – thus creating a more secure dwelling.

In terms of the “Bedroom Area”, the location of bedrooms in Type 1 is more clearly defined as they usually appear in the most private zone of the residence. This is not the case in Type 2 as they appear throughout the housing layout in both public and private zones.

Looking at the “Living Area”, it appears that there is greater definition in terms of the location of spaces in Type 1 than Type 2, as seen with the bedrooms. In Type 1, the informal living room is always situated in the more private zone and is well connected to other spaces whilst the formal appears in the public area close to the main entrance and generally, segregated from other spaces. In Type 2, there is no clear definition as to the location of informal and formal living rooms, which change with every project – not only within the floor plan but also the various floors.

The “Services Area” in Type 2 are also scattered throughout the plan. A similarity between Type 1 and 2 is in respect to the servant quarters, where they all are segregated from the rest of the house and have to be accessed from outside.

The conclusive remarks are presented in Chapter 6, which basically comment on the changes in Pakistani society that has led to the adaptation and evolution of courtyard houses. Factors such as privacy, personal space and the need for territoriality have all increased over time causing spatial organization to be reconsidered in the newer structures. In the exploration of various courtyard typologies, some of the meaning and importance of courtyards has been lost. In other cases, courtyard spaces remain the same as in older homes and havelis but are termed differently to keep up with changing ideas, values and beliefs..

PAKİSTAN’IN AVLULU EVLERİ: SPATIAL CONFIGURATIONLAR’IN SYNTAX ANALYSIS KARSILASTIRMASI

ÖZET

Mimarlığın çoğunluk bölümünün aslında konut ile ilgisi olmasına rağmen, konut mimarlığı Pakistan’da kentsel toplumun sıkça ihmal edilen bir özelliğidir. Dahası, insanlar zamanlarının çoğunluğu bu konutlarda harcadıklarından ve en temel fiziksel ve psikolojik ihtiyaçlarını karşıladığından konut mimarisi mimarinin en önemli türüdür. Pakistan’da çok çeşitli konut türleri olduğundan, bu tez, belirli bir tip yani avlulu ev analizine odaklanmaktadır ve sözdizimsel analiz yöntemlerini kullanarak ideal bir avlulu evin düzeninin nasıl olacağını karşılaştırmaktadır.

Konut binaları hakkında bir çalışma gerçekleştirmek için, Bölüm 2’de güçlü bir teorik temel sağlanmaktadır, sosyal grup teorisi, toplumsal değişim, kültürel ekoloji ve bireysel davranış değişiklikleri, sınırlama ve bunların yanı sıra mekansal organizasyon değişiklikleri, kişisel alan, mahremiyet ve davranışsal modlar gibi konuları kapsamaktadır. Ayrıca, teorinin Pakistan’daki mevcut durum ile olan ilgisini daha iyi anlamak için Pakistan toplumunun belirli durumları da ele alınmıştır. Toplumsal değişim teorisi, özel önem teşkil eden noktaları vurgulamak amacıyla, kültürel, ekonomik, dini, bilimsel ve teknolojik güçler tarafından tahrik edilebilen diyalektik ya da evrimsel süreçlerle toplumu ileri doğru götürme fikrine atıfta bulunur. Gemeinschaft ve Gesellschaft Pakistan toplumunun şu anki durumuna dönüşümünü en iyi açıklayan iki zıt terimdir. Gemeinschaft bir grup insanın bireyden daha önemli olduğunu kabul eder ve yaygın olarak “topluluk” olarak çevrilir, Gesellschaft ise bir birey ve onun çıkarlarının topluluğun ihtiyaçlarına göre önceliğini vurgular ve "toplum" olarak çevrilir. Tarihsel olarak, Pakistan toplumu ağırlıklı olarak insanların sosyal etkileşimler, değerler ve inançlardan oluşan ortak bir anlayışa sahip, yakın ya da aynı konutta büyük birleşik aile yapıları olarak yaşayan bir Gemeinschaft idi. Ancak, kapitalist ekonominin artması ile, daha bağımsız yaşam, dağınık aileler ve büyük kentler ile birlikte, Gesellschaft eğilimleri giderek Pakistan’ın sosyal yapısında daha baskın hale gelmiştir. İnsanların, malların, bilginin, fikirlerin ve zihniyetlerin değişimi sonuç olarak Karaçi ve Lahor gibi büyük şehirleri büyük değişim merkezleri haline getirmiştir.

Özel konutlar gibi birincil bölgeler – inzivaya çekilecek bir yer sağladıklarından, aile ve toplum içinde belli bir imaj ve statü üstlenecek bir yer olduğundan kent sakinlerinin hayatlarının merkezinde yer almaktadır. Toplumun dönüşümü ile bu konutların içindeki çeşitli alanların kullanımı ve kontrolü zaman içinde cinsiyet, yaş ve faaliyetlere göre değişmiştir. Açıkça, bölmeler daha ayrılmış ve spesifik olacak şekilde zamanla daha sağlam şekilde oluşmuştur. Ayrıca, bu alanlarda etkileşim halinde bulunan aile üyeleri zamanla daha kişisel alan ve gizliliğe sahip olmuşlardır. Modern avlulu evi anlamak açısından, kişinin bir konutun kökenine ve evin ilham aldığı uzun ve çeşitli mimari tarihine aşina olması gerekir. Bu nedenle, 3. Bölümde Hint alt-kıtasında bulunan ilk kırsal konut gelişmeleri, kırsal insanın ihtiyaçları değiştikçe bu evlerin uyarlanması, bu kırsal evleri temel olarak alan kentsel evleri ve ilk olarak daha gelişmiş kentsel avlulu evler olarak görülmeye başlayan kentsel

yaşam tarzına adapte edilmiş avlular takip edilmektedir. Bu evler daha sonra *haveli* ev tipine dönüşmüştür – bu da günümüz avlulu evin habercisidir.

Daha detaylı olarak, kırsal ev, ev planı gibi maddi ve gelenek ve görenekler gibi maddi olmayan özellikler için ilk prototip olmuştur. Bu 3 bölüme ayrılabilen ev için oluşturulmuş bir norm haline gelmiştir: (1) şömine içeren arka bölüm, (2) merkez alan ve (3) veranda. Her odanın mevcut zamanda göreceli olarak mobilya eksikliğine bağlı olarak ihtiyaçlara göre uyarlanabilir amorf bir mekan kullanımı vardı. Bu sabit desen, hem kırsal hem de kentsel evlerde tüm gelişim aşamalarında görülmüştür. Kentsel ev düzenindeki değişiklikler, ticarileşmenin artması ile, iç avlu girişinin kolaylaştırılmış ve konutun ön bölümünde bulunan Khadki odasının müşteriler ve iş ortaklarını ağırlanmasını sağlamıştır. Konutta yapılan diğer önemli değişiklikler arka bölümün artık şömine içermemesi ve bu nedenle depolama ve uyumak için bir mekan haline gelmesidir; ve zemin kat üç parçalı arka, iki parçalı ön, merkezi açık avlu ve avlunun bir tarafında bulunan iki ekstra oda içeren 8 mekana bölünmüştür.

Müslüman ve Hindu kentsel konutlarının çoğunluğu Müslüman evlerinde bulunan ekli kanat dışında ayırt edilemez. Bu kanatlar kadınların alanı, şömine ve çeşitli hizmetlerden oluşmuş ve öncelikle cinsiyet ayrımının gerektiği 'Peçe'nin gözetilmesi ışığında gizliliğe verilen artan önem nedeniyle eklenmiştir. Bu tema ile devam ederek genişlediğinde, ek katlar ilave edilmesinin komşuların gizliliğini ihlal etmek olarak kabul edildiğinden odak yanal olarak büyümede kalmıştır ancak ek katlar eklendiğinde, açık teras olarak işlev gören kalan zemin ile birlikte baraka benzeri odalar içermiştir.

Gelişiminin üçüncü aşaması açısından, haveli esasen ortak kentsel evin büyük bir versiyonudur. Mimari özellikleri aynı kalmıştır - sadece, boyutları ve sayıları artmış, konut mimarisindeki mevcut muhafazakârlığı vurgulamıştır. Haveli, fonksiyon değişiklikleri ve dekoratif elemanları ayrıntılandırmaları dışında az çok kırsal kalmıştır. Ayrıca, üst katlarda kırsal konuta benzer şekilde zemin kat olarak genellikle aynı plana sahipti. İkisi arasındaki fark; herhangi bir pencerenin bulunmaması, havelide ise bolca mevcut olmasıdır - tümü güvenlik amaçlı çubuklarla donatılmıştır. Odaların büyüklükleri ve sayıları arttıkça, evin ailenin farklı üyeleri için ayrı alanlara kolayca bölünmesi sağlanmıştır.

Kırsal, kentsel konut ve haveli gelişimini takiben, Pakistan'da inşa edilen çağdaş konutları incelemek gerekli hale gelmiştir. Mevcut mimarların artık zamanında oldukça görünen avlulu evlerin canlanmasına dönmesi ve odaklanmasını akılda tutarak, bu tezin amacı sözdizimsel olarak çağdaş avlulu evleri analiz etmek ve ideal bir avlulu evin çeşitli mekansal yapılandırmalarını karşılaştırmaktır.

Analizi yapmak için, görünürlük grafikleri kullanarak, çeşitli mekansal konfigürasyonlarda kat planlarını incelemek için "Syntax2D" yazılımı kullanılmıştır. 2 tür avlulu eve dayalı olarak Karaçi'den toplam 7 plan örneği seçilmiştir: (1) Tek orta avlu tipolojisi ve (2) Birden çok avlu tipolojisi. Tezin amacı mekanlararası ilişkilerin nasıl entegre ve ayrılmış olduklarını; hangi mekan ve aktivitelerin avlularla bağlantılı olduğunu ve oldukları yerde özel nedenlerle mi konumlandıklarını gözlemlemek – hizmet amaçları ve bu fonksiyonların kattan kata değişip değişmediğini keşfetmektir. Dolayısıyla, zemin ve birinci kat planları her tipolojide analiz edilmiş ve sonrasında Tip 1 ve Tip 2 ortalama sonuçları karşılaştırılmış ve sözdizimsel, sosyolojik ve işlevsel olarak bir arada kıyaslanmıştır. Toplanan veriler Eşgörü Alanı, Eşgörü Çevre, Dairesellik, Bağlantı, Ortalama Derinlik ve Entegrasyonu içermiştir. Ayrıca, her kat planı 4 kategoriye ayrılmıştır: (1) "Avlu Alanı: avlular, verandalar ve ilgili alanlardan oluşur; (2) Yatak Odası Alanı: yatak

odası, banyo, soyunma odaları ve ilgili mekanlar dahil; (3) Oturma Alanı: Resmi ve gayri resmi oturma odası, yemek odası, giriş holü ve ilgili alanlar; ve (4) Hizmetler Alanı: gres ve ana mutfak, hizmetçi alanları, depolama ve ilgili mekanları içerir. Ölçümler daha sonra her oda sınırları içinde bulunan ve değerlendirmek amacıyla bir tablo formatında kaydedilmiş tüm hücrelerin ortalamaları alınarak her oda için belgelenmiştir.

Araştırma ve toplanan bilgiye dayanarak, hipotez tek bir merkezi avlu tipolojisini takip eden çağdaş avlulu evlerin, daha iyi bir bağlantıya ve mekanların daha ayrı ve birbirinde izole olabileceği derin bir plana sahip olduğu ve dağınık avlulu çoklu avlulu tipolojisi ile merkezi olmayanı karşılaştırarak daha kompakt olacağı yönünde olmuştur.

5. Bölüm, 4 kategori ile ilgili olarak Tip 1 ve Tip 2 konutlarının durum çalışmalarını karşılaştırmakta ve kıyaslamaktadır. "Avlu Alanı"na bakarsak, geleneksel avlu olarak Tip 1 işlevi olan avlular, etrafında ortalama mekanlar ile merkezi bir konumda bulunan çok amaçlı mekanlardır. Tip 2'de ise, avlular ise yalnız görünüm, havalandırma veya malzemelerin depolanması amacıyla farklı mekanlar için farklı işlevlere hizmet etmeye başlar. Avlular evin içinde önemlerini kaybetmeye başlamışlardır ve bitişik alanlar avluların rolünü tanımlamaya başladığından üçüncül mekana aracı olmaya başlamışlardır ve bu durumda, sadece yeşil alan cepleri haline gelmişlerdir - tüm şekil ve boyutlarda görünen konutların çevresinde bulunurlar. Böylece daha güvenli bir konut oluşturarak - Tip 1 ve 2 avlular, estetik ve fonksiyonlarını içselleştirerek daha özel alanlar için konutu içselleştirmek yeteneklerini korurlar.

Genellikle konutun en özel alanında göründüklerinden, "Yatak Odası Alanı" açısından, Tip 1'de yatak odalarının konumu Tip 2'den daha net tanımlanmıştır. Toplu ve özel alanlarda konut planı içinde göründüklerinden Tip 2'de durum böyle değildir.

"Yaşayan Alan"a bakıldığında, yatak odasında görüldüğü gibi Tip 1'de mekanların konumu açısından Tip 2'ye göre daha büyük bir tanım olduğu görülmektedir. Tip 1'de, gayri resmi salon her zaman daha özel alanda yer alır ve diğer alanlarla bağlantısı iyidir, resmi olan ise ortak alandadır ve ana girişe yakın ve genellikle diğer alanlardan ayrılmıştır. Tip 2'de, her projede değişen – sadece kat planında değil aynı zamanda çeşitli katlarda - resmi ve gayri resmi salonların konumu ile ilgili açık bir tanım yoktur.

Tip 2'deki "Hizmetler Alanı" da plan boyunca dağılmıştır. Tip 1 ve 2 arasındaki bir benzerlik hepsinin evin geri kalanından ayrılmış ve dışarıdan erişilebilir hizmetli alanları açısından.

Avlulu evlerin adaptasyonu ve evrimine yol açan Pakistan toplumundaki değişiklikler hakkında temel olarak yorum yapan 6. Bölümde sonuçlar sunulmuştur. Gizlilik, kişisel alan ve sınırlama ihtiyacı gibi faktörler, yeni yapıların yeniden ele alınması için zaman içinde mekansal organizasyona neden olarak artmıştır. Çeşitli avlu tipolojilerin keşfinde, avluların anlam ve öneminin bir kısmı yok olmuştur. Diğer durumlarda, avlu alanları eski evlerde ve haveli'de olduğu gibi aynı kalmış ancak değişen fikirler, değerler ve inançlara ayak uydurmak için farklı adlandırmıştır.

1. INTRODUCTION

The domestic architecture is an oft-neglected aspect of urban society in Pakistan, even though a majority of architecture is in fact residential in nature. Furthermore, domestic architecture is the most important kind of architecture as people spend a majority of their times in these dwellings and draw upon these dwellings to provide for the most basic of physical and psychological needs. As there is a wide variety of different housing types in Pakistan, this thesis will attempt at analyzing a particular kind of house, the courtyard house, and compare that with what can be considered as an ideal courtyard house layout using syntactical analysis methods.

To perform a study on residential housings, a strong theoretical basis is needed, which is covered in detail in Chapter 2 of this thesis. This includes a discussion on social theory and social change, in general as well as in the particular cases of Pakistani society, as well as how residential dwellings have changed due to the factors that affect domestic architecture.

To try to understand the modern courtyard house, one needs to understand the origins of this house and the long and varied history of architecture that these dwellings draw inspiration from. Therefore, Chapter 3 follows the developments of the first rural dwellings found in the Indian sub-continent, the adaptation of these rural houses as the needs of the rural man changed, the urban houses that took these rural houses as their basis and the courtyards which first started to appear at this time, the more developed urban courtyard houses adapted to the urban lifestyle, and how these houses then reformed to the *haveli* house-type – the precursor of the modern day courtyard house.

The hypothesis of this thesis is that the contemporary courtyard houses following the central single courtyard house layout have better connectivity and smaller depth in comparison to other courtyard houses with distributed and non-central courtyard houses. This is explained in Chapter 4, along with the syntax analysis terminologies and methods that have been used to carry out this comparison. To mention briefly, 7 plan samples from Karachi were selected of two courtyard house typologies: 3

samples from the single central courtyard typology and 4 from the multiple courtyard typology. The ground floor and first floor plans were analyzed using a software program called Syntax2D and the results were analyzed in terms of 4 categories: the Courtyard Area, Bedroom Area, Living Area and lastly, the Services Area, which were then recorded in a tabular format.

Chapter 5 outlines the actual analysis done by presenting results for each floor of each residence. After looking individually at each case study, a comparison was done between the two typologies. This was achieved by taking averages for each room type in each house and next, the mean value across the houses in each type and comparing these results.

Chapter 6 presents the conclusion and overall findings from this research. To mention a few points, it was discovered that with the change in society, has come an adaptation and evolution of courtyard houses in Pakistan. Whilst exploring the two courtyard house typologies however, it was observed that some of the meaning and importance of the courtyards have been lost at times and the overall flexibility and adaptability of this space has been reduced over time due to the design of spaces and the presence of specialized furniture. To address the hypothesis, the belief at the beginning of the research was that single central courtyard typology would be the ideal configuration providing a network of compact and well-connected spaces but the syntax analysis indicated otherwise. The results demonstrated that the multiple courtyard typology as an adaptation retains the core elements present in the traditional single courtyard house and that more houses could follow this layout in the future.

2. THEORETICAL FRAMEWORK

2.1 Gemeinschaft And Gesellschaft: Social Group Theory & Social Change

Social change refers to an alteration in the social order of a society, which could possibly be brought about by changes in nature, social behavior, institutions, or social relations. It begins to suggest the idea that society moves forward by dialectical or evolutionary processes that may be driven by cultural, economic, religious, scientific or technological forces (Harper, 1993), which is the case in Pakistan. With the society moving forward, it becomes imperative to understand how the society is changing, the direction it is moving in, as well as recognize the factors that are responsible for influencing this change.

Gemeinschaft & Gesellschaft are two opposing terms coined by the German sociologist Ferdinand Toennies in 1887 as tools to describe social ties. Communities and people tend to show varying levels of Gemeinschaft and Gesellschaft behavior.

Gemeinschaft, commonly translated as “community” describes groups in which the “community” has a higher importance than the individual. The needs of the group are equally important, if not more important, than the needs of the self and the importance of morals and beliefs guide the overall behavior of the people. A strong sense of loyalty, trust, strong personal relationships, strong families and simple social institutions define such communities where order is maintained by silent accord without the need to enforce social control and the status of the individual is ascertained by the community.

The theory of Gemeinschaft assumes that all humans are connected to each other by either blood or marriage. In this state, people are either part of the *kinship group*, the *neighborhood*, sharing *friendship* or sharing a *common will*. The *kinship group* consists of family members with common ancestry, living close together, and required to protect the family honor. This results in a very close-knit group. The *neighborhood* consists of dwellings close to each other where the community members share common beliefs, values, rituals and customs, resulting in give and

take between the members. *Friendship* is a voluntary relationship created between individuals sharing a feeling of mutual affection. As it is a deliberate connection, the bond has no instinct, but is based on common likes and dislikes or a common occupation. *Common will* is the collective influence across the community, which binds the people in the *Gemeinschaft*. This common will then is the basis on which the members of the community share the same values, beliefs, and culture.

Gesellschaft, commonly translated as “society”, on the other hand, describes groups in which the individual and his interests take priority over the needs of the community. The members of such a society have achieved status, i.e. their status in the community is defined by their achievements through education and work. This sort of a structure is more commonly seen in large urban cities where competitiveness, institutionalization, and high social mobility prevent structures similar to *Gemeinschaft* from developing. *Gesellschaft* is promoted by the modern lifestyle of isolation and detachment.

The theory of *Gesellschaft* is underlined by the absence of the *Common Will*. The community members may be living in close proximity to each other but with everyone looking after their own interests, and with no concern in contributing to the community. This results in negligible amounts of give and take between the community members, distinct personal properties, lack of interest in other people’s dealings and a selfish approach to all interactions.

Historically, Pakistani society was predominantly conforming to the *Gemeinschaft* theory due to large joint families living in close proximity or in the same house, and therefore also having a common understanding of social interactions, values and beliefs. However, with the increase of a capitalistic economy, more independent living, large cities and scattered families, *Gesellschaft* tendencies are becoming progressively more dominant in the social structure of Pakistan. This is even more pronounced in the larger cities of Pakistan where rural to urban migration is most common resulting in individuals disconnected from their extended families and therefore giving more importance to the self than the society, resulting in a more obvious lack of *Common Will*. This transition from a *Gemeinschaft* society to a *Gesellschaft* society also has an obvious effect on the architecture which will be discussed in latter parts of this thesis.

2.1.1 Social change in Pakistani society

With the increase in agriculture, many Pakistani natives started settling down to become farmers and began to depend on certain pieces of land for their subsistence (Barnes, 1970; Martin, 1972). People became dependent on their land, and resented its use by others, resulting in their need for demarcation of land, stricter control, and resistance to unrestricted access.

This sense of land ownership probably arose with the increase in agricultural demands and the shift from simple horticultural technologies to more advanced techniques. As these changes occurred, the amount of land available, which up until then far exceeded the capability of being cultivated, started having a premium placed on it (Lenski, 1966). Farmers often cooperated within their communities to share crops and divide labor amongst themselves. This perhaps resulted in the formation of stable communities as well as a state of mutual protection, but also required the development of governance structures to define boundaries, which in return increased territoriality involving ownership and defense.

In this manner, small villages were founded in Lahore, by groups of families that were linked together by kinship. These families were considered the original settlers in the area that initiated the first *khadki*, which is essentially a long open space or enclosure that is lined by dwellings on both sides. These single kinship dominated khadkis did not allow other groups to settle in the village. The basic character of the khadki never changed or incorporated any new functions and therefore, stayed monotonously uniform consisting of only dwellings in which all activities took place (Pramar, 1989, p.62). Nevertheless, as the village continued to grow, the descendants would construct additional khadkis of different sizes around the original one. A point to note here is that there was no preconceived scheme for the location and so an irregular pattern came about gradually with narrow lanes connecting various khadkis, which tended to remain close together for security and climatic purposes.

Before continuing to trace the development of these communities, it is useful to understand the cultural ecology and its effect on individual behavior as it explains the reasons for people adapting and changing. This was not required in the initial stage when the khadkis were first forming as people were all related and the villages contained families with a common ancestor. However, the growth of villages into towns, brought about geographical expansion – change in environmental conditions

– as well as people from neighboring areas having different occupations and expertise that ultimately resulted in people adapting in several ways.

2.2 Change in Cultural Ecology and Individual Behavior

Cultural Ecology and Ecocultural Psychology are models to further explain human behavior in relation to factors pertaining to their environment and culture. *Ecological* (interaction with environment), *cultural* (related to the groups' settlement pattern), *acculturational* (urbanization, access to technology or advanced education and the like) and *behavioral* factors are all integrated in this approach.

As the environment and ecology changes from one place to another, the environmental features such as annual rainfall, temperature, soil quality and other climatic features all offer different economic possibilities. *Ecological factors* take these into account and how humans interact and adapt along with these changes to satisfy their needs. The *Cultural Factors* refer to the settlement patterns of the society, which can be grouped into gathering, hunting, pastoral, fishing or agricultural (Murdock, 1969, p. 130-131) societies. This can also be referred to in terms of degree of “food accumulation” (Barry, Child & Bacon, 1959), pastoral and agricultural cultures being “high food accumulation”, fully sedentary societies. *Acculturative factors* refer to the community's level of urbanization and access to advanced technologies, western education, governmental system and structured employment. These factors all affect the prevailing traditions, altering and shaping them in such a way that along with the original traditional behavior, slight shifts and changes also become part of the new behavioral norms (Berry, 1980, p.88-89).

As these cultural and environmental changes occur, different individuals respond differently. Firstly, *adaptation by adjustment* is when the individual adapts his or her behavior to reduce the conflict between the environment and behavior. Secondly, by *reaction* is the opposite where in the individual responds by resisting and retaliating against the environmental changes, forcing the environment to change in such a way that it is more in line with the individual's behavior. And thirdly, *by withdrawal*, wherein the individual reacts in such a way to mitigate the effect of the changes in environment. For example, by migration away from a difficult environment, the individual is neither adapting himself, nor is he affecting the environment, but is withdrawing away from it (Berry, 1980, p.100).

2.3 Other Factors of Change

In greater detail, factors such as physical elements, population distribution, isolation and contact issues, social structure, attitudes and values as well as technological factors can all bring about social change in a society on multiple levels. When considering physical factors, it is important to take note of climatic changes, as well as other ecological topics like land cover change, deforestation, loss or damage of wetlands, biodiversity loss and land degradation as these changes, although sometimes very slow and largely unnoticed, can affect the social and cultural life of the inhabitants. Saying that, at times, human misuse of the physical environment accelerates the changes leading to difficulties such as loss of livelihood, population displacement, conflict and inappropriate adaptation and modification of the environment.

Population change is another factor, which in itself can be considered a social change that drives further social and cultural changes. This occurs when groups of people migrate to new localities and begin to interact with the first dwellers triggering the development of secondary group relations, growth of elaborate institutions, and many other changes that follow accordingly. Also, societies with a fast-growing population tend to have less control over the amount of changes that occur at a given time than societies with a stable population, as people are constantly migrating into the community, requiring more improvements and adaptations to be made in order to survive.

In terms of isolation and contact issues, societies that are located at crossroads on the world map, make them the natural point of intersection for all kinds of streams: people, goods, information, ideas, and mentalities – ultimately making them the centers of great change. Due to the close contact between these different societies, new traits and features appear more rapidly in such places than in the isolated areas, which tend to be more stable, conservative and resistant to change. Social structure of the society is related in a similar manner, in that it is able to bring about greater changes when a society is loosely structured wherein roles, lines of authority, and responsibilities are not so clearly defined, allowing for individuals to rearrange them as required. This is in sharp contrast to the tightly structured societies where all duties, roles, rights and benefits are precisely and strictly predefined.

Moving on, the extent to which social change can occur is also highly dependent on the attitudes and values of people as some are more open and receptive to change whilst others venerate the past, and remain preoccupied trying to preserve their customs and traditions, consequently changing slowly and reluctantly. In this case, when change does occur, it is often too gradual to be seen or felt. On the other hand, citizens of rapidly changing societies have a different attitude and so when change does happen, they are aware and thus able to be critical of various elements of their beliefs and customs regarding which ones to keep and which to discard by experimenting with norms and practices from the new association and social order. Such attitudes strongly inspire and encourage the acceptance of changes by individuals within a society, which has its share of liberals and conservatives, and therefore, it is the attitudes and values of both groups that affect the amount and the direction of social change that takes place. Societal changes, both due to population changes and the interaction with other societies is most obvious in the larger cities of Pakistan such as Lahore and Karachi where large amount of migrants from rural areas and smaller cities has resulted in large population changes, both in number and demographics, over a short time, resulting in the need for the city dwellers to adapt quickly to the changing society. This is more pronounced due to the fact that the Pakistani population is extremely diverse in terms of culture, language and societal norms. However, as each group within the country also has a strong identification with its own roots, the adaptation of one group to the other's culture has a lot of resistance and is quite slow.

Technology – considered a byproduct of civilization – is used to serve human purpose by satisfying the requirements of human beings and generally making life more comfortable for them through the use of tools and machines also brings about social change. This is done by changing our surrounding environment to which we in turn, adapt by modifying our customs and social institutions. A prime example being rural Pakistan, where increasing use of mechanical technologies (tractors, thrashers etc.), biological technologies (improved yield seeds, fertilizers etc.) and advanced irrigation techniques is resulting in a smaller labor force cultivating more land and driving social change. Furthermore, the introduction of machines and appliances have reduced the dependence of these societies on domesticated work-animals, which used to be a very important part of society.

2.4 Impact of Change

Having looked at some of the factors of social change, it is equally important to recognize some of the impacts that arise due to the above-mentioned factors. These impacts include industrialization, urbanization, modernization, collective action, development of means of transportation and communication, issues concerning employment, as well as cultural lag.

To explain this furthermore, technology has contributed to the growth of industries, which have in turn, played a major role in the growth and development of societies. Consequently, the manual skilled labor that was once carried out by a large number of specialized artisans, was now replaced by factories and a mechanized process of production resulting in improved quality, maximized output and reduction of product costs. On the one hand, the increase in number of factories provided many employment opportunities for thousands of people but at the same time, also took away many roles, responsibilities and occupations of the craftsmen, reducing the status of people to generic factory workers. In the same manner, machines have created new employment opportunities for people whilst also taking them away through laborsaving devices. Overall, the progression of industrialization has affected the nature, character and the growth of economy and has played a key role in the growth of cities and ultimately increased urbanization.

The increase in urbanization involved a vast number of large groups of natives moving from scattered rural areas to large urban centers, thus shifting from an agriculture-driven society to a more widespread range of city-based occupations and correspondingly changing the behavior patterns that were once considered a norm. The development of the means of transportation and communication further facilitated this movement as it led to the increase in both the national and international trade on a large scale. The road transportation, train services, ships and aircrafts all assisted in easing the exchange of men and material goods between villages and towns, towns and bigger cities as well as between metropolises themselves. In other words, the travel networks have helped people belonging to different corners of the nation to move around freely and have regular contact with each other.

With the passage of time, especially those people who have had close ties with their customs are faced with the challenge to adapt their lives and values to modern ways. This includes the need to change people's food habits, dress habits, speaking styles, tastes, choices, preferences, ideas, values, recreational activities and so on, resulting in remarkable changes in the fabric of social relationship and the replacement of traditional ideologies with new ones. These changes are only possible through social movements that can be expressed as a form of collective action; one that involves a group of people acting together in order to promote or resist change in a society that they are a part of. The point to note here is that these movements are probable if there is a common interest generated which is supported for a long period of time by a large number of people. At this point, there is a slight tension between the new techniques and the many organizational facets of the new social system compared to those of the old social order where changes follow very slowly if at all, causing a socio-cultural lag of sorts.

These impacts are most evident in large metropolitan cities of Pakistan where industrialization, urbanization and modernization due to the improved transportation and communication has been most extensive. In Karachi for example, availability of industrial jobs, better life standards and availability of easy transport from all parts of the country have resulted in widespread rural to urban migration creating a society where different people with different cultures, cuisines, social norms and languages all live in a cosmopolitan mix. Compounded by the increased exposure to foreigners due to being the largest port and industrial and commercial center of the country, this has resulted in the social fabric of the city continuously struggling to change and adapt drastically over the past few decades. This constant need to change has obviously been met with resistance in certain social groups more than in others, resulting in an amalgamation of various levels of change visible in every aspect of life in the city.

2.5 Change in Territoriality

The word “Territory” can be defined as objects, places or geographical areas, irrespective of size and shape. Territoriality is the concept of territories being owned or controlled in some way or form, either temporary or permanent. This control can range from controlling and limiting permission to use or access the territory to

forbidding it completely. Many of these definitions suggest the territory as being personalized by its occupants in some way. Also, the control can be by individuals as well as groups of small or large sizes, and often includes defense and protection from actual or potential invasion by others (Chemers, 1984, p.120). This Territorial Behavior, in effect, serves a large variety of social functions such as status, identity, and family stability as well as physical functions such as food storage/regulation and child rearing.

“Primary Territories” are territories which are exclusively controlled and owned by individuals or groups, and are clearly recognized as being so by others on a relatively permanent basis. Furthermore, primary territories have a role of considerable significance and are central to the everyday lives of the urban residents over which they exercise exclusive control and to which they feel strong attachment (Altman, 1975, p. 112). Examples of primary territories can include a person’s bedroom, a family home, a family farm, and a community’s property as these territories have a psychological importance to their occupants and a strong sense of identity on relatively long-term basis. Primary territories also enjoy a significant amount of unambiguous control where the society as a whole identifies and respects the occupants’ control of these territories. This can be readily related to, for example, the case of someone’s home, where entry without explicit permission is a serious matter and unexpected or uninvited intrusions are unacceptable.

This concept of Primary Territories can be observed by the way certain additions and modifications had to be made to the rural house because of the new functions that arose following commercialization. Due to the increasing amount of trade, manufacture and artisanship, clients who were considered complete strangers, would now visit the residence in order to conduct business, as a result, intruding into the Primary Territory of the residents. As the rural residence was mainly visited by relatives and therefore not designed to meet requirements of the urban setting, when the stranger was given open access to the dwelling, it became problematic for the women of the household to observe their *purdah* [practice of female seclusion] due to the close proximity of spaces and the custom of leaving all doors open, as they would come in contact with each other (Sabzwari, 2003, p.20).

Due to the strict observance of *purdah*, there was a certain amount of physical segregation that was needed between men and women. In the past, this was achieved

by spaces around the courtyard being divided into male and female areas, at times separating the vertical circulation spaces as well as positioning the main entrance at some distance to prevent any unexpected exposure (Pramar, 1989, p.167). Therefore, when Muslim male visitors entered the residence, they would announce their arrival and wait for the women of the household to withdraw from the courtyard into more secluded areas. At night no visitors would arrive unannounced and so the courtyard was used for sleeping by family members. In effect, the scope of the Primary Territories was redefined as the rural dwelling adapted into the urban dwelling, ensuring that the control over these Primary Territories remained with the female residents exclusively. Here, the two factors that have changed slightly in the present times is (1) that there is a less strict observance of purdah and (2) customs have changed or policies relaxed in that visitors, or other outsiders can arrive at different times of the day. Technology can be considered the reason for such a change as messages would take longer to get delivered for household residents to be alerted whereas now, a single phone call or text message could relay the same information much faster.

Similarly, primary territories could include places or things, which are identified with certain people, families, and kinship groups. These places or things are highly personal and they have full control over them, including rules and regulations for entry to places or use of these items. The *jhoola* [swing] – a flat wooden board suspended by metal chains from a crossbeam above – is a fitting example as it was considered to be a status symbol which elderly family members would sit on and enjoy by gently moving it with their feet. Family members that wished to honor guests would share their swing and would even take the trouble of keeping it in motion while they conversed.

Another aspect can be exemplified by *khadkis* [long open spaces], where important social functions such as marriages and religious festivals were performed. All members of the family and community were expected to participate in these events so much so that the *khadki* became an extension of the house with a semiprivate character (Pramar, 1989, p.61-63). Failure to engage in such events could lead to clear resentment and aggression, as it would symbolize disrespect for the group and its boundaries. The point to note here is that, it was not the occupied physical place that was of importance but the respect for the boundaries and rights of the social

group itself that mattered so greatly. Nowadays, this custom is seldom followed whereby the new trend has shifted to holding celebrations in specialized venues. Primary territories, in this sense serve as symbols of the significance of control over an individual's or a group's own self/other boundaries that are both spatial and psychological boundaries in essence.

The strict protection and control of primary territories is perhaps allowed because such territories are so important to a person's or group's well-being and viability. Thus, it is believed to be important for people to have homes and places within homes where they can retreat, where they can assume a certain image and status within a family and a society, and over which they have relatively complete control.

An example would be the courtyard, which is seen as a primary space at which the entire spatial structure of the dwelling begins and all the other spaces were seen as secondary that basically evolved from the main courtyard and continued to depend on it for sustenance as shown in Figure 2.1. In single court havelis, men would usually stay outside the court from morning to evening, allowing women to remain in the court and carry out their domestic chores as well as entertain their guests. This was different in the multi-court havelis because with the addition of separate male courts, men would remain in their own area and therefore, rarely enter the female courts. This example demonstrates the importance of primary territories within the private residence, which has a direct relation to the psychological well-being of a group of individuals within the family. The women, here, have a place which they have complete control of, where they can retreat, relax and feel safe to do as they like without any outside interference. Furthermore, as courtyards served as a multipurpose space that allowed one to entertain, carry out chores, and eat and sleep, they were considered far more important than the bedrooms on various floors of the house.

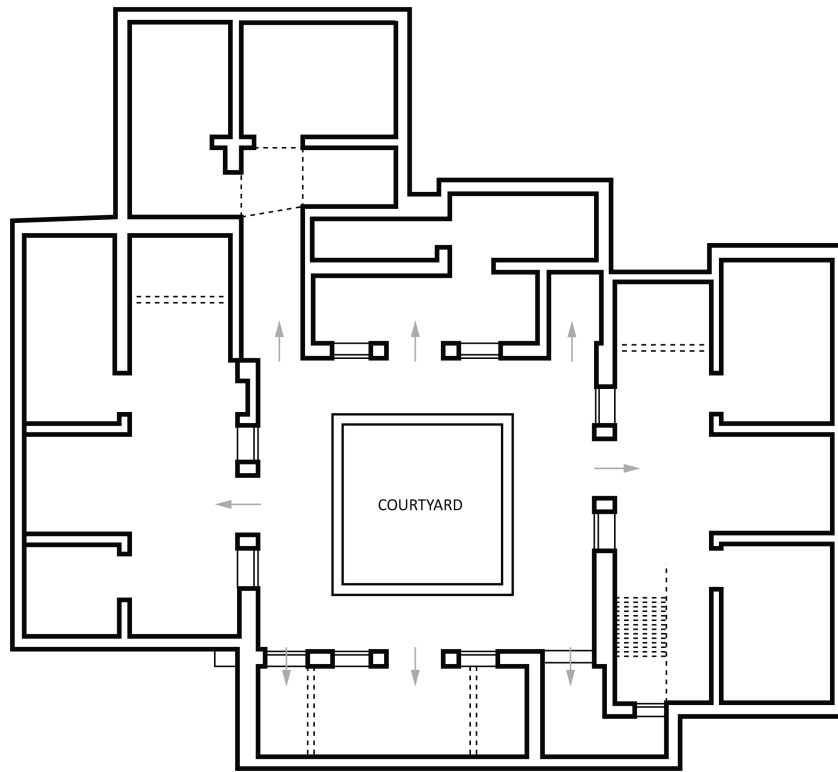


Figure 2.1 : Schematic showing courtyard as a primary space.

2.5.1 Determinants of territorial functioning: cultural factors

Culture tends to dictate specific functions and meanings with areas and tends to control who is allowed where and when. An example being the baithak [sitting area], which was an elaborate room used for holding male gatherings, meetings or for practicing a profession. The men would spend most of their time either here or outside the haveli, and would only enter the courtyard for specific tasks at certain times of the day, such as to have meals or to sleep at night. The women and children, on the other hand, were not allowed into the baithak and so in the few exceptional cases like performances, would be able to watch through a double height balcony from the zenana court. As such, the baithak functioned as the outsider's view into the haveli and a status symbol of the household (Jain, 2004, p.67). As cultural beliefs, norms, and ways of doing things have changed over time, certain changes have also been made to the formal living room. Namely, the descriptions given to the space or area have been altered which have also seen a shift in function and location in the residence. For example, the baithak has been replaced by the formal living room that is now situated within the dwelling as opposed to being detached from the house, where both men and women can entertain their guests in mixed gatherings.

2.5.2 Determinants of territorial functioning: physical factors

Physical features of a space also dictate the extent of a site to function as a territory for certain occupants, and affect the degree of exclusion and control of activities. In residential spaces, household members allocate certain spaces to certain groups or individuals such as the sleeping quarters and others are agreed as being accessible to all, like the courtyard. Even within the shared spaces, there may be areas identified where particular individuals tend to sit. The clearly identified locations with boundaries can be defined as territories belonging to individuals or subgroups, therefore rooms and pieces of furniture were the main kinds of territories identified in the household (Taylor, 1988, p. 141). Similarly, it is in these physically bounded, enclosed spaces owned by an individual or a group where territorial strategies to control access and activities are most achievable. This territorial functioning is less prominent when a bounded space is used by multiple or incompatible users, resulting in an increased boundary permeability.

The female or zenana court in the havelis is a prime example where the physical separation between the male and female courts provided territorial control of each by a certain group of people. A further physical factor was the introduction of an indirect entrance to the zenana court by the use of a baffle wall, which provided a visual barrier between the inner and outer courts to protect the privacy of the women within (Jain, 2004, p.60).

Similarly, in joint family systems when sons got married, they would generally set up their own independent hearth on the first floor and use it as the ground floor was used. Accordingly, parents would always occupy the prestigious ground floor and the younger couples occupied the upper floors at night but during the day, all family members carried out their household chores and activities on the ground floor (Pramar, 1989, p.101). The physical separation of each floor and the clear demarcation of control for each territory existed and in parallel also displayed the hierarchy and status within the family according to relationships, age and gender.

At present, the physical separation that was once seen is not so stark as immediate family members spend time together in a more informal manner. Also, when people live in joint families nowadays, the parents do still tend to live downstairs but there is shift in ideology as it is more for functional reasons like ease and comfort rather than prestige.

2.6 Change in Dwelling, Identity and Time

Part of what makes us human is our being ‘self-aware’ of ourselves. In our lives and at any given time, we are continuously finding new ways to express and interpret our own selves. We define ourselves as people of a certain type, quality or value but also convey ourselves with other objects of significance to us, creating a sense of belonging and attachment (Hummon, p.209). Dwellings are just such social and cultural objects, which identify the owner’s feelings, thinking and social practices while identifying space for culturally defined activities, in addition to the obvious - offering protection (Rakoff, 1977). Also, this is communicated via various facets such as the interior, exterior, form, function and style.

Therefore, in culture, dwellings and other domestic objects have come to be viewed as significant objects symbolizing the beliefs, values and identities of people. The house gets assigned multiple meanings reflecting cultural, social and psychological processes wherein apart from providing shelter, security and a place to sit, it also expresses respectability, authority and independence (Geertz, 1973). Not only the house itself, but also the furnishings and other elements of the dwelling can convey volumes about the owner’s identity.

The dwellings were not always considered such important symbols. In traditional societies, dwellings did not have cultural significance in representing an individual, but instead it was the settlement patterns which expressed the community’s identity. Even if the dwelling had any significance, it was more towards the group identity rather than the individual (Rapoport, 1982). Moving from Gemeinschaft communities towards Gesellschaft societies, we are immediately made aware of the change from the community being of utmost importance to the individual taking on precedence. By constructing unique houses, the individuals now choose to act in their own interest in order to stand out amongst the crowd and display their wealth and status.

Earlier on, the expenditure of valuable resources on dwellings to set the individual apart was highly disapproved of (Cohn, 1979). This can clearly be seen for example in dwellings in Hyderabad, India where the houses and settlements in the walled city’s neighborhoods still represent the “old” families’ and communities residing there, wherein the newer dwellings express the individual identities of the more

westernized elite individuals (Duncan and Duncan, 1976a, 1982a). This is explained by the fact that in traditional societies, the community was given more importance over the individual and displays of individualism was even frowned upon due to the significance of participation and contribution to social relations and values at the group level. As such, dwellings were seen only as a place of shelter and group activity. Furthermore, as these societies were tightly knit and possibly even of the same extended family, everybody knew everyone else, nullifying even the need to develop the dwelling as a display of individualistic character, prestige or stature.

In contrast, large modern and industrial societies such as the cities of Karachi and Lahore, which consist of individuals from different regions coming to the urban centers for better living standards, have no such prohibitions and dwellings in these cities started to characterize the individualistic social relations and values. Also, due to the social and cultural heterogeneity as well as the increased mobility and relative openness, there was a rising need for the individuals to identify themselves from the “others”. Dwellings and other household objects under these circumstances tended to become symbols of identity, economic rank and personal wealth. The house became a dominant symbol of respect, prosperity, diligence and independence.

With the passage of time, these dwellings also become important historical symbols of the people, their culture and their life in the past. Old homes, although quickly being replaced with newer construction, are an invaluable public link to the past. Courtyard Houses that are preserved or which have been restored may serve as bridges to a “valued past” giving modern day Pakistanis with a useable history and a sense of continuity, belonging and identity as Pakistanis, (Lynch, 1972; Tuan, 1977; and Steele 1981).

On a personal level, homes and the objects within also have great significance as memoirs of past experience, events and relationships. These memories are very personal and are often only of importance to the individuals and close family (Csikszentmihalyi and Rochberg-Halton, 1981). As such, a “house” is not necessarily a “home” as the concept not only encompasses the physical dwelling space, but also the “rootedness” in a place which develops with time and a sense of attachment and a sense of being “oneself” there. This develops also with the relationship with other people, as a place of safety and comfort and as a personal symbol of self-identity (Hayward, 1982; Relph, 1976).

However, in the modern age, increased geographic mobility has created circumstances where the individual has lost a sense of identity due to the lack of a sense of home. As social, cultural and material uniqueness is blended away with the more modern lifestyles now prevalent, the individual moves from one house to another, never developing a sense of belonging to any particular place, dwelling, community or region, resulting in a state of placelessness. (Berger et al., 1974; Relph, 1976).

2.7 Change in Spatial Organization

Space can be divided based on the use of certain areas for specific activities. This can be along the lines of conceptual and/or physical boundaries, such as walls, screens or curtains, and is heavily dependent on the cultural norms prevalent. Each of these spaces is used for separate functions by different people (Berk, 1980), and is also referred to in different terms based on the activities appropriate to the area, such as living room, dining room, bedroom or kitchen. These partitions have in fact grown more rigid with time, as previously, activities flowed from and to adjacent spaces depending on the particular situations. Similarly, conceptual partitions where the spaces are segregated by furnishings with specific functions, is a more modern phenomenon as previously, due to the relative lack of furniture, every space could potentially be used for multiple activities (Kent, 1991, p. 453). Examples include the dining table defining the dining room and couches referring to the living room, even if the space is physically undivided.

This spatial organization has many aspects where gender and status can play very active roles too. Although the basic physiological differences between men and women is inarguable, the perception of certain groups in regards to these physical, emotional and intellectual differences between the genders can result in segregation that affects every facet of their culture. Dependent on this, the stratification can be more homogeneous or more unequally hierarchical between the genders, based on the division of labor, gender roles, gender segregation and economic strategies. This segregation can be physical such as imposing different work settings, functional by the division domestic tasks or social by the imposing of different rules of etiquettes for each sex (Reskin & Roos, 1987). The extent and rigidity of the physical and conceptual segregation of genders is a direct reflection of the gender differences

present in a group's culture and revealed in the division of labor, gender differentiation and including different salary and statuses (Reskin & Roos, 1987, p.9)

In societies such as Pakistan where more segmentation exists, cognitive and spatial segregation is also more prominent and based on multiple factors. Segregation based on activity-function exists where spaces are identified by the functionally related activities that occur there, as in Figure 2.2, vs. multipurpose areas where these activities could be functionally unrelated. Gender specific segregation is when locations are primarily used by one gender, as in Figure 2.3, vs. non-gender specific areas, which are used, by both genders (Kent, 1991, p.442). Age specific segregation similarly is in situations where spaces are demarcated based on their use by groups of people of certain ages vs. spaces that are used by people of all ages. The extent of these kinds of segregation can vary from many such restricted areas to virtually none.

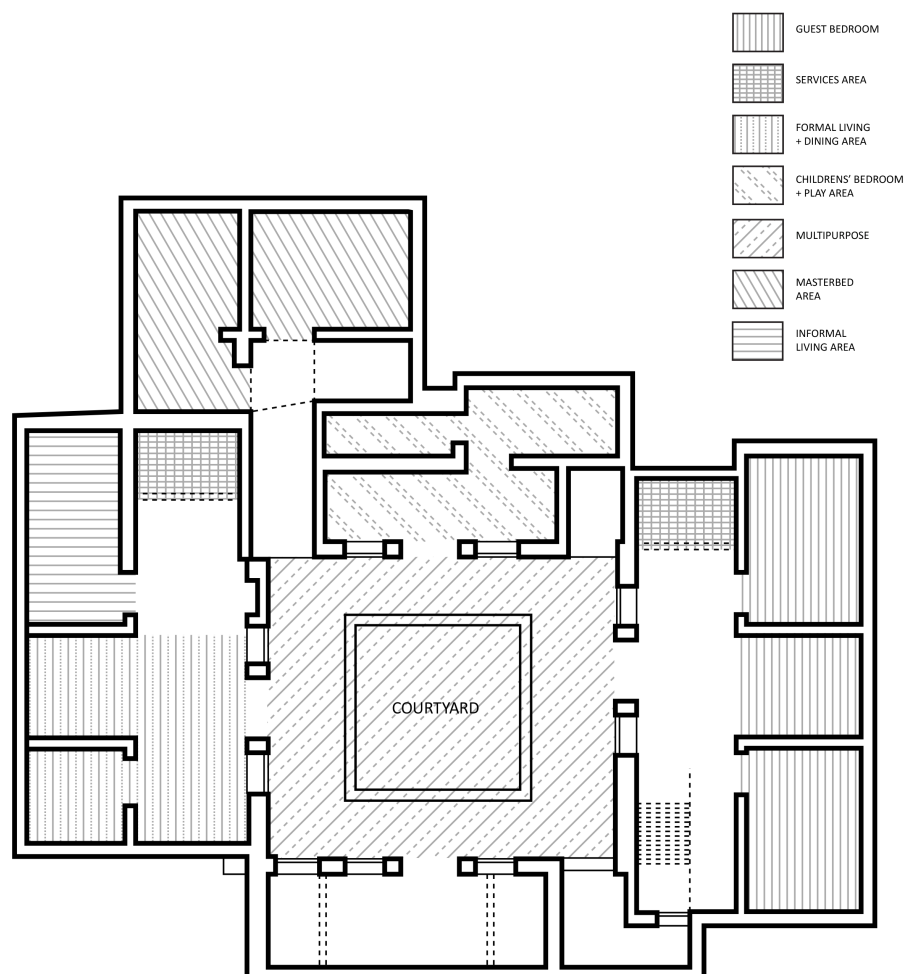


Figure 2.2 : Activity & Age Specific Segregation.

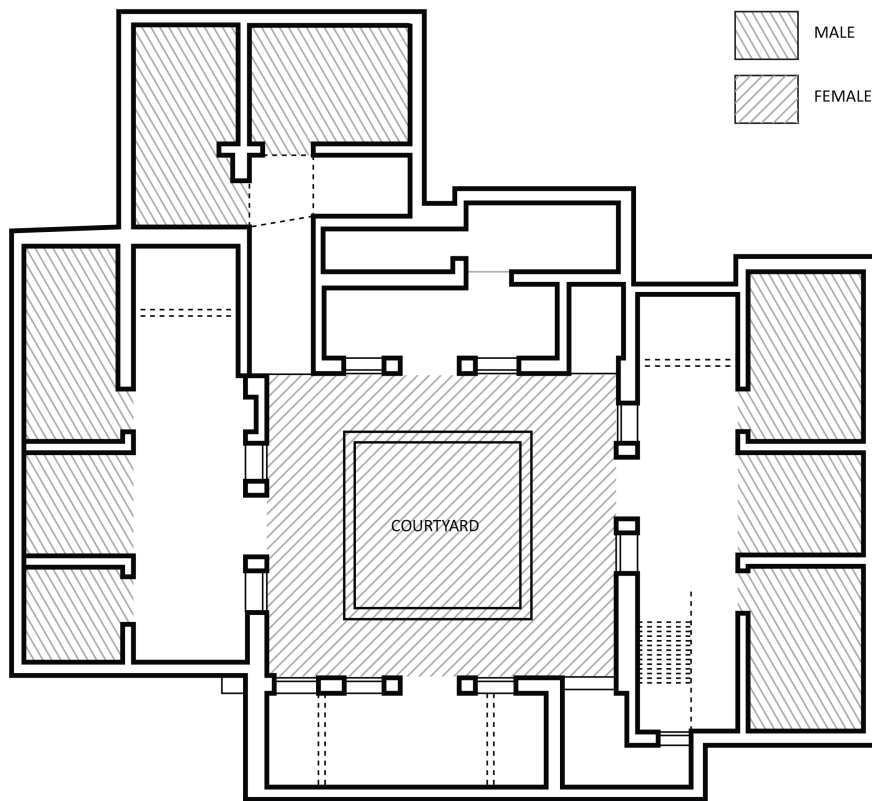


Figure 2.3 : Gender Specific Segregation.

Segmented spaces are also directly correlated with the extent of physical or architectural segmentation. Furthermore, there is a link between the mobility, or vice versa the sedentism, found in a society and the degree of segmentation present, where a decrease in mobility and sociopolitical complexity is shown to have an increase in segmentation present. This is explained by the fact that once people become less mobile, the prospect of performing activities at a given location increases. Such a situation where the same space could be competed for by different mutually exclusive activities and people is resolved by the gender, age and/or activity specific segregation (Kent, 1991, p.464). Furthermore, each user's cultural requirements of acceptable spatial patterning could require completely different home designs (Kent, 1991, p.467). Houses are therefore also commonly remodeled according to the user's needs of segmentation as defined by his culture, as individuals are far more willing to change the architecture than to adapt their behavior to the built environment.

As much as the culture defines the conceptual and physical boundaries and therefore creates segmentation, these partitions in and of themselves also have a marked

influence on the sociopolitical stratification, cultural distribution and occupational concentrations. As according to Donley-Reid (1990, p.117), "*People define space, and space defines people*". The boundaries, both the visible and the invisible, effectively communicate with the individuals by providing cues as how to act and react in certain social situations according to their culture by providing the appropriate situations and context (Rapoport, 1982, p.52).

Along with the segregation of space it is also common for the space to be bounded or segmented by time (meals, naps, work, leisure etc.), although this is a less rigid form of segregation and not strictly defined.

Virtually all the factors affecting space segregation can be seen in Pakistan, some more than others, and some more before than in contemporary times. Examples would be the presence of activity-restricted dining and living rooms, and age-segregated master and children's bedrooms / play rooms and grandparents living area. An example of a multipurpose space would be the informal living room which is used by all at all times of the day. In contemporary times, segregated areas depend more on activity and age segregation and less on gender specific segregation where as before, more gender specific segregation was seen due to the "purdah" having been given more importance.

2.8 Change in Personal Space

Robert Sommer defined personal space as "an area with an invisible boundary surrounding the person's body into which intruders may not come." In other words, it is a distance that an organism generally places between itself and others which may vary from species to species or individual to individual. He went on to explaining that the space around the individual is not essentially spherical in form but is more like the 'soap bubble' or 'breathing room' in that it allows people to come together to share warmth and companionship but far enough to prevent contact (Sommer, 1959 & 1969).

Personal space has two main functions: firstly, to regulate the amount and quality of sensory stimulation and thus protecting individuals against potential mental and physical social encounters; and secondly, it reveals information regarding the relationship between the participants, including the level of closeness or formality of

the interaction, by giving signs as to the preferred distance chosen between them (Aiello & Thompson, 1980, p. 113-114). There are instances when an individual will invite another to enter their personal space boundaries, for example, when seeking intimacy whereas in other situations, the individual will not welcome the invasion and consequently resort to displaying disapproval and annoyance towards the other (Goffman, 1963). A third scenario that is also quite common is the unwanted intrusion into the personal space but one that is endured in crowded conditions. In this case, individuals exercise reserve by lowering their gaze and avoiding conversations in order to obtain privacy (Hall, 1966).

Links between personality and territorial functioning have not been firmly established but there appears to be a gender dependent link between the two (Mercer & Benjamin, 1980). One study showed a stark contrast between the attitudes of men and women in that the self assured women when sharing a room with others needed a smaller amount of space, which they could call their own versus the men, who needed a larger part of a room to serve as their own territory. Other studies indicated that sociable people were more likely to choose living arrangements involving more shared living space with others with a lesser need for individual private spaces (Switzer & Taylor, 1983). Saying that, conflicts were likely to arise if people sharing a space had incompatible personality profiles where the inability to agree on suitable territorial strategies could cause people to part ways. Some members were able to reduce interpersonal friction by implementing very strict allocations of spaces within the living unit (Williams, 1976; Altman & Haythorn, 1967).

Furthermore, older houses in Karachi and Lahore generally adopted the “open” approach and so had bedroom doors open all day, family members visited one another quite often and particular activities such as sleeping, eating, washing and grinding of spices and grains were not confined to certain rooms. Also, guests were entertained in interior rooms, courtyards or verandah and terrace spaces depending on their relationship with the host. This basically gave the territory a warm, flexible and inviting nature for the occupants. At the same time, there were instances when spaces were allocated to reduce interpersonal friction or displeasure such as the gender separation in zenana and mardana courts – men would avoid entering the women’s court unless by some exception and the women were strictly not allowed in the courts or sitting areas [baithak] of men. In present day residences, there are

similarities with the past but the main difference evident now is that the spaces when allocated are done according to age as opposed to gender in order to ease social friction. For example, children tend to have their games room or spend time in the informal living room whilst the grandparents, if living together, have their own private living quarters on a different floor altogether, so as not to be disturbed.

By understanding the importance of primary territories and how they affect the well-being of their occupants, it is important to also understand the activities and dealings of the household members on a more micro- level, within these spaces.

As mentioned earlier, there is a link between territoriality and personal space but what sets them apart is that while territoriality is relatively stationary, personal space moves around. Another difference is that the boundaries of personal space remain invisible and therefore, somewhat undetected until they have been trespassed, in which case outwards signs indicate the next step or action to take, whereas the boundaries of a territory are made visible for all others to see and be aware of. A third point that sets the two topics apart is that living beings generally fight in order to protect and defend their territory but tend to retreat when their personal space has been intruded by others (Sommer, 1959, p. 248).

How people adapt the environment or use the available space to control social dealings is also of interest (Aiello & Thompson, 1980, p. 108). The relationship of personal space with culture, which can be defined as the socialization patterns and collection of norms, beliefs and customs, is not firmly defined (Altman and Vinsel, 1977). However, the interactions between the built environment and the spatial behavior are better understood (Wohlwill, 1970). The built environment, both restricts the behavior that can be displayed within it, as well as affect the quality of the behavior and the individual both. Furthermore, the environment may also affect the feeling, attitude and approach of any action. To this end, man continuously tries to adapt the natural environment by creating built environments according to his needs and the dominant culture, lifestyle and attitudes (Aiello & Thompson, 1980, p. 167). These built environments are heavily affected by culture, and therefore also provide a medium to carry-on cultural norms and values across generations (Aiello & Thompson, 1980, p. 108).

These man-made environments also vary between large metropolitan societies and smaller more traditional ones. In the latter, there is usually a great level of

conformity in terms of the architecture, as it developed to match the environmental and cultural requirements of these societies. Pakistani society is also such where people exhibit a “contact culture” of living in close proximity to each other and high interaction and communications with each other (Hall, 1966).

2.9 Change in Behavioral Modes

Behavior settings are believed to be a stable combination of activity and place – one that has a recurrent activity, a particular layout of the milieu [environment], a harmonious synomorphy [relationship between activity and place] and a specific time period. Additionally, a standing pattern of behavior may include a number of different behaviors that are all taking place simultaneously such as: emotional behavior, problem-solving behavior, gross motor activity, interpersonal interactions and manipulation of objects.

An example of a standing pattern of behavior present at a certain moment in the central courtyards of residences would include: (1) elderly women sitting on the charpai [traditional woven bed] and chatting with their relatives from neighboring houses whilst watching the younger women carry out their chores; (2) a lady cooking in an adjacent room adjoining the courtyard and another or perhaps the same lady kneading dough for roti [flat bread] and multitasking; (3) a female servant giving a head oil massage to an elderly woman and (4) another lady walking into the courtyard in order to deliver messages coming from outside the haveli. In present day city dwellings, the standing pattern of behavior would be quite different in a similar setting in that young children would be playing in the garden with their school friends, being watched by a caretaker whilst the mothers sit inside the living room talking and having tea.

At times, the same physical setting can have multiple behavior settings when different standing patterns of behavior occur within it, at different times. Also, different individuals or groups occupy different parts of the behavior setting due to their distinct roles. To add and contrast to the example mentioned above, the same courtyard space at a different time of the day – lunch time, for instance – would be used by the men of the household to receive and entertain their guests. In this case, the women would withdraw further into the house and the lady cooking would prepare the meals in the kitchen and have the guests served by servants, children or

young males, meanwhile still maintaining her purdah. The men would now take control of the charpais and move them as they like, to best suit their needs and conduct their business meetings, or talk casually until late evening. These examples not only illustrate the fact that a person is able to achieve a “multiplicity of satisfactions” (Barker, 1960) but that it is possible for the same behavior setting to enable one individual to meet their needs for connection and at the same time, let another meet their more basic needs to earn a living (Lang, 1987, p.114).

Examining a behavior setting from a distance, one is able to notice a boundary for the activity where the behavior generally stops (Bechtel, 1977). Saying that, as the courtyard is a primary space within the dwelling through which all secondary spaces draw their sustenance, these boundaries are not as clear as verandah spaces and interior rooms continue to afford the same activity systems and allow for the same behavior patterns as seen in the courtyard. The only difference being, that at times due to climatic reasons, individuals choose a closed area to an open one. Although, spaces like the jharokas, window balconies as seen in Figure 2.4, and terraces present on upper floors also draw their sustenance from the courtyard, there appears to be a clearer delineation of boundaries as the behavior cannot be continued vertically up as easily as horizontally out into the verandah and interior rooms. In this case, as in many others, a wall forms an ideal boundary which stops behavior getting in or out better than a small change in level which occurs between the courtyard and verandah in certain house plans.



Figure 2.4 : An example of a Haveli with *Jharoka*.

Biases, tendencies, competencies, costs of engaging and perceived rewards are but a few factors that are useful or valuable to individuals and groups that in turn cause them to act differently in different patterns of the milieu. Individuals may or may not choose to participate in a behavior setting based on their ability and desire to conform to the standing behavior pattern in a particular place. If they do choose to join, they are also able to adapt the environment to better fit the existing or desired behavior patterns.

Designs at times severely reduce the affordances for different rooms and the activities that come with them. This was not the case in courtyard residences as the spaces had no fixed function – each room could be adapted according to the needs present at the time as they were not clearly defined for activities such as sitting, eating, working or sleeping. This amorphous use of space is possibly due to the relative lack of furniture which would enforce a fixed behavior to each space – there were no beds, tables and chairs and all activities including sleeping, eating and socializing took place on the floor (Pramar, 1989, p.76). This was the case in the older courtyard houses, in the contemporary courtyard houses, the presence of furniture defines the usage of each space in a more constrictive manner. The flexibility still exists, but in a much lesser extent.

2.10 Change in Privacy

The concept of privacy is closely interlinked with the concepts of territorial behavior and personal space. Privacy, as defined by Alan Westin (1970), consists of four types: “*solitude*, the state of being free from the observation of others; *intimacy*, the state of being with another person but free from the outside world; *anonymity*, the state of being unknown even in a crowd; and *reserve*, the state in which a person employs psychological barriers to control unwanted intrusion”. Furthermore, the four main reasons for privacy are that it allows an individual to be independent and self-governing, allows for one to openly express their feelings and emotions, assists with self-assessment as well as limits and protects communication. Privacy is a basic need as all individuals require moments of solitude, isolation, security, intimacy as well as a place to be themselves and relieve frustration and the like. The need for privacy has spatial implications that extend from a personal bubble surrounding the individual

where only very few are allowed to enter – to the separate room where one can go to be alone. Privacy is of utter importance as it provides time for contemplation and reflection, rest and relaxation, a state of concentration as well as a counteraction to the confusion and chaos of the modern world, which is so critically needed in the family dwelling (Chermayeff & Alexander, 1963). If this requirement is not met, it can lead to issues such as stunted individuals whereby they are unable to acquire and develop delicate, sensitive feelings and relationships, ultimately resulting in health disorders.

Amos Rapoport (1977) further elaborated on the subject suggesting that privacy supports the capability to control interactions, to make several different choices, and the achievement of desired interactions, and should not be regarded merely as a physical detachment of a person from another, in search for seclusion. It protects the individuals from intrusion upon themselves, their homes, families, relationships, communications, properties and business dealings by spying, meddling, inspecting, and unauthorized overhearing (Ernst & Schwartz, 1962). Saying that, there are different types and levels of privacy that are desired according to the standing behavior pattern of the particular setting, the cultural context, the personalities of the individuals involved, together with their aims and objectives vis-à-vis what they plan to do or achieve. In order to attain the desired level of privacy, a number of architectural features can be made use of, such as: walls, screens, symbolic and territorial demarcators as well as distances between various spaces. For example, in the traditional courtyard houses, in order to attain privacy, the ground level exterior façade would be flush facing the street and would have all the fenestrations looking into the central courtyard – to avoid anyone looking into the house and seeing the women of the household. On the other hand, the upper levels had openings on the exterior façade, as a high level of privacy was not required due to the activities conducted there.

The amount of privacy is of utmost importance because too much or too little privacy are both situations that are undesirable. To expand on this point, too much privacy can lead to people feeling socially isolated where their solitary confinement has been regarded as one of the worst punishments one can be subjected to. On the other hand, too little privacy has left people with the feeling of being crowded and congested causing much stress and subsequently affecting relationships between various

individuals (Altman, 1975). Crowding is believed to be stressful for many people, as it tends to reduce personal autonomy, expression, and disrupts desired communication patterns. Furthermore, crowding is often linked with the feeling of lack of control over the environment as well as the individual's own perception of the amount of control others have over the interventions they are making (Rapoport, 1977). The lack of control felt by individuals in crowded conditions, at times leads to negative behavior due to the "social overload" experienced. Thus, it can be duly noted that behavior settings should never be over populated but instead, the number of people participating in a particular setting should be suitable for the standing pattern of behavior whilst still providing ample personal space and territorial control over the surrounding space that they hold so dearly (Bechtel, 1977). In the past, as majority of the people tended to live in the joint family system, they were constantly used to having people around which meant less privacy but that was considered normal back then. Today, however, people have dispersed and even in the case where relatives live in the same city, they are scattered around and so have become more used to having their own space and time to the extent that within a single household, family members are not aware of the events taking place at home.

The degree to which privacy is required is dependent on mainly two factors: culture and socioeconomic background of the groups or individuals involved. According to Edward Hall, people belonging to different cultures respond to space and spatial configurations in different manners. Hess and Handel (1959) believed that family life is what gives form to the family without foregoing the rights of individuals and it is the physical environment - the dwelling – that in turn plays a major part in the establishment of family living patterns. Finally, it is the family living patterns that give meaning and form to family life by creating patterns of "separateness and connectedness" through the accommodation of privacy and interaction that it affords (Smith, Downer, Lynch and Wilson, 1969, p. 559). To explain this concept, the physical properties of the dwelling either promote or interfere with the satisfaction of the need for privacy or interaction. Interaction is equally important when trying to understand privacy, as it is not only necessary among all aspects of society but is also of great importance within the confines of the nuclear family unit through its mutual and reciprocal influence. The nuclear family being discussed is seen as a distinct unique unit through the sharing of a dwelling, which is seen as a place to live. The

fact that the house is enclosed and has a particular spatial arrangement encourages interactions and relationships to take place (Farber, Mustacchi & Wilson, 1965). Here, the family relationships are able to provide members with traces to their identity, their role within the family along with their place in society.

Moreover, spatial dimensions and configurations tend to affect family interactions, privacy of individuals and begin to determine the use patterns of specific spaces by family members. While examining the use of spaces, it is possible to notice similarities and differences in trends of the family members, either interacting or in solitude, in terms of the amount of time spent based on spatial dimensions, family size, age, and gender of the members. Another point worth discussing is the one made by Humphrey Osmond with regards to *sociopetal* and *sociofugal* spaces that are essentially spaces that either bring people together or keep them apart. Accordingly, spaces are divided into distinct locations; areas are allotted to different people or functions, privacy-interaction orientation of family members and stage in family life cycle are all considered when designing.

As the concept of privacy involves the ability of individuals or groups to control their interactions, make choices and achieve their desired interactions; it is also essential to understand the link with personal space and the amount of distance that is maintained between the people during these interactions. When studying the past, it seems there was a lesser need for privacy than there is currently, as represented by the greater psychological and physical separation of family relations into their own allocated areas in the house.

The concept of privacy has also been under continuous change in Pakistan. Before, there was lesser privacy on a personal level due to large joint families living together in large residential areas or neighborhoods, and every aspect of life was shared between them. However, the large family unit had a higher level of privacy from other family units as houses and residences weren't constricted and crowded. In contemporary times, the concept has shifted as the families have become smaller, the people have more personal privacy and the concept of personal space has gotten more importance in a residence. But as a whole, due to having houses squeezed together in large congested cities such as Lahore or Karachi or in crowded apartment complexes, people feel as if their privacy is encroached upon continuously.

3. DOMESTIC ARCHITECTURE IN PAKISTAN

The study of traditional architecture in Pakistan has had the tendency to focus primarily on imperial buildings such as palaces, mosques, tombs and temples, and in the process, has practically ignored the whole field of domestic architecture. A reason for this being that perhaps the definition of historical architecture until recently was limited mostly to monuments as opposed to being a more comprehensive one covering residences also. It is rather unfortunate that a one-dimensional image of Pakistan has emerged as a result of this. For example, even when exclusively studying monumental architecture, it cannot be understood in its entirety without considering the overall context of the social and cultural milieu of a society and an important part of this background is the domestic settlement pattern and the individual house form. Therefore, to study monuments alone would be to study fragments of a culture.

In recent years, domestic architecture has started receiving increasing attention and appreciation as it reflects an intimate lifestyle that was very important in human terms and it is this dimension that is lost in contemporary architecture. Hence, a study of past domestic architecture could perhaps help reestablish some of the human qualities that were lost, which in turn can offer valuable insights in order to create better modern architecture.

3.1 Sociology and Planning of the Rural House

It is necessary to begin with the rural house as it is the foundation of vernacular architecture and hence, provides the first prototype for both material aspects such as the house-plan as well as the non-material aspects like customs and traditions.

The setting in which a rural house can be analyzed was a village founded by a group of families that were linked together by kinship. These families were considered the original settlers in the area that initiated the first *khadki*, which is essentially a long open space or enclosure that is lined by dwellings on both sides. In other words, it is a circulation space for all the dwellings which open on to it, allowing a range of

activities for different people to carry out at different times of the day and year. For example, it provided a stable area for cattle to be kept, a place for children to play, men to socialize or sleep outdoors as well as women to conduct their daily chores. Important social functions such as marriages and religious festivals were also performed in *khadkis* where all members were expected to participate so much so that the *khadki* became an extension of the house with a semiprivate character (Pramar, 1989, p.61-63), as shown in Figure 3.1.

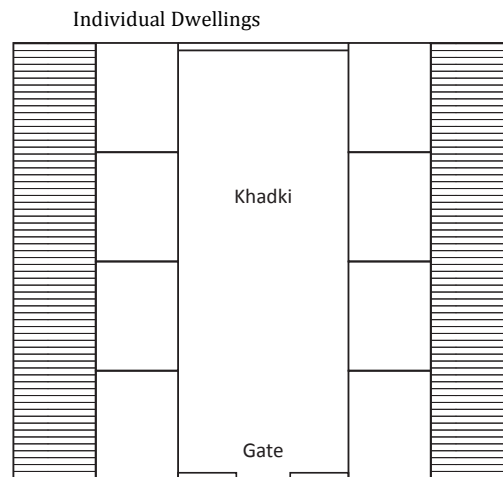


Figure 3.1 : A schematic view of a Khadki surrounded by Individual Dwellings.

The disadvantage with the single kinship dominated khadkis was that this prevented artisans, manufacturers, and traders from outside the kinship from inhabiting the place. This was due to the fact that dwellings of each khadki belonged to members of the same family who were very closely related such as uncles and aunts from the paternal and maternal sides as well as siblings and their families. Also, due to the exclusively domestic nature of life, features such as the assembly hall, marketplace or even the village square did not emerge as no other construction took place other than the dwellings of identical design and layout (Pramar, 1989, p.68). The basic character of the khadki never changed or incorporated any new functions and therefore, stayed monotonously uniform consisting of only dwellings in which all activities took place. Nevertheless, as the village continued to grow, the descendants would construct additional khadkis of different sizes around the original one, as shown in Figure 3.2

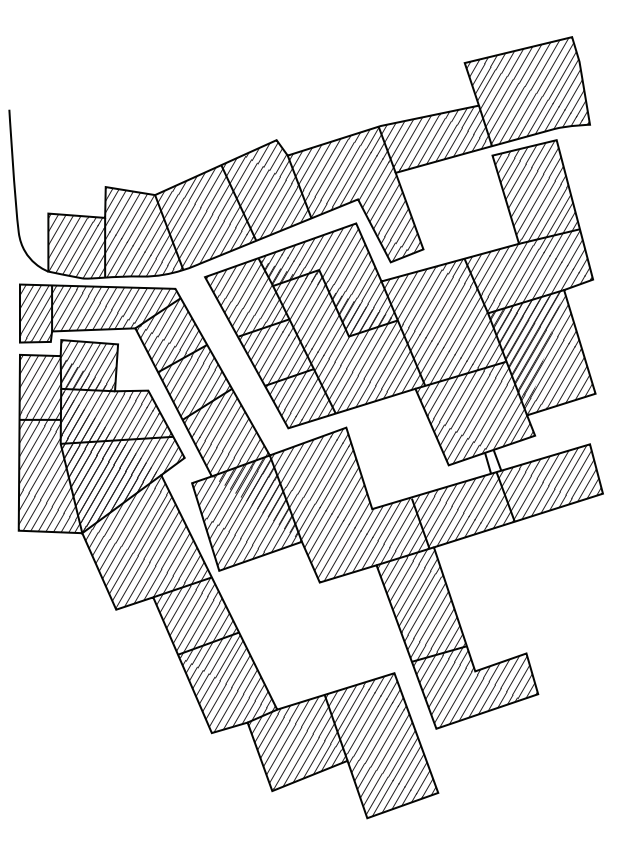


Figure 3.2 : The development of a settlement pattern as new khadkis were built around the original one.

A point to note here is that there was no preconceived scheme for the location and so an irregular pattern came about gradually with narrow lanes connecting various khadkis, which tended to remain close together for security and climatic purposes. Buildings were designed close together to cast shadows on the narrow lanes in order to maintain lower temperatures in the hot summers whilst still providing privacy to the residents. Once again, as the villagers were all related to each other, a very homogeneous and tightly knit society was created (Sabzwari, 2003).

Additionally, to better appreciate the individual dwelling, it is crucial to understand the psychological attitude towards the house. There was a common proverb that the local farmers would use declaring “a field produces wealth, while the house eats it up.” Thus, if there was an agricultural surplus, it would be used to extend agriculture as opposed to building lavishly. Another reason for designing and building in a simplistic manner was the uncertainty of the duration for inhabiting a certain place.

The rural house constructed by the farmer was composed of an outer covering to which he added internal subdivisions depending on the availability of funds and

security conditions at that particular time. The hearth would typically be situated at the back of the dwelling with a row of clay storage jars placed in front of it, for privacy purposes. Due to the lack of security, there were no windows or ventilators there, and so smoke from the fireplace would escape through the crevices of the roof. The air and light, on the other hand, would come in through the single main entrance door. The interior of the house was divided into three parts; the back with the hearth, the central space and the veranda which combined form a fixed pattern seen through all stages of development in the rural and urban houses.

The spaces of the dwelling had no fixed function – each room could be adapted according to the needs present at the time as they were not clearly defined for activities such as sitting, eating, working or sleeping. This amorphous use of space is possibly due to the relative lack of furniture which would enforce a fixed behavior to each space – there were no beds, tables and chairs and all activities including sleeping, eating and socializing took place on the floor. A reason for this was the fact that the villager was originally a nomadic migrant requiring any furniture that he had to be transportable in a bullock-cart, thus restricting both its size and amount (Pramar, 1989, p.76).

The development of the farmer's dwelling from its simple origins depended on his needs. The first addition to this envelope-like house was a loft at the back, which was used to store cooking fuel during the heavy monsoon rains without losing additional ground space. This modified the spatial interior to one with a high, single storied space in the center with a two-story arrangement at the back. Another modification was the replacement of the jar space dividers by a wall that extended up to the loft beam overhead allowing for the rear part of the dwelling to be fully closed off into a room. This in turn created a new secure internal space for all valuables to be stored by the family.

As the enhanced triple division became an established norm, every farmer then built the initial envelope with this notion in mind. The final stage of development followed with the extension of the loft to the front of the dwelling in order to cover both the central space and veranda, thus creating a regular first floor. In other words, the first floor now replicated the spaces of the ground floor. Therefore, in the joint family system, when sons got married they would generally set up their own independent hearth on the first floor and use it as the ground floor was used. As the

family grew, members would huddle closer together until the congestion became unbearable at which point, a new house would be constructed in a new khadki. From the beginning, families would design houses that could eventually be partitioned and so they would build houses next to each other, leaving out the walls that connected various units. In this manner, the residence could operate as a single dwelling or be partitioned by restoring the missing central walls (Pramar, 1989, p.80). Figure 3.3 shows an example of how a rural house may have been.

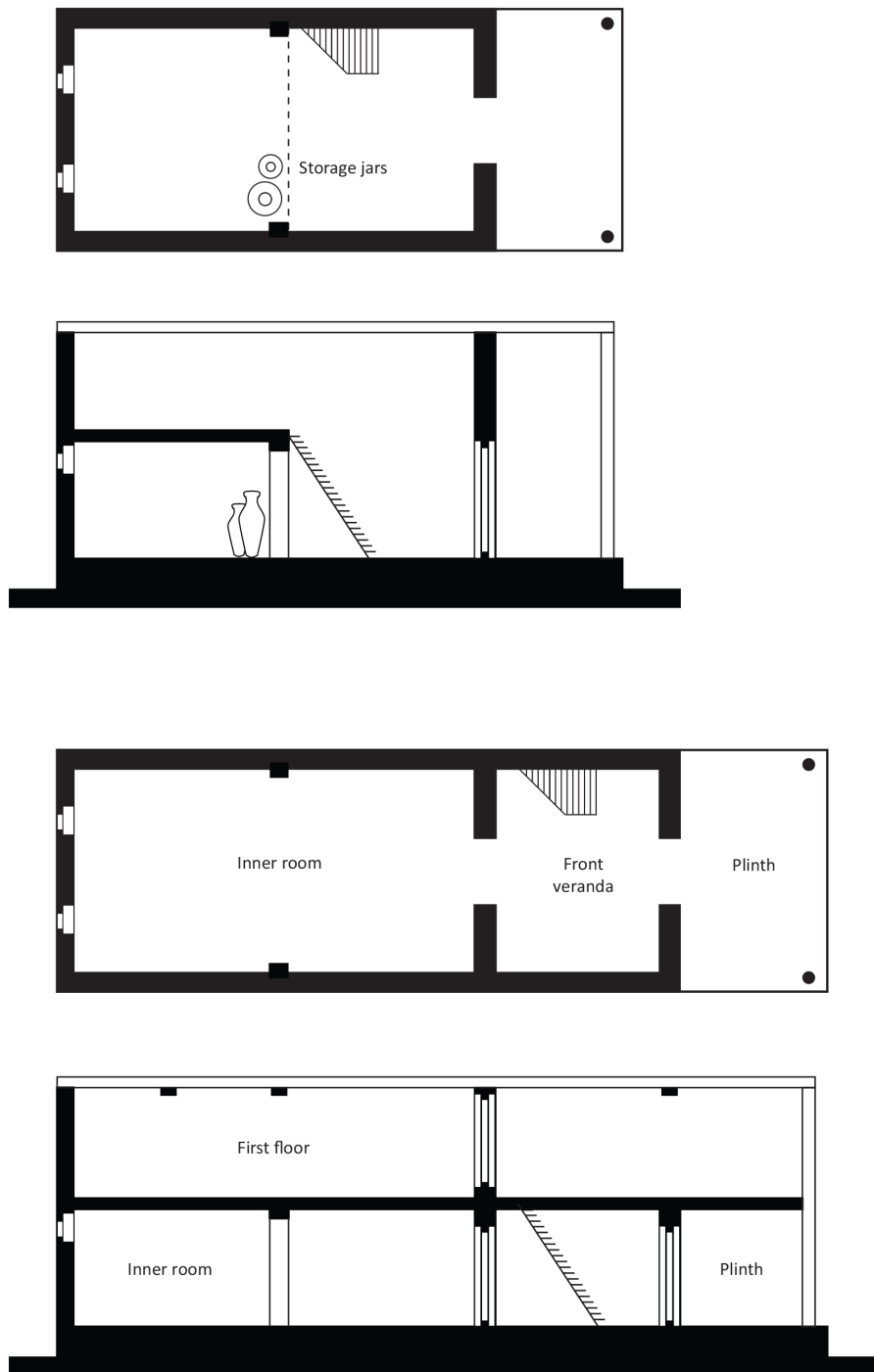


Figure 3.3 : A Rural House.

3.2 Development of the Hindu Urban House

The urban house can be seen as a continuation of the basic unit consisting of the tripartite subdivision of spaces seen in the rural dwelling. Saying that, certain additions and modifications were now made because of the new functions that arose following commercialization. Due to the increasing amount of trade, manufacture

and artisanship, clients who were considered complete strangers, would now visit the residence in order to conduct business. This became an issue as the rural residence was mainly visited by relatives and therefore not designed to meet the new situation. In the urban setting, when the stranger was given open access to the dwelling, it became problematic for the women of the household to observe their purdah due to the close proximity of spaces and the custom of leaving all doors open, as they would come in contact with each other (Sabzwari, 2003, p.20).

The first modification made to the urban house was the introduction of the internal courtyard, which was situated in between two distinct units, as opposed to being in a single one. The reason for this was to emphasize the separation in layout, which in turn was in response to the architectural requirement arising from commercialization. Also, instead of giving access to the whole house, the khadki-room in front of the dwelling became the ideal space to receive clients and business associates. In this manner, the khadki-room could function as a shop for the trader, a workshop or atelier for the artisan and a place for negotiating business. As the front veranda was no longer needed to accommodate casual visitors, it now became a narrow space and the plinth height was increased substantially to give the residence a more distinguished frontage. Although the three parts at the back of the dwelling stayed the same in the urban house, a small amendment was made with regards to the veranda; the rural house had one but now there were two in the urban residence (Pramar, 1989, p.98).

In the next stage of development, additions were made to the courtyard in order to link the two-part front with the three-part rear, as the space between them was inconvenient to cross especially during the heavy rains of the monsoon season. Thus, it became necessary to connect the spaces with a covered passage that not only acted as a weather shield but also formed a walkway on the first floor (Sazwari, 2003, p.20). Furthermore, in the rural house, the kitchen had been at the back but due to the relative lack of ventilation, smoke dispersal had become a serious problem and so in the urban residence, this issue was resolved by adding a new room to the other side of the courtyard. As the new kitchen was attached to it, smoke could escape easily via ventilators into the open space. Part of the covered central space that was adjacent to the newly located kitchen, now became more clearly defined as the dining area (Pramar, 1989, p.99) and the rear that no longer contained the hearth,

began to be used as primarily a storage space and partial sleeping area. The reason for this being, that the place provided privacy and when it was not being used for resting, it was locked. This was the first time a 'locked' room appeared in a dwelling (Pramar, 1989, p.99).

The ground floor now had eight parts in total: a three part rear, two part front, the central open courtyard and the two extra rooms on one side of the courtyard. The front and rear spaces remained the same from the rural dwelling with the addition of flat terraces on either side of the courtyard connecting the two and three-part spaces. The first floor continued to be used as it had in the predecessor – to accommodate the growing family and the occasional visitors. The normal two-storied residence was usually expanded to three or four stories as the pressure of population increased with the basic plan repeated on every floor. In earlier cases when sons got married, they would construct their houses in another khadki but as the city was fortified for security purposes by a long wall and city gates, after an extent when population increased, it could not be accommodated by horizontal architectural growth but instead had to be expanded vertically. Thereby came the multistoried dwellings (Sohail, 1998, p.8). Parents would always occupy the prestigious ground floor and the younger couples occupied the upper floors at night but during the day, all family members carried out their household chores and activities on the ground floor, thus restoring the original usage as much as possible.

In the city, due to more activities, parades, and festivals, the upper floors served as a vantage point from which family members observed events. Consequently, long windows were designed on the first floor of the khadki-room stretching down to the floor and in some cases, even had balconies projecting over the façade. The introduction of these window-balconies [jharokas] overlooking the narrow lanes gave the house an elegant appearance, which then became a defining characteristic of the urban residence (Pramar, 1989, p.100).

All these enhancements helped to more clearly outline the functions of specific parts of the dwelling and reduce its flexible nature, and Figure 3.4 shows the floor plan of how such a house may have looked like. The urban house now had more interior space and even though the functions were more defined for different spaces, they were still adaptable allowing for changes to be made according to various situations. For example, the women used the courtyard for washing clothes, bathing, and drying

grain while the children used it for playing. Additionally, there was an evident semipublic area in the front of the house and a private area at the back to the extent that when relatives came to visit, the men would sit in the more public khadki-room and the women in the inner veranda or central space, thus implicitly creating a 'men's area' and a 'women's area' (Pramar, 1989, p.100).

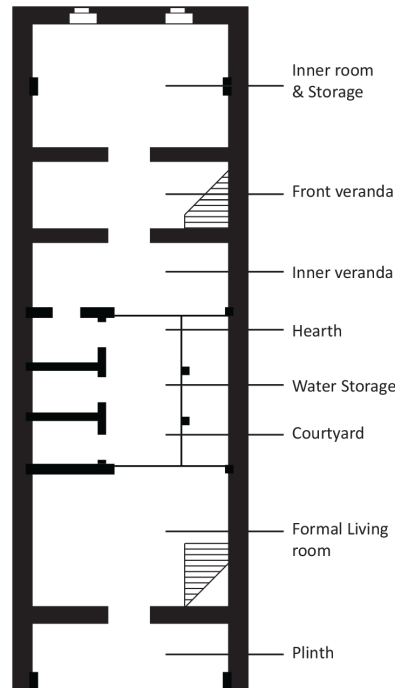


Figure 3.4 : An Urban Hindu House.

3.3 Development of the Muslim Urban House

A great majority of the dwellings that Muslims lived in were almost indistinguishable from the Hindu ones. A possible reason for this could have been the fact that as the people had converted from Hinduism, they not only retained their social customs but also their traditional architecture and developed it further to produce a composite culture. The superimposition of Muslim social norms on the Hindu house would at times, complicate the usage of dwelling spaces because in general, the house plan was neither changed in order to better accommodate the new requirements, nor was a new plan adopted, instead, the existing plan was used in new ways. In other cases, spatial proportions and organization were altered, which then changed the house plan and domestic atmosphere of the dwelling (Pramar, 1989, p. 154).

At the neighborhood scale, a striking difference between the Muslim scheme and the Hindu one was that in the former, houses were grouped together in zones along straight roads as opposed to twisting lanes and offsets. Plot sizes were also almost equal in size and depth, forming neatly aligned rows, which gave the impression of regularity and consistency (Sabzwari, 2003). Another scheme, inspired by the Islamic practice of West Asia, though seen less often in Pakistan, was the small group of houses that were located at great distances away from each other where the design revolved around the strict necessity to keep women out of sight. This was achieved through the avoidance of close proximity by having large areas of open ground and through the planning of the courtyard house.

In the cases where the Muslim House did change, the individual house plan of the Hindu urban dwelling was greatly modified to conform to the new conditions. The courtyard that was earlier situated between two residences was now incorporated within the dwelling as well as increased significantly in size. Furthermore, one or two wings were added to the sides and so with this new arrangement, we see a true courtyard house for the first time, with all the spaces organized around the central court. The wings on either side of the *chowk* were comparable to the *zenana* or women's area which contained the hearth, underground cistern, well, water storage and toilets. As the use of traditional spaces from the urban house became largely redundant due to the main functions taking place in the wings, spaces adjacent to the courtyard like the veranda and back rooms drastically reduced in size. Nevertheless, these spaces were still used as before, in order to store valuables, sleep and a place to meet female visitors (Pramar, 1989, p.168).

Due to the strict observance of *purdah*, there was a certain amount of segregation that was needed between men and women. This was achieved by spaces around the courtyard being divided into male and female areas, at times separating the vertical circulation spaces as well as positioning the main entrance at some distance to prevent any unexpected exposure. An interesting point to note here is that in both the Hindu and Muslim dwellings, when male visitors came to the house, privacy became an issue as men and women being in close proximity could encounter each other. For the Hindus, mutual visibility brought about by the *khadki-room*, where the visitors sat, overlooking the courtyard was tolerable as their avoidance was psychological whereas the Muslims required physical seclusion. Therefore, when Muslim male

visitors entered the residence, they would announce their arrival and wait for the women of the household to withdraw from the courtyard into more secluded areas. At night no visitors would arrive unannounced and so the courtyard was used for sleeping by family members. This basically indicates how flexible and adaptable the courtyard is as well as the fact that it can range between semi-public to private in nature according to the time, function and user demographics.

Most of the changes that occurred in the Muslim Houses were due to the increased consideration of privacy and the importance given to it by the Muslims. For this reason, the focus when expanding was on growing laterally, as higher floors were seen as breaching the privacy of neighbors. When these floors existed, they would usually consist of shed-like rooms in front and back with the remaining floor as a terrace and thus would be inferior to the floor or floors below in terms of quality as well as material. The mezzanine floor called *sojala*, if existent, overlooked the courtyard from the front of the house. This was to allow women to participate in any ongoing ceremonies and performances in the courtyard via small windows. Again for reasons of privacy, the *khadki*-room was also removed as clients were no longer expected or welcomed to come to the house and instead business was conducted in a separate shop (Pramar, 1989, p.170).

Wind catcher devices were also introduced in these houses wherein a brick chamber beginning from the ground floor and going straight up, facing the wind direction at the roof, would draw in air and introduce it where needed, such as in the courtyard and veranda on the ground floor where people slept and entertained visitors (Pramar, 1989, p.169). All these modifications can also be seen in Figure 3.5, which shows how a Muslim urban house may have been like.

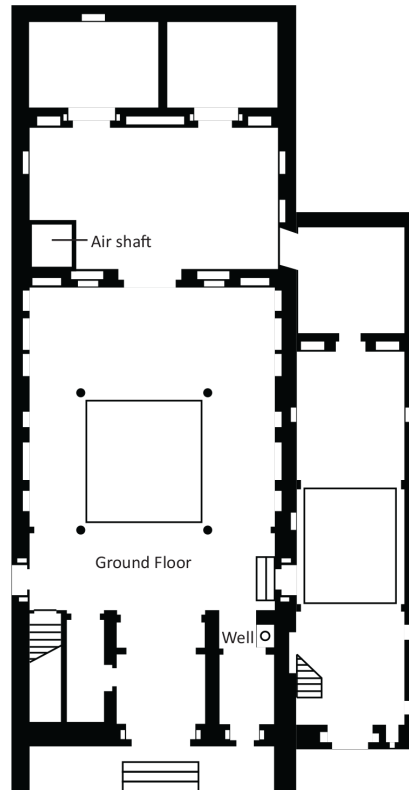


Figure 3.5 : An Urban Muslim House.

3.4 Development of the Haveli

The final development of the urban house was the haveli. The Mughal use of the word haveli was similar to the English use of the word 'estate' to define a piece of land. With time, the same word started being used not just for land, but also the dwelling on it. Now, the term haveli is more particularly used to define any medieval mansion built around at least one courtyard (Cooper, 1987) or a large residential mansion (Pramar, 1989). These were the officially recognized residences of princes, nobles, members of the aristocracy, estate owners, religious figures, ministers, royal doctors and wealthy merchants who were given a special status by the king or ruler. As such, these official residences were a symbol of social status and each haveli had a unique individual identity in accordance with its owner and his family (Jain, 2004, p.21).

Nonetheless, these havelis were still connected to the overall picture of the town itself. The mansions showcased the diversity of the land and its people, adapting to variations in geographical characteristics and culture resulting in havelis of each area having their own unique architectural style, building material and personality. Also,

the haveli symbolized that generation's lifestyle, customs and manners as well as their arts, crafts, architecture and music.

3.4.1 Transition from the urban house to the haveli

The haveli was, essentially, a grand version of the common urban dwelling. The increased size was attained by duplicating parts and so instead of a single room, two or more were placed adjacent to each other. Although the central space remained a single space, it now ran the full width of the house that was the same depth but became twice the width of the usual space. The courtyard also extended the full width of the house and where there were more than two rooms, it became a very large open space (Jain, 2004). Although the owners of the haveli were not opposed to novelty, and in fact had the wealth and wish to show it, the architects of the time added nothing new per se. The difference between the haveli and the common urban house remained one of quantity and not quality: the architectural features remained the same, only increasing in dimensions and numbers underlining the conservatism present in domestic architecture. This was probably due to the lack of education and exposure of the local artisans to outside architecture, resulting in a lack of innovation due to which their efforts were solely concentrated on improving the already identified solutions acceptable by society and developing their skills in perfecting details. The capacity to rethink the fundamentals was completely lacking and the changes that eventually did occur, were those derived from European architecture on Indian soil (Pramar, 1989, p.108).

The urban haveli thus remained intrinsically rural albeit the refinements in decorative elements and changes of function. Most importantly, the plan remained constant and many other aspects such as the absence of furniture remained primitive and traditional. The floor, occasionally spread with cushions and mattresses but void of any beds, tables or chairs with the exception of a wooden chest remained the stage for domestic life to play out. Similarly, toilets and bathing facilities also remained primitive. The rural life held the urban existence firmly in its stronghold (Pramar, 1989, p.112).

The haveli did however adapt to its new surroundings in certain aspects. The upper floors of the haveli generally had the same layout of rooms as the ground floor, similar to the rural house, but windows which were missing on the ground floor in

rural houses due to security concerns were now present in abundance in havelis, fitted with wooden or iron bars for security. Concealed chambers to store valuables were also similar in location under floors or in walls but more elaborate and sufficiently large so as to accommodate a man comfortably (Jain, 2004). As the number and sizes of rooms increased, it also enabled the house to be easily partitioned into separate areas for different members of the family such as brothers to reside in to allow for a dual residence (Pramar, 1989, p.112).

3.4.2 Effect of towns and settlement patterns to the development of the haveli

To understand the haveli, it is as important to study the surroundings and the environment in which it developed, as it is to understand how and where it came from. In other words, domestic architecture is comprehensible only within the social setting of the community, the settlement pattern of the area and the individual house plan. Furthermore, the constraints imposed by nature on the one hand and the sociocultural relations between the people, on the other, also determined the spatial organization of the traditional architecture. The constraints included: climate, topography and landform; functions and privacy relationships; and local materials and building methods of the region (Tillotson, 1998, p.163). Therefore, it became crucial to differentiate between the various urban characteristics such as the urban planning pattern, the topographical variations and the economic structure of the feudal towns as they all had a significant impact on the haveli form. For instance, whether a town had an organic, non-axial or grid iron, symmetrical layout; if it was classified as a hill town, valley town or one on the plains as well as functionally, if it was considered a military, agrarian, mercantile or religious town, all changed the way settlement formed and functioned.

The influence of the socioeconomic factors was distinctly evident in the physical planning and land use of towns which was brought on by the different social classes inhabiting the town such as the ruling and elite class, business class, and the farmers and ordinary workers. A noticeable hierarchy emerged as the ruling class and elites constructed their residences around the communal urban spaces that were usually private in nature, and inaccessible both physically and visually except through a narrow doorway connected to a public street. The businessmen followed next by building their dwellings close to or around the marketplace with the farmers and workers seen on the periphery of the village. To expand on this further, as the market

town developed, it attracted many traders and artisans from surrounding areas where eventually, various castes and guilds started developing their own mohallas; cobblers in one area, dhobis in another, goldsmith, traders, masons, carpenters and so on (Sohail, 1998, p.7). Although there were no strict rules and regulations for such segregation, most wealthy people lived side by side but when segregation did occur, it depended on the family background and profession (Jain, 2004, p.50).

There were two main types of settlement patterns in Pakistan: the Delo style community and the Khadki style. In the Delo style, each residence was an independent unit with its own private front yard which one could only access through a single gateway (delo) as the unit was enclosed by a wall, as exemplified in Figure 3.6. This wall ensured that each family was relatively isolated from its neighbors and that the inner privacy was increased further. Therefore, in a neighborhood that held a variety of communities that were not necessarily of the same family or religious sect, social interaction would occur outside the house and was limited to mostly men. Thus, the delo style arrangement strongly encouraged the lack of interaction among its residents. In terms of neighborhood layout, dwellings of roughly the same size were built in a row along the street onto which entrances of all houses opened on to (Sabzwari, 2003, p.14).

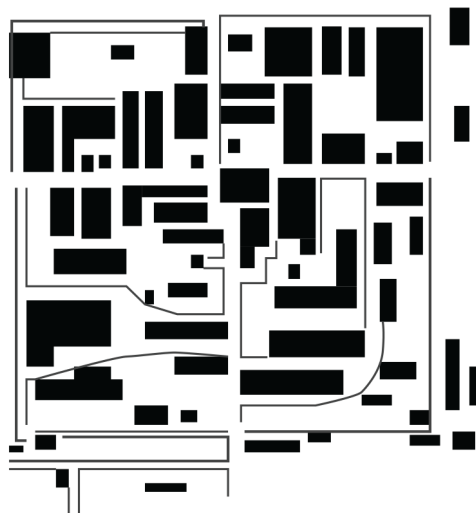


Figure 3.6 : Delo Style Community.

In contrast to the delo style, the khadki style had dwellings that were joined to each other by a common wall and this configuration of such units would form rows within the neighborhood. In many cases, the street between two rows would serve as a common yard. In order to ensure privacy and security for the residents, one end of

the row would be closed off by a wall and the other end by a gateway where the settlement formed a cul-de-sac guarded by a single entrance [khadki] (Sabzwari, 2003, p.15).

Apart from hierarchical patterns present on an urban scale, they were identifiable within the individual dwelling structures as a simple rectilinear geometry was used in order to organize various spaces, establish zones of varying levels of privacy and to control the movement through spaces. Most of the residences, regardless of their size, would then form part of a well-defined street system as the houses would always share their sidewalls; usually the longer ones, in narrow and deep houses, thus creating a harmonious façade. In this manner, a very small dwelling could coexist beside a large haveli and still produce a continuous façade with some variation in the height of houses. Therefore, one was able to perceive a strong connection between a house and the street it's on (Tillotson, 1998, p.163). The street itself was a narrow and winding lane that would widen at intersections and junctions forming small chowks and at times terminate into a cul-de-sac in neighborhoods, as seen in Figure 3.7. Additionally, they were treated as social and commercial nodes where the men would come to socialize and purchase items and youngsters would come to play.

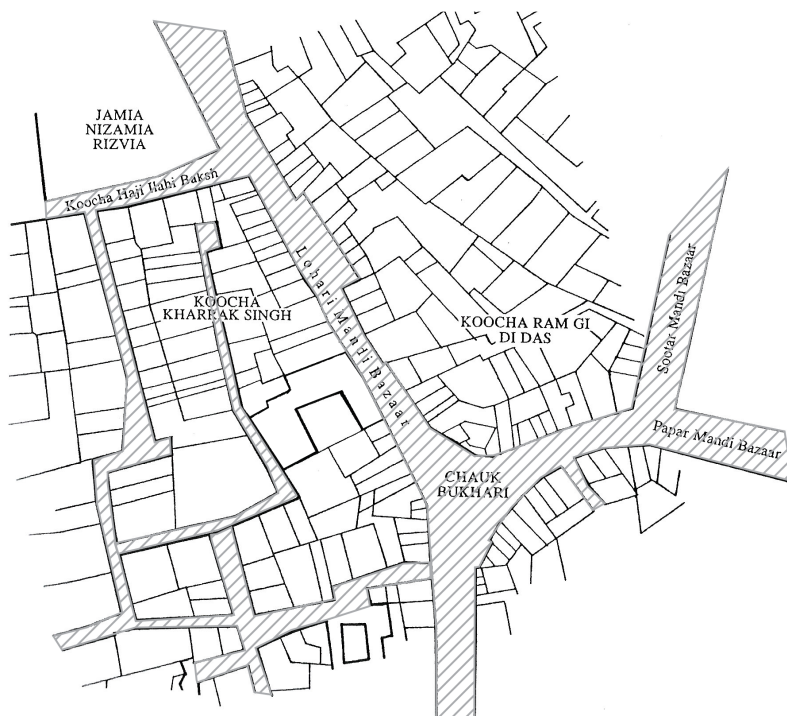


Figure 3.7 : Street view showing settlement patterns.

3.4.3 Understanding spaces in a haveli

The havelis were usually resided in by a single family, along with the required support system of servants and stables that also occupied the complex with them. Depending on the stature of the haveli owner, the family size and location of the haveli, the scale and number of courtyards could increase significantly. Large havelis in capital cities could have up to eight courtyards; however, majority of them would have either one or two. Furthermore, the chowk was used for all gatherings at the metropolitan scale, cluster level and within the individual residences (Jain, 2004, p.58).

Grand palatial havelis would have a minimum of three courtyards – one for the servants and stables, one for the men to receive guests called the *mardana*, and one for the women to entertain their guests, the *zenana* which is usually the innermost court (Jain, 2004, p.60). This separation of men and women was necessary due to the strict segregation or *purdah* as part of the culture at the time. This meant that the havelis would have a direct entrance into the mardana courtyard while the zenana was accessed via a baffle wall indirectly. The total number of openings to the haveli were limited though as the haveli also had a dual purpose, similar to a fortress, of providing defense.

Apart from the courtyards themselves, which identify another important space within the haveli, was the sitting area or *baithak*, which would be an elaborate room used for holding meetings or as an assembly area or for practicing the profession. Similarly, the *jharoka* is a space on the upper floors projecting over the street that had the important role of providing privacy to the women while allowing them to participate with the outside world (Tillotson, 1998, p.161). From outside the haveli, the jharoka would be seen as the owner's showpiece displaying his wealth, but from within, it offered the opportunity to provide light, ventilation and a view. The jharoka would be the women's view of the outside world as only the men were responsible for outdoor activities; neither knowing the details of each other's world. The women had full responsibility of the food grains; production of spices, pickles, edibles and control of the servants and the men would not interfere. These polar differences were even visible in the layout of the haveli where the mardana and zenana sections were

housed on separate floors or separate courtyards. In extension, the polarity can be seen in the lord and servant relationship as well where the haveli owner would be housed in the interior courtyard and the servants in a lower court or outer areas of the haveli. This follows the trends observable on different levels of organization – the center is represented by the ruler at the town level, the influential aristocrat at cluster level and the master of the house in the haveli (Jain, 2004, p.47).

In much the same way, at the individual house scale, the courtyard at the center of the dwelling is seen as the primary space at which the entire spatial structure of the dwelling begins. It defines its territory and thus, the place around it. In this manner, the generic core of the haveli can be perceived even when examining an irregular plot as the courtyard is always either square or rectangular in shape with the built form being a remainder of the plot size and the court (Jain, 2004, p.58). The courtyard connects other spaces both horizontally and vertically and in some cases, particularly on the upper floors, controls the views of individuals so that they cannot look across. The jharokas overlooking the courtyard presented a similar opportunity in that the inhabitants were able to choose whether to participate visually in the activities in other parts of the residence or not (Tillotson, 1998, p.166).

Access to the inner court of the haveli was of great significance because in single court havelis, it would serve as the main entrance to the dwelling. In havelis with multiple courtyards, there were two main types of lobby entrances, either providing direct access to the inner courtyard or indirect access using a baffle wall with a small opening to look through. The indirect entrance was used as a visual barrier between the inner and outer courts to protect the privacy of the women within the zenana court and this was done by ensuring that an individual had to turn in order to enter the space (Jain, 2004, p.60). Additionally, apart from the entrance being a physical access point, it also served as a source of communication with the outside world for the women of the haveli. As women of the household rarely left the haveli, the men both conveyed the happenings and events of the haveli out to the community and brought information from outside in. This would make the entrance a very important part of the life of those within the haveli as it took the form of an information portal for these people (Jain, 2004, p.61).

In the case of single court havelis, men would usually stay outside the court from morning to evening, allowing women to remain in the court and carry out their

domestic chores. This was different in the multi-court havelis because with the addition of separate male courts, men would remain in their own area and therefore, rarely enter the female courts. In both scenarios, the courtyard and the surrounding interior rooms would be used for various activities such as grinding spices, cooking, washing and drying of clothes and grains. Additionally, terrace and veranda spaces were also used as a continuation of courtyard activities as women were required to go outdoors for several activities, especially during morning and evening hours or when conducive by the climate such as in winters when the sun's warmth was welcome (Jain, 2004, p.63). However, as the need for privacy and a sense of enclosure was still important, this resulted in semi-covered and open enclosures resulting in a desirable situation of being outdoors, yet fully maintaining one's privacy (Tillotson, 1998, p.168). In the summer, women would use the interior open spaces for sleeping which changed in the winter, as they would use interior rooms instead. In much the same way, married couples used the chandni space, which was an enclosure on the upper floors with high walls and no rooftop during the summers and would switch to the interior rooms during the winter time. Terraces and interior rooms on various floors thus acted as multifunctional spaces where individuals could sleep, carry out household chores and store grains and family belongings (Jain, 2004, p.63).

In contrast to the private zenana court of the women, the mardana court was semi-public in nature. As the men had more interaction with people from outside the haveli, the need arose for the existence of a space where hospitality could be offered. This baithak (place to sit) space for male gatherings, originated from the rural house where it was first located some distance away from the main dwelling and then was incorporated in the house plan of the present-day haveli. The space itself was in the form of a large colonnaded hall called the mahal [palace] and usually overlooked the street (Jain, 2004, p.67). The men would spend most of their time either here or outside the haveli, and would enter the courtyard via a separate exterior entrance for specific tasks at certain times of the day, such as to have meals or to sleep at night. The women on the other hand were not allowed into the baithak and so in the few exceptional cases like performances, would be able to watch through a double height balcony from the zenana court. As such, the baithak functioned as the outsider's view into the haveli and a status symbol of the household (Jain, 2004, p.67).

All the secondary spaces in the haveli basically evolved from the main courtyards – the general, mardana and zenana courts – and continued to depend on these courtyards for sustenance. Although the spatial organization of the upper floors would accommodate more private functions such as sleeping, the residence tended to open up more as one moved up. To explain this concept more, the ground floor would invariably remain closed from the street, as there was a greater need for privacy at the public level as opposed to the upper ones. Therefore, like the courtyards on the ground floor, terraces and jharokas were designed at various levels of the house in order to create a sense of enclosure for the introverted lifestyle and at the same time respond to the harsh climatic conditions of the region (Tillotson, 1998, p.168).

An example of a typical haveli is shown in Figure 3.8. This haveli in Lahore Mandi Bazaar, north of Chowk Bukhari, is bounded by the bazaar to the east, and houses in the north, south and west. Figure 3.9, Figure 3.10 and Figure 3.11 show the ground, first and second floor plans of the haveli respectively also.

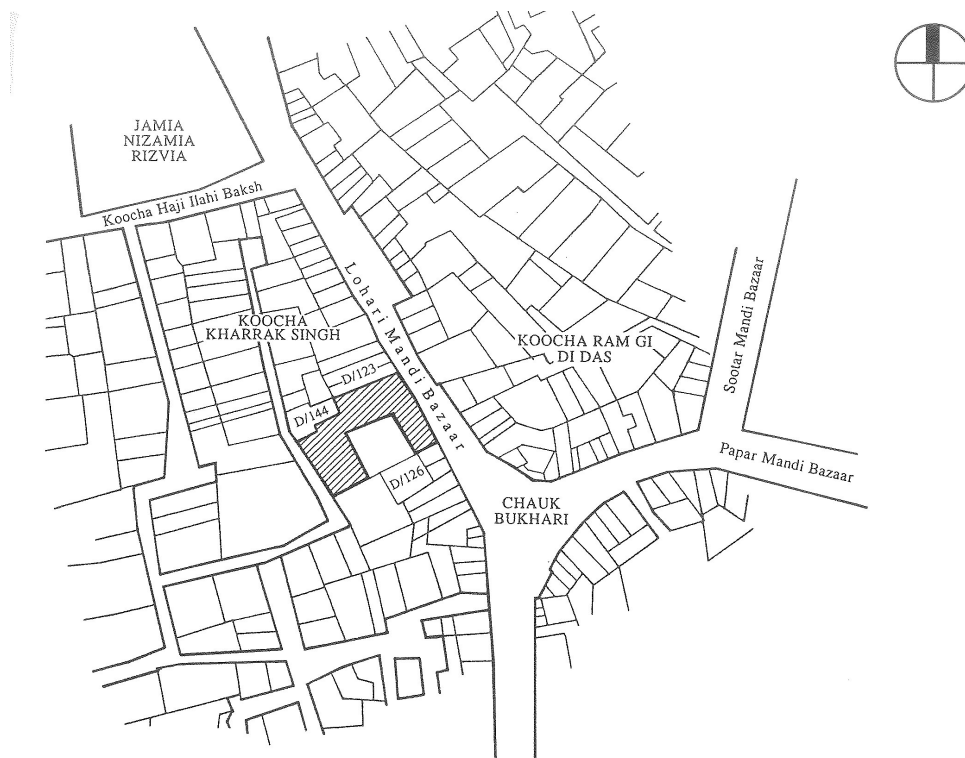


Figure 3.8 : Haveli in Lahore Mandi Bazaar.

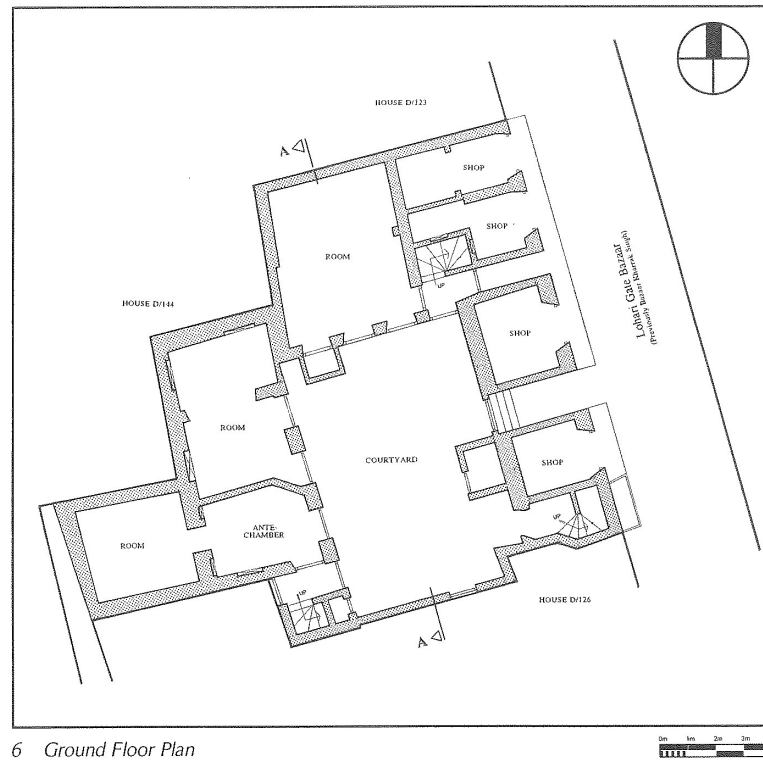


Figure 3.9 : Ground Floor Plan of Haveli in Lahore Mandi Bazaar.

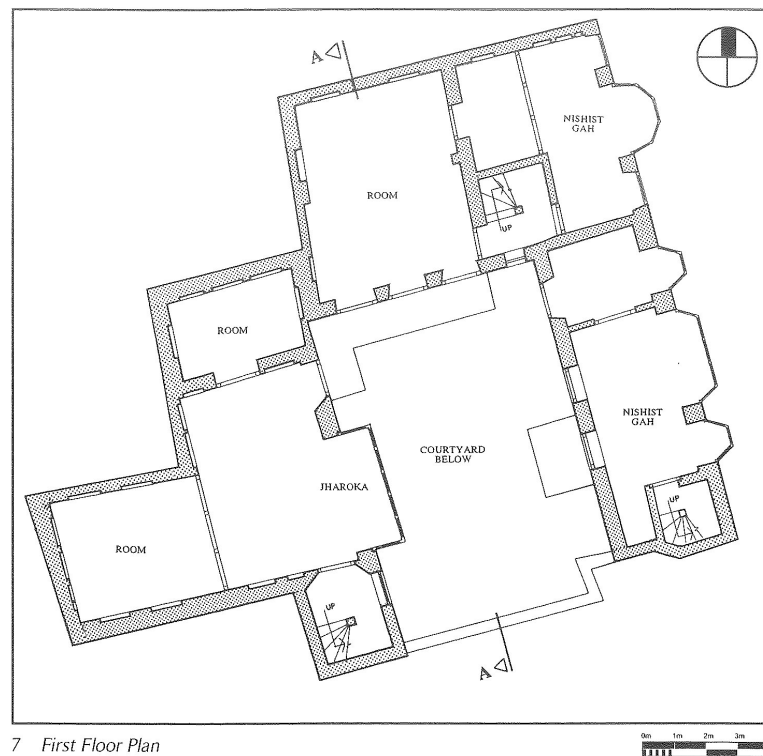


Figure 3.10: First Floor Plan of Haveli in Lahore Mandi Bazaar.

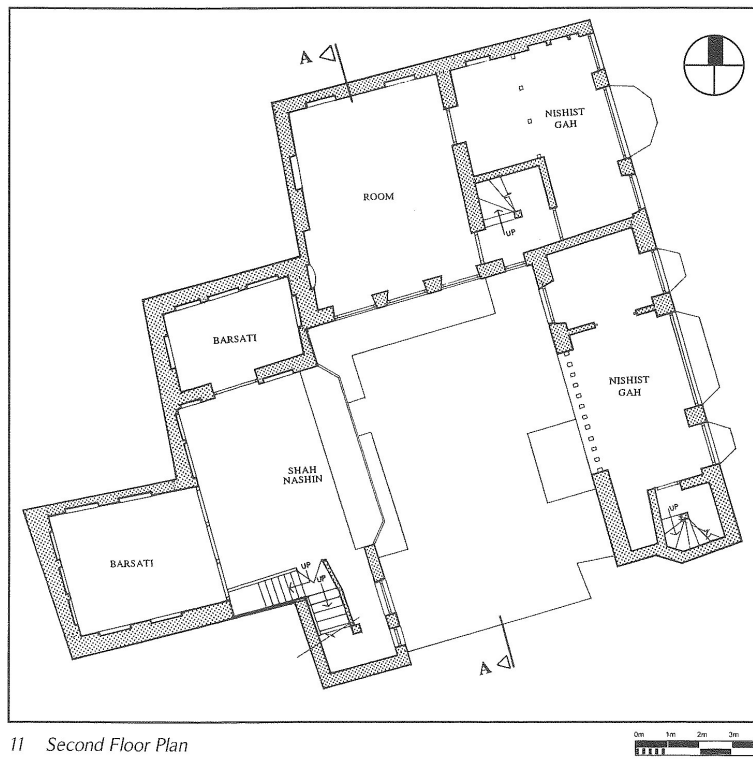


Figure 3.11 : Second Floor Plan of Haveli in Lahore Mandi Bazaar.

A second example can be the Lal Haveli in Lahore as seen in Figure 3.12. The ground, first and second floor plans can be seen in Figure 3.13, Figure 3.14 and Figure 3.15 respectively, showing the central courtyard around three sides of which the rooms have been arranged. The courtyard is rather large for the size of the haveli, probably because it was used to accommodate a large audience. Jharokas were placed on the bazaar-side façade and this was where the dancers would perform.

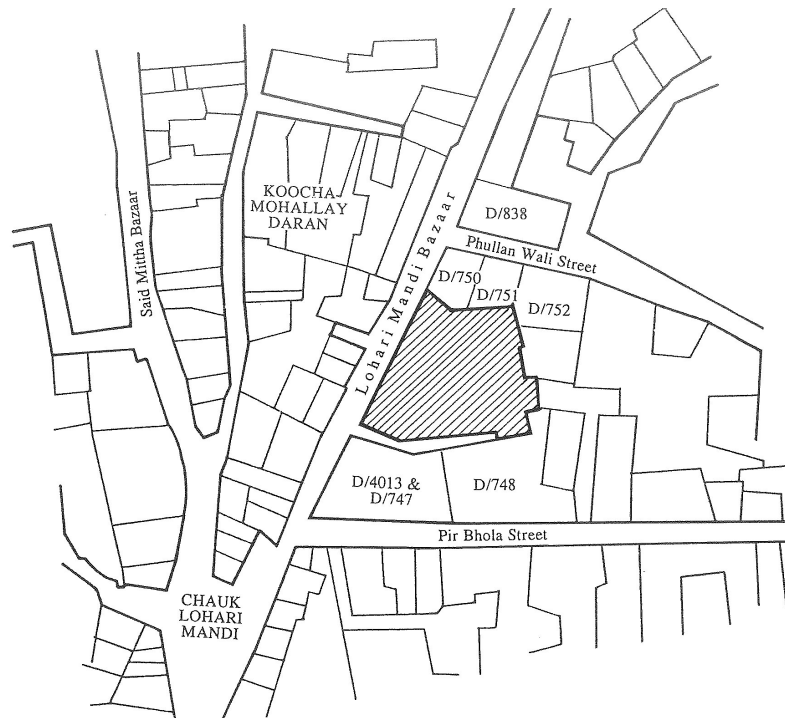


Figure 3.12 : The Lal Haveli in Lahore.

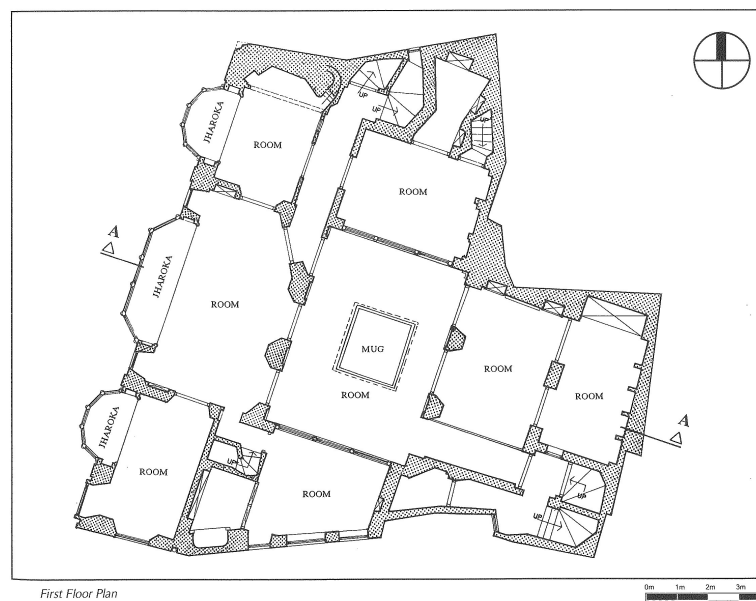


Figure 3.13: Ground Floor Plan of the Lal Haveli in Lahore.

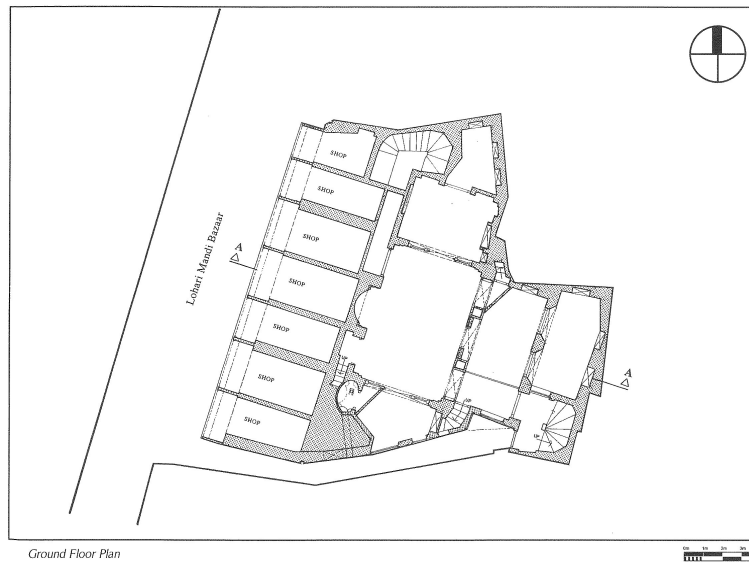


Figure 3.14: First Floor Plan of the Lal Haveli in Lahore.

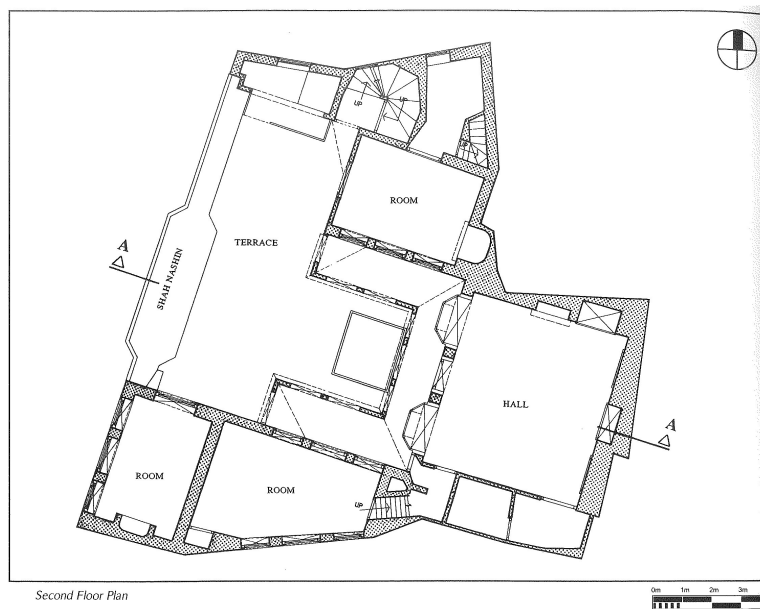


Figure 3.15 : Second Floor Plans of the Lal Haveli in Lahore.

3.4.4 Material limitations

The urban dwellings and havelis in Pakistan were constructed using a combination of materials such as brick, timber, marble, limestone, and red and yellow sandstone. Timber provided good dimensional stability but also became a limiting factor in the earlier dwellings as the size of the house was determined by the available timber

dimensions, which not only depended upon supply but also a cart's capacity to transport them to the site (Pramar, 1989, p.81).

As there is an evidently close relationship between the load bearing capacity of materials and the patterns of spatial organization, rubble masonry also offered some advantages and disadvantages. For example, the size of bricks used for construction was typically either [6 x 12 x 3] inches or [4 x 9 x 1.5] which meant that these dimensions governed all wall thicknesses. Also, when constructing rooms, their sizes depended on the maximum available length of stone slabs (Jain, 2004, p.145). In the case of bigger halls, stone or timber columns would have to be used for support. Walls were also used along with the column and beam system.

In terms of benefits of using certain materials, a major advantage of using mud, brick, sarkanda (a reed growing locally) and wooden planks in the construction was that the combination provided insulation both against heat and rain. Furthermore, the double-banked walls with sun-dried bricks on the interior and kiln dried bricks on the exterior, helped cater to wide temperature ranges between the extreme climates. The mixture of lime and chalk was used additionally to insulate the dwelling from heat during the scorching hot summers. Here, the residences were built with high ceilings to maintain a relatively constant internal temperature (Sohail, 1998, p.12).

4. METHODOLOGY

Following the development of rural, urban dwellings and havelis, it is important to examine the contemporary residences being built in Karachi and Lahore. Keeping in mind that current architects are now returning and focusing on the revival of courtyard-style houses that were once commonly occurring, the intention of this thesis is to syntactically analyze the contemporary courtyard houses and compare the various spatial configurations with an ideal courtyard style house. This thesis explores the hypothesis that dwellings with a single courtyard situated in the center of the residence will have spaces that are more integrated and connected versus the ones with multiple courtyards spread throughout the plan.

4.1 METHOD OF ANALYSIS

Investigations continue in the understanding of the nature of space, its importance to humans, how space is shaped in terms of form and organization to embody and express cultural or lifestyle preferences (Hanson, 1998, p.1). Houses everywhere serve the same needs of living, eating, sleeping, bathing, entertaining and the like. The pattern of spaces in the house are used to organize these activities and conventions and lifestyles dictate which space is used for each activity as well as which activities go together and which are separated out (Hanson, 1998, p.2). However, houses of different cultures and time periods show a large variety in the way these activities are accommodated in the layout of the house. The measure of how closely integrated or segregated each space is, defines whether the space is quiet or busy, and therefore provides an understanding of the social content of architecture (Hanson, 1998, p.1).

Space syntax is an approach to analyzing the relationship between humans and space based on a general theory of the structure of inhabited space, whether in the form of buildings, settlements, cities and landscapes. This approach firstly requires partitioning of the continuous space into discrete units. Each unit can then be labeled, assigned to groups or activities, and unique behavior patterns and conventions can be

associated with them (Bafna, 2003, p.17 & 18). Furthermore, the boundaries of each component space help identify the access or visibility between them, thus helping generate probabilistic patterns of movement and interaction within the housed population. Syntactically, spaces are considered more integrated if they can be directly reached from one another, or segregated if a need exists to pass through intermediary spaces (Wineman & Peponis, 2010, p. 88). This analysis helps bring out the patterns of hierarchical and social relationships from within the spatial configuration, calculated in depth, which is the measured distance between two spaces or the number of turns along a path between two spaces (Bafna, 2003, p.25).

Moreover, syntactical analysis of the configured spatial layout is typically conducted in the form of a building floor plan in order to generate quantitative measures of its properties. It involves the study of patterns of connections in terms of the relationships between neighboring spaces as well as the relationships of an individual spatial unit to the entire set of units that make up the spatial system being studied. It also offers a systematic approach to “disregarding small, circumstantial, and sociologically irrelevant geometrical data such as relative sizes of rooms” (Bafna, 2003, p.19).

In order to conduct the analysis, “Syntax2D” software was used, which was developed by the University of Michigan (Benedikt, 1979; Batty, 2001; Edgu et al., 2012). Here, floor plans of varying sizes were converted into cellular spaces with the “smallest grid cell” outlined so that a comparison could be made of different sample plans where ultimately, the underlying relationships can be examined using isovist visibility graphs. Isovists or visibility polygons are primarily a field of view from any particular point in space and so features such as walls, furniture and other elements that obstruct views, affect the parameters of the visual field (Benedikt, 1979; Turner & Penn, 1999; Batty, 2001). Visibility graphs were used to measure values of particular properties whereby these values appear mapped on the graph at each generating location through a color scale. To explain this furthermore, the visibility graph brings to light the relationship between visibility (what one can see) and permeability (where one can go). In order to produce these graphs, plans of various residences were drawn to scale digitally on AutoCAD in the (.dwg) format and then transferred to Syntax2D.

A total of 7 plan samples were chosen from the city of Karachi based on the varying spatial configurations of courtyard houses from single central courtyards to multiple courtyards dispersed throughout the plan. The selection was made in this manner to be able to compare and contrast the various layouts in relation to the ideal courtyard house that was based on the Hasht-Bihisht architecture as seen in Figure 4.1, which is a specific type of floor plan that is divided into 8 spaces surrounding a central one, as seen in Figure 4.2 - common in Persian and Mughal architecture.

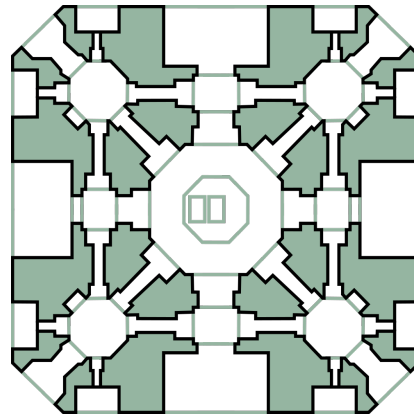


Figure 4.1 : Hasht-Bihist architectural diagram.

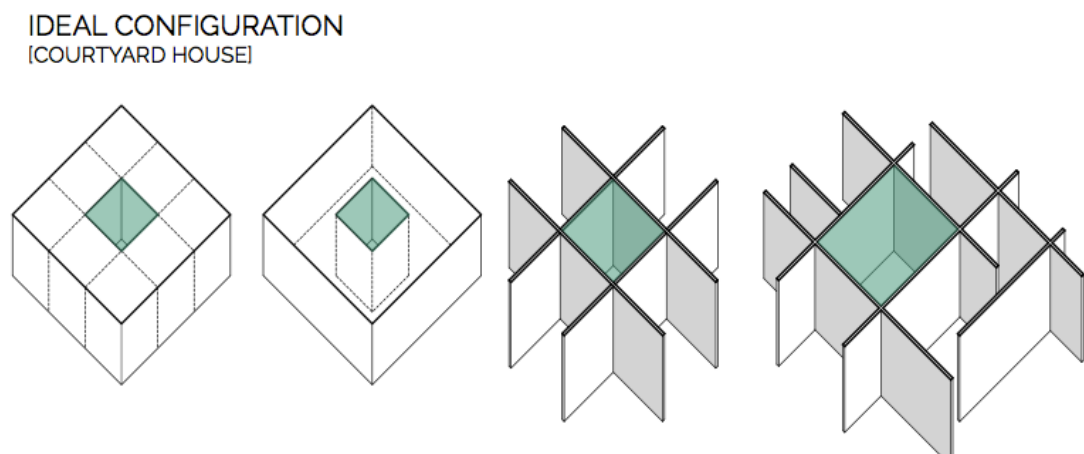


Figure 4.2 : Ideal Configuration of a Courtyard House.

The intent of the thesis is to explore the relationships and connections between spaces in order to observe how integrated or segregated they are. Also, which spaces and activities are connected to the courtyards and whether there are any particular reasons for them being situated where they are, for example, to acquire natural daylight and ventilation when cooking in the kitchen. Additionally, it would be beneficial to learn the nature of the courtyard and related spaces themselves to see

what purpose they serve and whether these functions change from floor to floor, such as the case where a courtyard can be accessed and used on the ground floor whilst it serves aesthetic purposes on the upper floors. Furthermore, the thesis looks to find out which spaces are easily accessible in the different case studies, as this could begin to demonstrate which spaces are ultimately used more, for longer time periods and also how the lifestyle and culture dictates the spatial configuration.

The data that was collected includes the Isovist Area, Isovist Perimeter, Circularity and Compactness, Connectivity, Mean Depth and Integration. Acquiring these particular parameters allows one to understand which residences have a layout where the spaces are organized close together by measuring “Circularity”. “Connectivity” will illustrate which spatial units are directly connected to each other whilst “Mean depth” provides an understanding as to the linear distance from the center point of each spatial unit to the center points of all the other units while Integration correlates the distribution of population within the setting by measuring how many turns have to be made from a spatial unit to reach all other units in the network, using the shortest paths possible. In other words, these parameters help understand how close or distant various spaces are from each other, which spaces and activities are linked together by being in close proximity, and how much distance an individual would have to cover to get to various places. Ultimately, the results were expected to prove that the dwellings with single central courtyard configurations would have a shallow plan that is compact and well connected whereas an arrangement of multiple courtyards spread out would have a deep plan, causing spaces to be more segregated and isolated.

The various spatial configurations were tested by dividing each floor plan into 4 distinct sectors that are as follows: “Courtyard area”, “Bedroom Area”, “Living Area” and “Services Area”. The Courtyard area included all the courtyards and related spaces; the Bedroom area contained all the bedrooms, the bathrooms, related balconies and the interconnecting spaces whilst the Living Area included the formal and informal living rooms, the dining room, the entrance hall, related balconies and interconnecting spaces. Lastly, the Services area contained the kitchens, circulation hallways, servant quarters and interconnecting spaces. Each floor plan was analyzed on Syntax2D software and the relevant measurements documented for each room by taking the averages of all the cells that lie within the confines of that room. Next, all

the measurements are recorded in a tabular format in order to make a comparison between the different case studies and their distinct layouts.

In the sections to follow, the measured values are discussed in detail in terms of their possible usefulness and implications.

5. SYNTAX ANALYSIS AND RESULTS

Syntax analysis was done on 7 contemporary courtyard houses across Karachi. The floor plans of each floor, along with the visibility graphs and tabulated data of relevant and important syntax analysis parameters are given below. The values in the tables are the mean values for each room, achieved by averaging the numbers for all the cells in each room. This ensures that a more representative value is used instead of just the value at the center of the room which can be misleading.

5.1 Type I: Houses with Single Central Courtyard Typology

5.1.1 Case study 1: Syed Ali Husnain Residence

The first case study is the Syed Ali Husnain Residence, with its ground floor plan and visibility graph shown in Figure 5.1, followed by the tabulated data for the ground floor in Table 5.1. The floor plan and visibility graph for the first floor is shown in Figure 5.2 and the corresponding tabulated data in and Table 5.2.

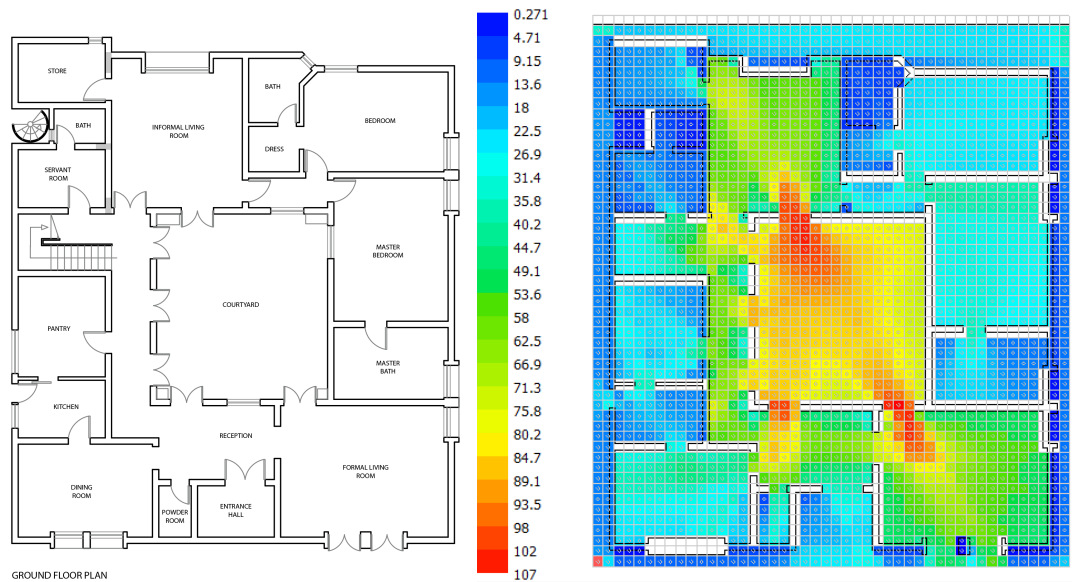
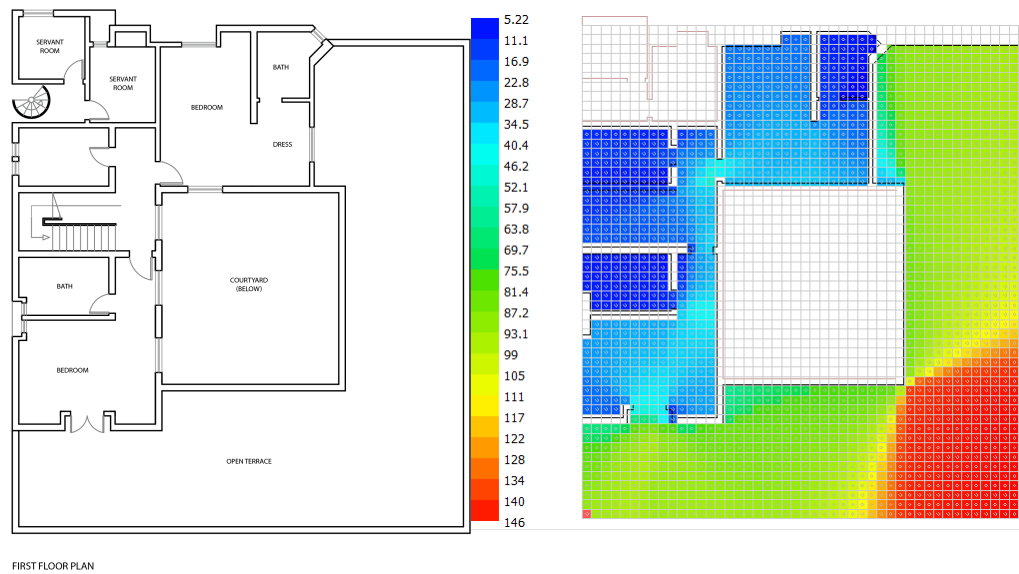


Figure 5.1 : Syed Ali Husnain Residence - Ground Floor Plan & Visibility Graph.

Table 5.1 : Syed Ali Husnain Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Master Bathroom	19.9	26.6	0.7	36.3	104.8	3.8	44.5
Master Bedroom	31.7	36.1	0.9	41.6	184.6	3.2	93.9
Bedroom1	25.6	28.3	0.9	31.6	143.1	3.5	61.0
Bedroom1 Bathroom	8.0	21.4	0.4	61.6	48.8	4.0	18.3
Bedroom1 dresser	19.3	26.5	0.7	36.8	110.5	4.3	45.0
Courtyard1	85.2	98.3	0.9	113.9	487.6	2.3	401.2
Dining Room	32.9	46.7	0.7	67.9	189.6	2.8	122.4
Powder Room	25.6	44.8	0.6	83.2	145.1	2.6	119.2
Entrance Hall	22.5	40.5	0.6	74.4	130.8	2.7	92.6
Formal Living Room	62.6	74.5	0.9	90.2	365.0	2.5	277.5
Informal Living Room1	63.0	81.1	0.8	105.5	378.2	2.3	303.0
Store1	18.3	28.6	0.6	46.0	114.1	3.0	78.1
Servant1 Bathroom	6.1	15.0	0.4	38.1	38.4	3.6	19.0
Servant1 Bedroom	14.1	28.8	0.5	60.7	88.3	3.1	52.6
Pantry	24.3	47.6	0.5	96.1	139.9	2.8	92.7
Kitchen1	17.8	30.0	0.6	50.8	102.6	3.2	58.2

**Figure 5.2 : Syed Ali Husnain Residence - First Floor Plan & Visibility Graph.****Table 5.2 : Syed Ali Husnain Residence - First Floor Syntax Analysis Results.**

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bedroom2	32.1	39.2	0.8	48.8	223.0	2.3	166.9
Bedroom2 Bathroom	9.3	16.4	0.6	29.3	63.8	3.1	29.2
Bedroom3	26.8	34.4	0.8	45.3	192.6	2.8	89.2
Bedroom3 Bathroom	8.7	16.6	0.5	32.3	59.8	3.9	20.9
Bedroom3 Dresser	23.7	37.2	0.6	58.7	169.3	2.9	76.3
Open Terrace	101.4	57.5	1.8	33.1	729.6	2.0	684.0
Store	11.8	24.5	0.5	51.7	84.3	3.0	37.4

As can be seen from the data, the courtyard is surrounded by adjacent spaces in a tightly integrated manner as demonstrated by its circularity value of 113.9, connectivity being 187.6 and having the lowest mean depth of 2.3. It also has the

highest integration value, illustrating that through the courtyard, multiple spaces can be accessed using the shortest distance possible.

Looking at the bedroom area, the master bedroom has a larger isovist area than the other bedrooms. The two bedrooms on the first floor have higher circularity and connectivity values than the master bedroom on the ground floor as there are less spaces upstairs, and therefore the spaces that are present like bathrooms and dressing rooms are directly connected and close in proximity to the bedrooms. Furthermore, Bedroom2 has the highest integration value of 166.9 as it opens up on to a large open terrace vs. the others which open on to internal corridors.

The formal and informal living rooms have roughly the same isovist area, and compactness but the informal living room has a greater circularity value of 105.5 vs. 90.2 for the formal living room. This implies that it is closer to other spaces than the formal living room. This is because the formal living room is situated in one corner of the house and is linked only to the reception and courtyard.

In terms of the service area, from a mean compactness range of 0.4 to 0.9, the kitchen falls in between at 0.6, showing that it is relatively well connected to adjacent spaces. The servant quarters on the other hand are more isolated and separated from other spaces with an average mean depth of 3.35, it is evidently pushed to the periphery of the residence and only connected to circulation space, (staircases and corridors).

5.1.2 Case study 2: Waseem Shafi Residence

The second case study is the Waseem Shafi Residence, with its ground floor plan and visibility graph shown in Figure 5.3, followed by the tabulated data for the ground floor in Table 5.3. The floor plan and visibility graph for the first floor is shown in Figure 5.4 and the corresponding tabulated data in and Table 5.4.

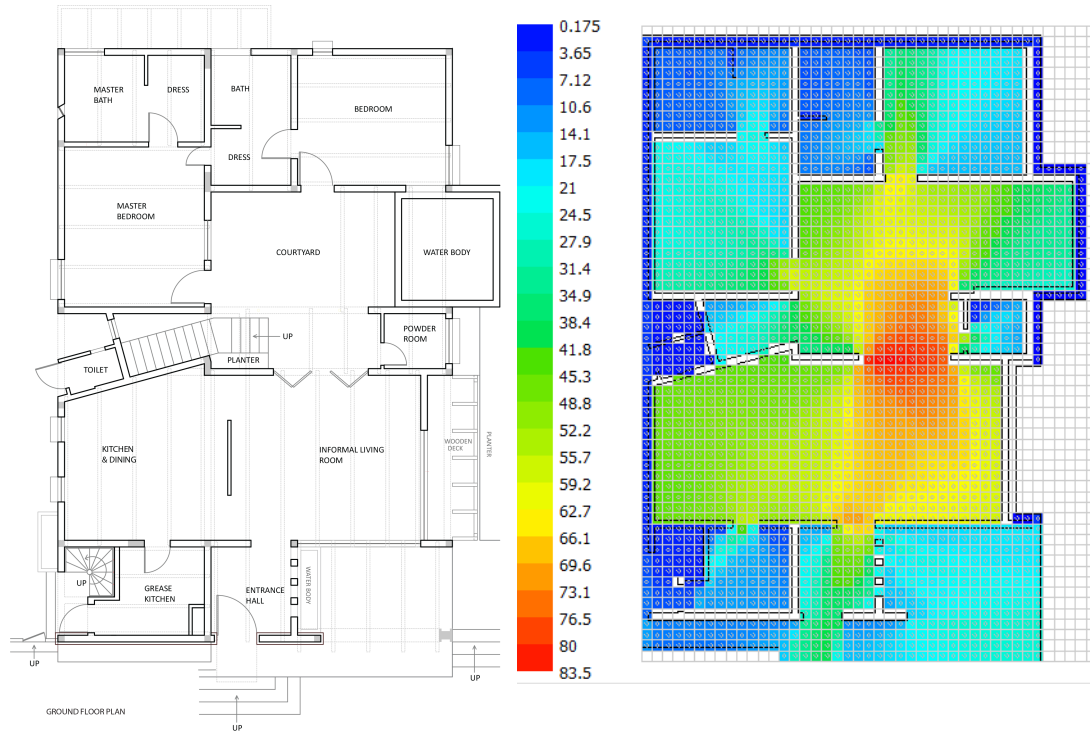


Figure 5.3 : Waseem Shafi Residence - Ground Floor Plan & Visibility Graph.

Table 5.3 : Waseem Shafi Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Master Bathroom	8.8	17.1	0.5	33.9	106.0	3.6	48.4
Master Dresser	15.7	25.2	0.6	41.2	184.8	3.0	108.5
Master Bedroom	25.9	37.4	0.7	54.4	302.4	2.4	244.3
Bedroom1	26.6	38.2	0.7	55.9	310.6	2.4	269.9
Bedroom1 Bathroom	9.0	23.5	0.4	63.9	104.5	2.7	71.5
Bedroom1 Dresser	13.7	22.2	0.6	36.3	156.6	2.8	103.1
Courtyard1	57.2	61.9	0.9	67.3	675.1	2.0	674.8
Waterbody	38.6	49.0	0.8	62.7	453.8	2.2	434.1
Powder Room	17.3	32.1	0.5	66.6	203.7	2.4	190.9
Dining Room	49.5	58.3	0.9	69.8	587.1	2.1	581.9
Informal Living Room1	64.9	62.4	1.0	60.8	767.9	2.0	778.1
Entrance Hall	39.2	66.8	0.6	121.1	463.3	2.2	458.3
Kitchen1	15.7	26.4	0.6	45.5	180.6	2.6	153.2

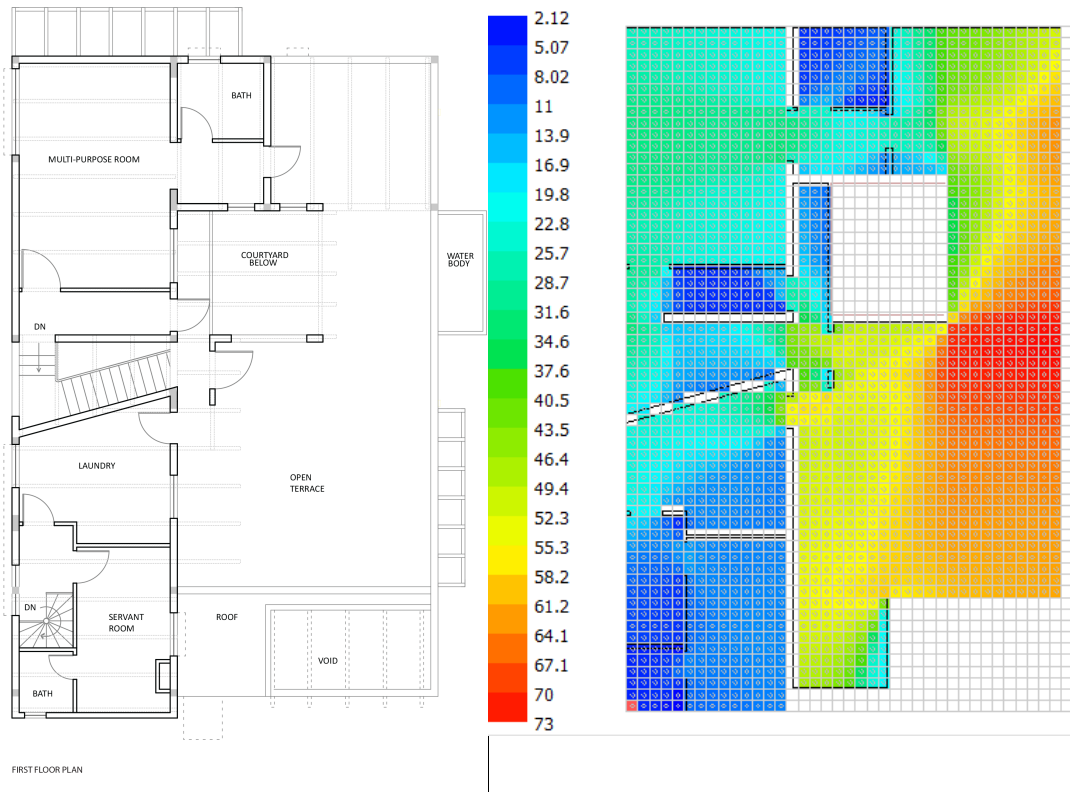


Figure 5.4 : Waseem Shafi Residence - First Floor Plan & Visibility Graph.

Table 5.4 : Waseem Shafi Residence - First Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bathroom1	8.7	19.9	0.4	46.5	119.7	3.0	69.7
Open Terrace	51.3	49.9	1.0	50.1	705.0	1.9	806.1
Multipurpose Room	26.5	32.8	0.8	41.0	375.1	2.4	268.9
Laundry Room	15.3	27.8	0.6	51.9	209.2	2.3	178.2
Servant1 Bedroom	11.3	19.4	0.6	33.6	158.8	3.2	70.9
Servant1 Bathroom	5.4	12.9	0.4	30.7	76.3	3.9	30.7

As seen in case study 1, the single central courtyard is surrounded by various spaces on all sides and is highly integrated. Saying that, the informal living room is the only other space that is as highly integrated and directly connected and accessible as the courtyard. Both the courtyard and informal living room have the same mean depth but the courtyard has more spaces organized closer to it as indicated by circularity whilst the informal living room has higher connectivity and integration values, implying the ease of accessibility (shortest distance and least amount of turns required to access other spaces).

According to the analysis, both the bedrooms have the same compactness and mean depth, as well as very similar isovist areas, circularity and connectivity values. The only difference between the two rooms syntactically is integration, illustrating that it

is easier to access the bedroom vs. the master bedroom. This could be an intentional strategy to give the master bedroom more privacy.

The open terrace on the first floor is the most integrated space as it stretches along the length of the dwelling and can be accessed through a staircase connecting the two floors, a corridor, the laundry room and the multipurpose room. The open terrace can be indirectly accessed in most instances apart from direct access through the laundry room. Also, the servant room and the multipurpose room are situated on opposite ends of the dwelling, in order to achieve the greatest level of privacy for both spaces. Based on the floor plan, the servants appear to move up and down through their own private stairwell, or access the rest of the first floor through the laundry room.

5.1.3 Case study 3: Khalid Adamjee Residence

The third case study is the Khalid Adamjee Residence, with its ground floor plan and visibility graph shown in Figure 5.5, followed by the tabulated data for the ground floor in Table 5.5. The floor plan and visibility graph for the first floor is shown in Figure 5.6 and the corresponding tabulated data in and Table 5.6.

Table 5.5 : Khalid Adamjee Residence - Ground Floor Syntax Analysis.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bathroom1	12.3	19.8	0.6	32.9	80.2	3.1	36.2
Servant1 Bathroom	5.0	17.0	0.4	104.6	37.4	3.1	16.5
Servant1 Bedroom	14.0	27.9	0.5	57.5	96.5	2.7	63.9
Courtyard1	39.1	47.7	0.8	59.4	269.4	2.1	202.6
Waterbody	10.1	17.5	0.6	30.4	70.4	2.8	33.2
Open terrace	44.2	50.3	0.9	57.9	295.0	2.2	214.6
Informal Living Room1	25.4	36.8	0.7	55.6	175.6	2.6	88.5
Dining Room	68.9	73.0	0.9	78.8	460.5	2.0	358.3
Formal Living Room	55.3	50.9	1.1	48.0	370.9	2.1	290.9
Entrance Hall	82.2	98.3	0.8	118.9	560.2	1.8	441.0
Store1	12.1	20.2	0.6	35.0	78.2	3.0	36.4
Store2	9.7	25.6	0.4	73.9	62.3	2.7	38.0
Grease Kitchen	27.3	49.4	0.6	91.1	179.1	2.2	123.4
Pantry	37.2	62.2	0.6	107.8	249.9	2.1	187.8

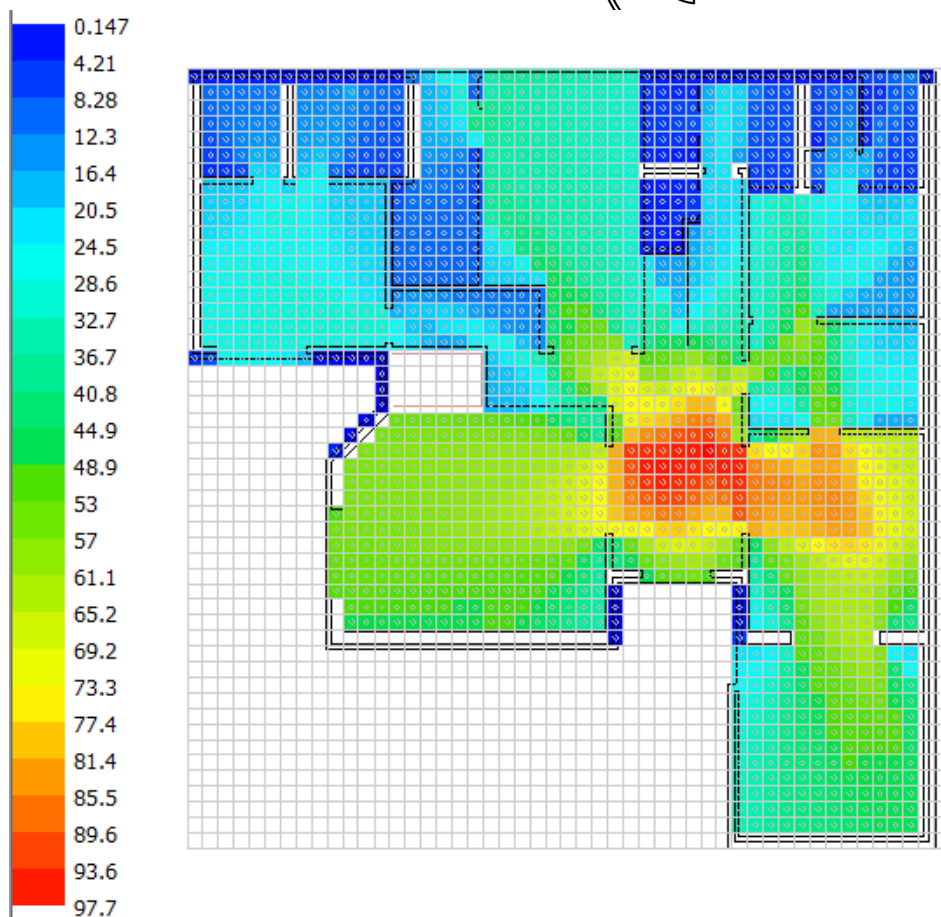
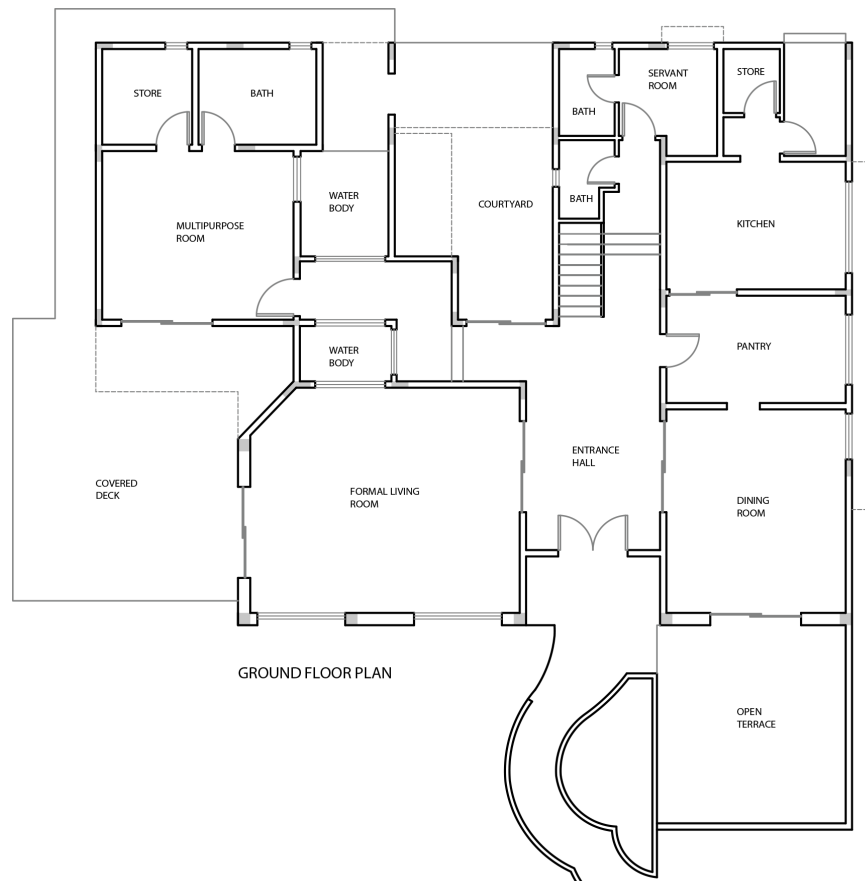
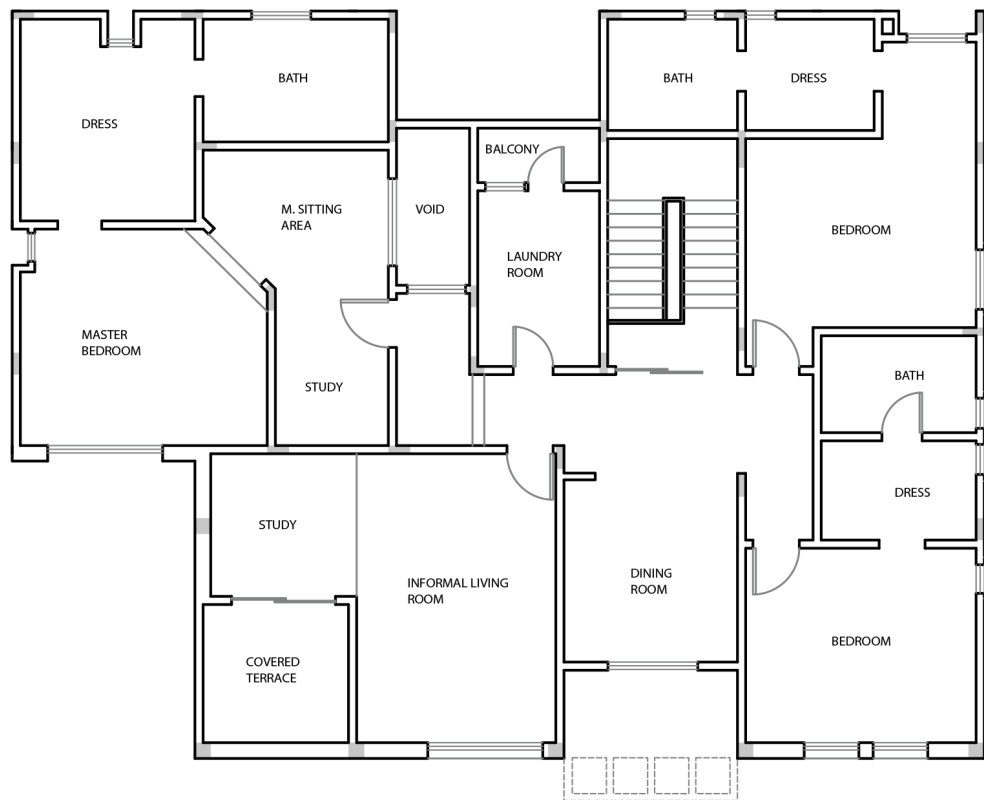


Figure 5.5 : Khalid Adamjee Residence - Ground Floor Plan & Visibility Graph.



FIRST FLOOR PLAN

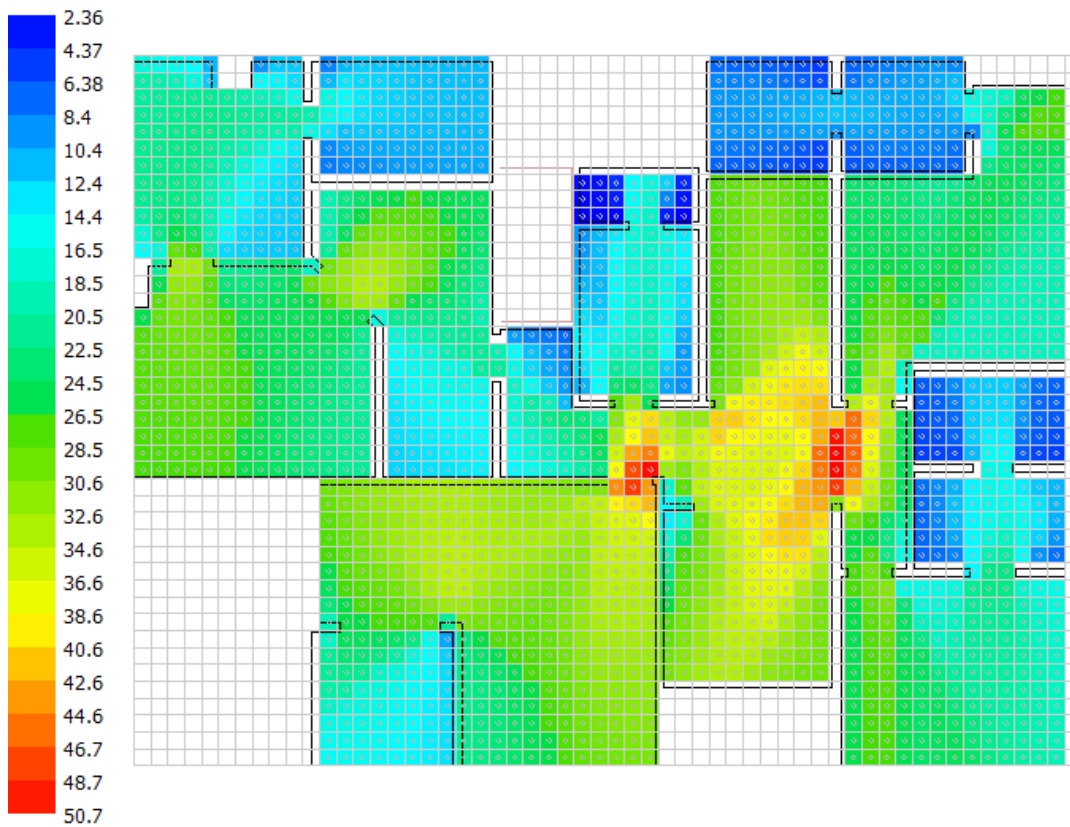


Figure 5.6 : Khalid Adamjee Residence - First Floor Plan & Visibility Graph.

Table 5.6 : Khalid Adamjee Residence - First Floor Syntax Analysis.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Master Dresser	19.0	29.2	0.7	45.1	180.9	3.7	64.8
Master Bathroom	12.0	19.9	0.6	33.1	106.9	4.5	30.6
Master Bedroom	26.2	30.7	0.9	36.0	247.9	2.9	117.7
Master Sitting Area	27.5	38.2	0.7	54.1	252.8	2.5	131.6
Bedroom1	22.9	34.8	0.7	53.7	208.2	3.1	94.7
Bedroom1 Dresser	12.8	22.9	0.6	41.5	114.3	3.9	40.8
Bedroom1 Bathroom	9.3	18.5	0.5	37.4	81.3	4.1	26.2
Bedroom2	23.4	36.4	0.7	57.5	215.3	2.8	112.6
Bedroom2 Dresser	10.0	19.6	0.5	38.5	97.0	3.5	37.0
Bedroom2 Bathroom	9.2	18.4	0.5	37.1	90.2	3.7	32.2
Balcony1	9.5	22.1	0.4	54.8	88.6	3.3	44.1
Covered Terrace	16.3	21.0	0.8	27.4	153.4	3.2	78.0
Master Study	15.2	21.1	0.7	29.9	136.1	3.1	72.2
Study1	31.4	34.8	0.9	39.4	302.9	2.6	158.9
Informal Living Room1	31.0	35.7	0.9	41.4	302.9	2.7	163.9
Dining Room2	32.8	45.2	0.7	62.5	300.9	2.4	190.6
Laundry Room	16.4	31.4	0.5	61.8	155.0	2.8	82.8

Looking at the data, the courtyard has a circularity of 59.4, connectivity of 269.4 and integration of 202, showing that it is moderately well packed and integrated within the house plan. However, it is not the most integrated as spaces like the entrance hall and formal living and dining rooms are more integrated and better connected. Bedrooms 1 and 2 are virtually syntactically identical. They have the same isovist area (22.9 vs. 23.4), same compactness (0.7), same circularity (53.7 vs. 57.5) and connectivity (208.2 vs. 215.3). Integration and mean depth set the two apart: Bedroom1 has mean depth of 3.1 and integration of 94.7 whereas Bedroom 2 has a mean depth of 2.8 and an integration value of 112.6, indicating that Bedroom2 is more integrated than Bedroom1. The Master bedroom has access to greater number of spaces than Bedroom1 and Bedroom2 but has less spaces close to it. It is the most integrated out of the three bedrooms (117.7 vs. 112.6 and 94.7). The formal and informal living rooms have roughly the same circularity value (48 vs. 41.4). Formal living room is more accessible and connected to greater number of adjacent spaces than the informal (370.9 vs. 302.9). The informal living room is set deeper into the plan as indicated by the mean depth making it more private. The formal living room is far more integrated into the plan than the informal living room.

The entrance hall has the largest isovist area, the best circularity (118.9), highest connectivity (560.2) and highest integration (441.0). The kitchen with a circularity of 91.1, connectivity of 179.1 and integration of 123.4 is moderately well connected to other spaces.

5.2 Type II: Houses with Multiple Courtyard Typology

5.2.1 Case study 4: Badr Muneer Residence

The fourth case study is the Badr Muneer Residence, with its ground floor plan and visibility graph shown in Figure 5.7, followed by the tabulated data for the ground floor in Table 5.7. The floor plan and visibility graph for the first floor is shown in Figure 5.8 and the corresponding tabulated data in and Table 5.8.

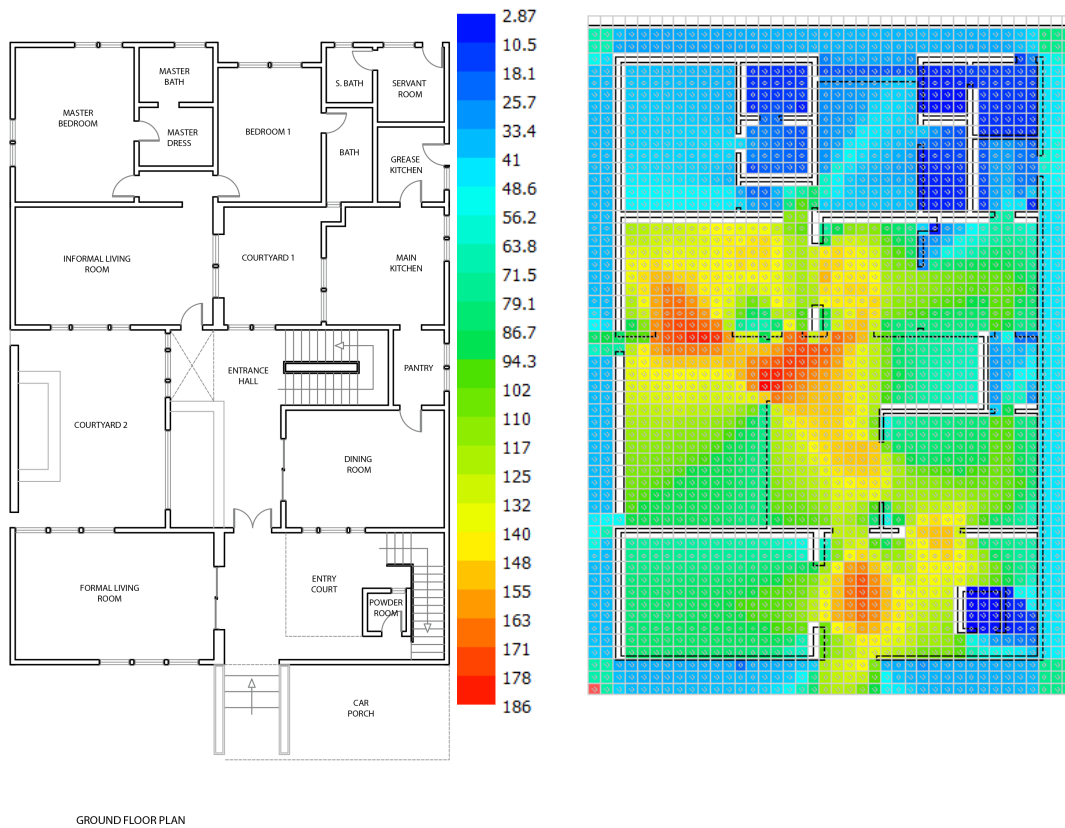


Figure 5.7 : Badr Muneer Residence - Ground Floor Plan & Visibility Graph.

Table 5.7 : Badr Muneer Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Master Bedroom	41.2	37.6	1.1	34.9	123.6	3.6	49.8
Master Bathroom	12.4	20.4	0.6	34.3	33.1	4.6	10.1
Master Dresser	23.4	32.0	0.7	44.1	66.3	4.3	23.0
Bedroom1	38.0	48.1	0.8	62.4	122.4	2.8	74.5
Bedroom1 Bathroom	14.9	22.8	0.6	35.9	48.1	3.5	23.4
Entry Courtyard	129.4	120.8	1.1	114.6	422.1	2.3	309.8
Courtyard2	116.2	94.7	1.3	77.9	379.3	2.3	298.0
Courtyard1	123.0	107.5	1.2	95.3	392.7	2.3	318.8
Dining Room	96.8	84.2	1.2	74.6	316.8	2.4	241.0
Powder Room	5.5	11.9	0.5	26.5	19.7	3.4	10.4
Formal Living Room	84.0	60.8	1.4	44.2	267.1	2.7	178.7
Entrance Hall	142.0	126.6	1.1	113.1	463.9	2.2	375.3
Informal Living Room1	138.6	120.8	1.2	106.4	443.5	2.2	350.4
Servant1 Bathroom	7.4	17.2	0.4	40.2	23.6	4.6	6.9
Servant1 Bedroom	12.8	20.1	0.6	31.7	40.6	4.0	13.7
Kitchen2	29.8	45.8	0.7	71.2	96.6	2.7	64.4
Kitchen1	82.7	91.4	0.9	103.5	268.9	2.4	206.9
Pantry	40.2	56.0	0.7	79.3	131.8	2.6	95.2

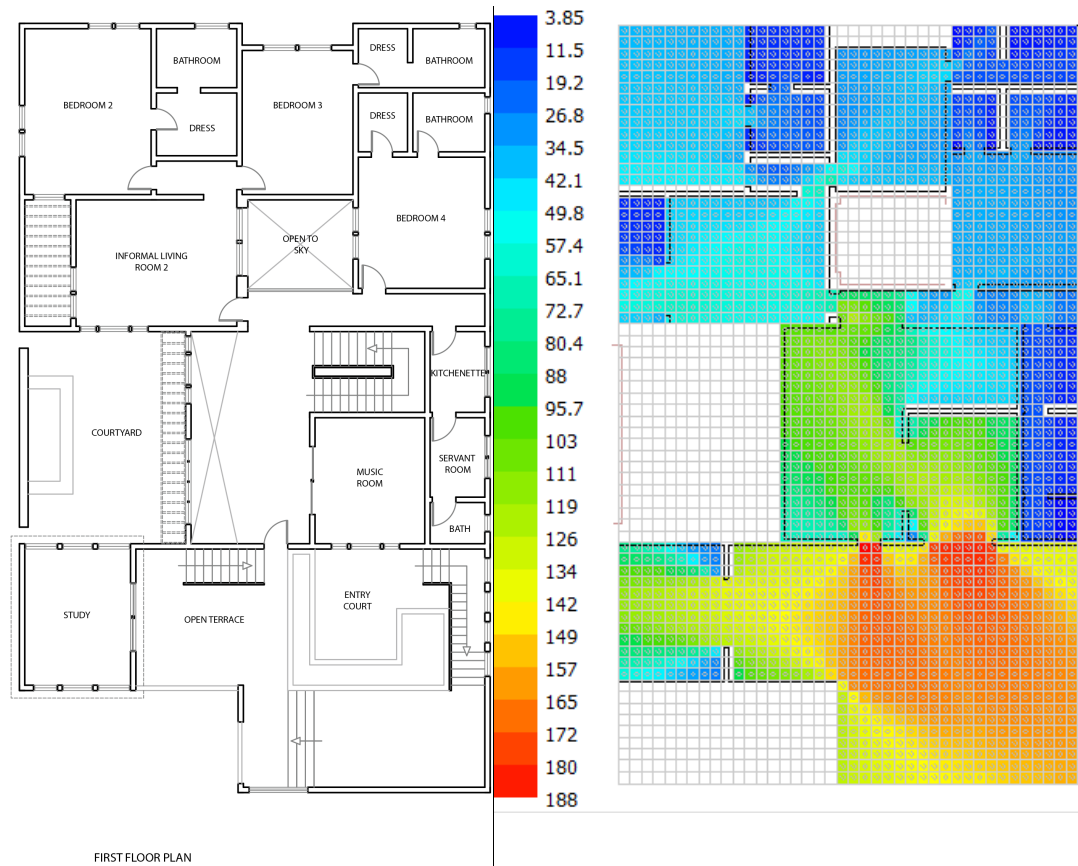


Figure 5.8 : Badr Muneer Residence - First Floor Plan & Visibility Graph.

Table 5.8 : Badr Muneer Residence - First Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bedroom2	40.7	37.1	1.1	34.3	174.2	4.2	56.5
Bedroom2 Bathroom	12.2	19.9	0.6	32.9	52.9	5.3	13.5
Bedroom2 dresser	23.3	31.1	0.7	42.7	99.8	4.9	28.3
Bedroom3	37.1	46.9	0.8	59.9	161.3	3.1	80.1
Bedroom3 Dresser	17.1	32.2	0.5	64.4	72.5	3.5	34.6
Bedroom3 Bathroom	11.2	20.1	0.6	36.7	46.4	4.3	16.7
Bedroom4	33.8	36.1	0.9	39.2	154.6	3.1	74.2
Bedroom4 Dresser	18.9	25.5	0.7	36.1	83.0	3.4	39.0
Bedroom4 Bathroom	15.4	22.6	0.7	34.9	66.4	3.7	29.2
Servant2 Bedroom	14.8	25.2	0.6	43.3	71.6	3.5	30.9
Servant2 Bathroom	12.2	22.6	0.5	42.5	60.3	3.6	26.1
Open Terrace	155.5	85.0	1.8	46.7	704.6	2.5	459.8
Music Room	111.2	68.5	1.6	42.9	509.0	2.7	343.0
Study1	94.0	54.9	1.7	33.9	425.0	3.0	261.6
Informal Living Room2	50.8	59.6	0.9	70.9	227.6	2.5	157.6
Kitchenette	15.3	26.6	0.6	46.7	73.0	3.3	33.8

The syntax analysis shows that Courtyard 1 functions in similar way to previous examples – multipurpose space. Also provides natural daylight, ventilation, views, and access. Courtyard 2 and entry court are on the periphery and yet both courtyards have similar integration values (298.0 and 309.8). This indicates that the location of the courtyard is possibly not important.

The Master bedroom on the ground floor and Bedroom 2 (first floor) behave in the same way looking at their compactness (at 1.1) and practically the same circularity (34.9 and 34.3). Connectivity, mean depth and integration though are significantly higher for Bedroom 2 than for the master bedroom. Looking at the Bedroom, bathroom and dresser as a unit, these are the most private units as indicated by mean depth values. Integration values are relatively low as they are segregated spaces on the opposite end to the entrance of the house.

The Formal living room is detached from the rest of the house (placed outside and accessed before entering the dwelling). This is similar to baithak in havelis. Connectivity for formal living room is significantly lower than the informal living room, although both are in the same zone – guests in the formal living room can look into courtyard 2 but not access it like the informal living room. The Informal living room can access more private courts versus the formal living room which can only access the public entry court.

The grease kitchen and pantry are on the boundary of the dwelling but it is the pantry that has better connectivity, circularity and integration, which means that more

people can access pantry versus the cook accessing the grease kitchen. The flow of spaces is as follows: grease kitchen – main kitchen – pantry- dining.

5.2.2 Case study 5: Asim Raza Residence

The fifth case study is the Asim Raza Residence, with its ground floor plan and visibility graph shown in Figure 5.9, followed by the tabulated data for the ground floor in Table 5.9. The floor plan and visibility graph for the first floor is shown in Figure 5.10 and the corresponding tabulated data in and Table 5.10.

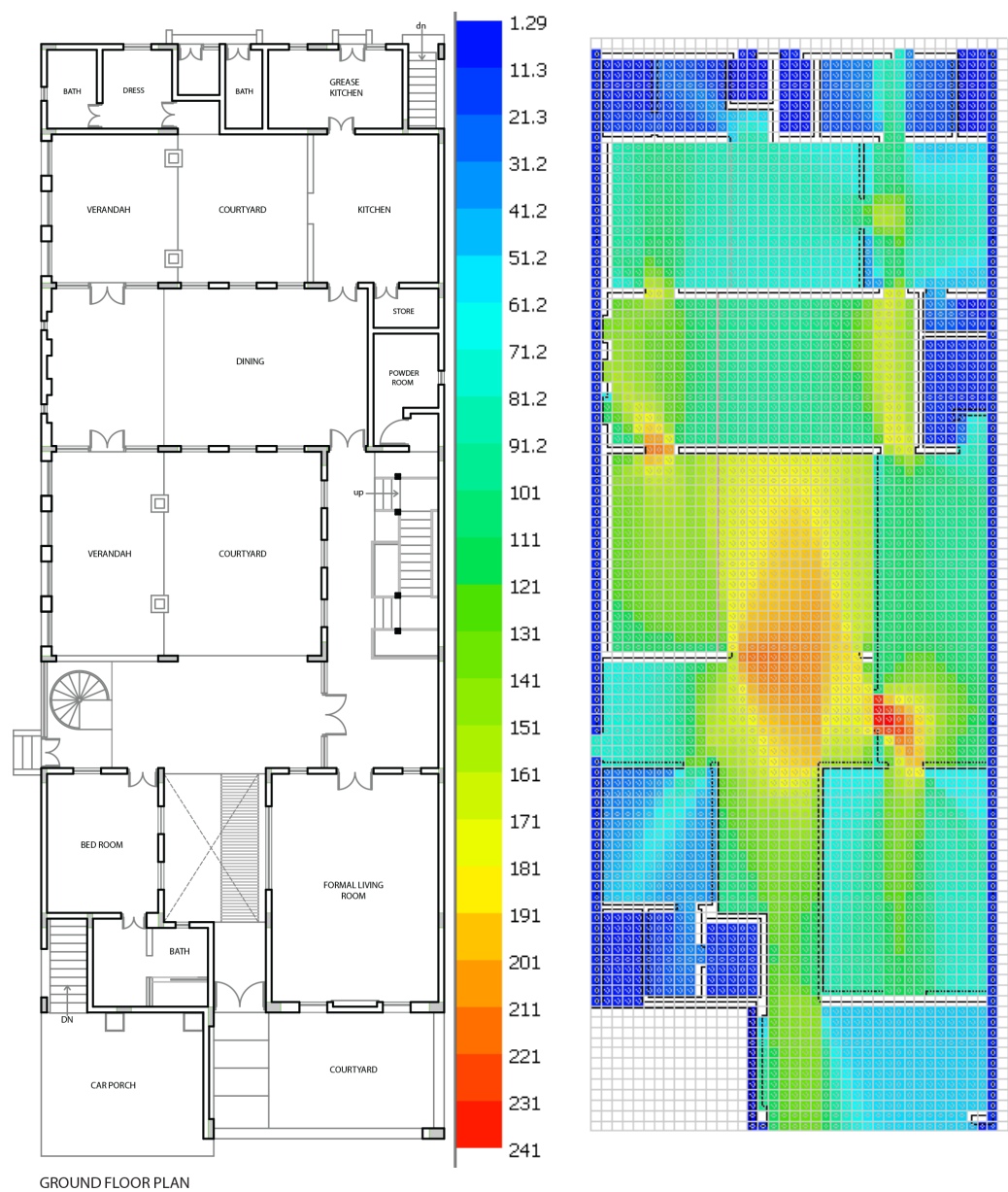


Figure 5.9 : Asim Raza Residence - Ground Floor Plan & Visibility Graph.

Table 5.9 : Asim Raza Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bathroom1	16.9	29.3	0.6	52.1	86.7	3.6	79.0
Bedroom1 Bathroom	10.7	18.4	0.6	32.6	52.1	3.7	35.9
Bedroom1	47.3	51.4	0.9	57.9	250.5	2.7	322.7
Verandah1	99.1	74.6	1.3	56.4	513.3	2.5	625.8
Verandah2	141.1	89.0	1.6	56.3	728.4	2.1	1213.7
Courtyard1	80.3	60.3	1.3	45.5	417.5	2.6	472.5
Courtyard2	180.8	112.3	1.6	70.1	943.4	2.0	1519.7
Courtyard3	56.6	38.8	1.5	27.2	291.0	3.2	286.2
Powder Room	16.5	21.1	0.7	29.3	84.8	3.7	91.8
Dining Room	112.9	82.2	1.4	60.1	563.0	2.3	781.3
Formal Living Room	94.3	73.1	1.3	58.1	509.6	2.4	697.4
Entrance Hall	135.9	83.8	1.6	52.0	711.8	2.3	1149.3
Kitchen1	37.4	47.4	0.8	60.8	194.0	2.9	231.0
Kitchen2	85.1	92.4	0.9	102.3	445.9	2.5	559.0
Store	16.5	30.0	0.5	63.4	82.1	3.0	92.6

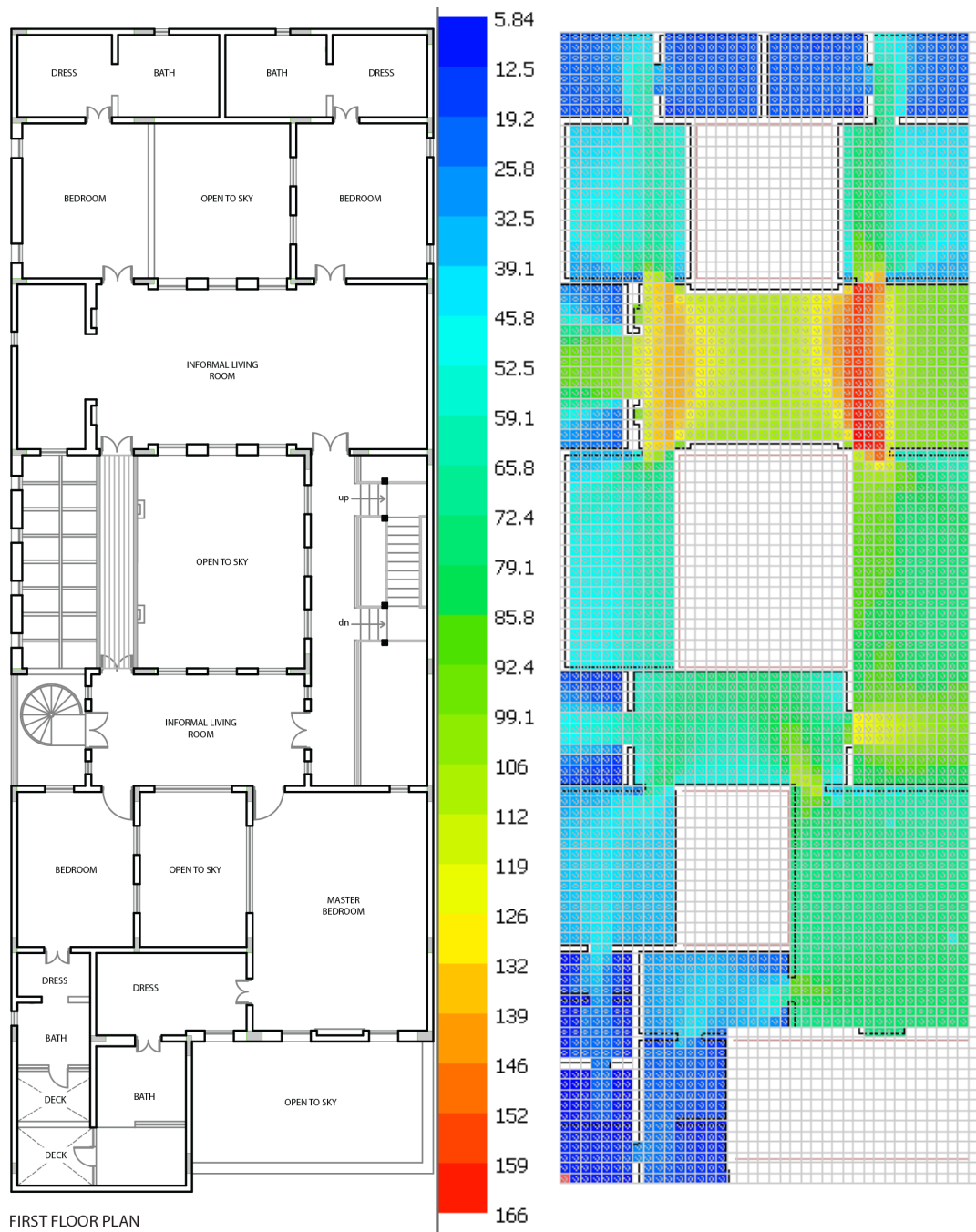


Figure 5.10 : Asim Raza Residence - First Floor Plan & Visibility Graph.

Table 5.10 : Asim Raza Residence - First Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bedroom2 Dresser	29.7	41.1	0.7	57.3	171.7	3.8	106.1
Bedroom2 Bathroom	20.0	24.1	0.8	29.3	113.7	4.1	58.8
Bedroom2	53.1	58.4	0.9	64.9	296.2	3.1	232.1
Bedroom3	59.5	60.5	1.0	62.8	342.1	2.8	321.9
Bedroom3 Dresser	36.9	50.1	0.7	68.7	214.4	3.1	180.8
Bedroom3 Bathroom	20.0	24.1	0.8	29.5	113.6	3.5	73.5
Bedroom4	39.9	45.1	0.9	52.0	232.9	3.3	165.9
Bedroom4 Dresser	23.4	36.2	0.6	58.3	136.1	3.6	89.2
Bedroom4 Bathroom	18.6	33.4	0.6	62.8	109.3	3.7	66.7
Balcony	12.3	23.4	0.5	46.7	72.6	4.1	40.6
Master Bedroom	75.2	53.3	1.4	38.2	453.0	2.8	373.2
Master Dresser	36.3	43.6	0.8	52.7	207.3	3.6	135.9
Master Bathroom	19.2	29.1	0.7	44.5	109.0	4.6	49.7
Balcony2	10.5	19.0	0.6	35.2	63.8	5.4	23.0
Informal Living Room1	120.3	92.8	1.3	72.0	690.0	2.5	667.6
Multipurpose Hall	55.7	53.6	1.1	52.0	319.0	3.2	246.1
Informal Living Room2	69.9	72.0	1.0	75.1	411.8	2.6	386.2

The syntax analysis shows that the Courtyard 2 has the highest circularity (70.1), connectivity (943.4) and integration (1519) among the 3 courtyards. It also has the lowest mean depth of 2 as it is centrally located on deep floor plan. Courtyard1 and Courtyard 2 are similar to traditional courtyards but Courtyard 3 is more like a front yard providing views for the formal living room and a place to inhabit if one chooses not to go indoors.

There is 1 bedroom downstairs by the main entrance and formal living, and due to its accessibility from the public zone, it implies its use as a guest room. It has relatively low integration, i.e. it is a highly segregated space. On the first floor, there are 4 bedrooms: a set of two bedroom units on opposite ends of the house. The Master bedroom is moderately well connected to other spaces, while Bedroom4 is pushed into a corner. Master bedroom has a circularity of 38.2 indicating that it is far from other spaces. Also, one has to move a significant distance in order to access bathroom, and balcony, turning multiple times.

The formal living room situated closest to the main entrance in a deep floor plan, where the residence is elongated and has spaces further apart along y axis, has a surprisingly high integration of 697.4 considering its location. Informal living room 1 and 2 have similar circularity values of 72.0 and 75.1, mean depth of 2.5 and 2.6 but connectivity and integration set the two apart in that informal living room 1 has better connectivity of 690.0 and integration of 667.6 versus the 411.8 and 386.2 for informal living room2 respectively.

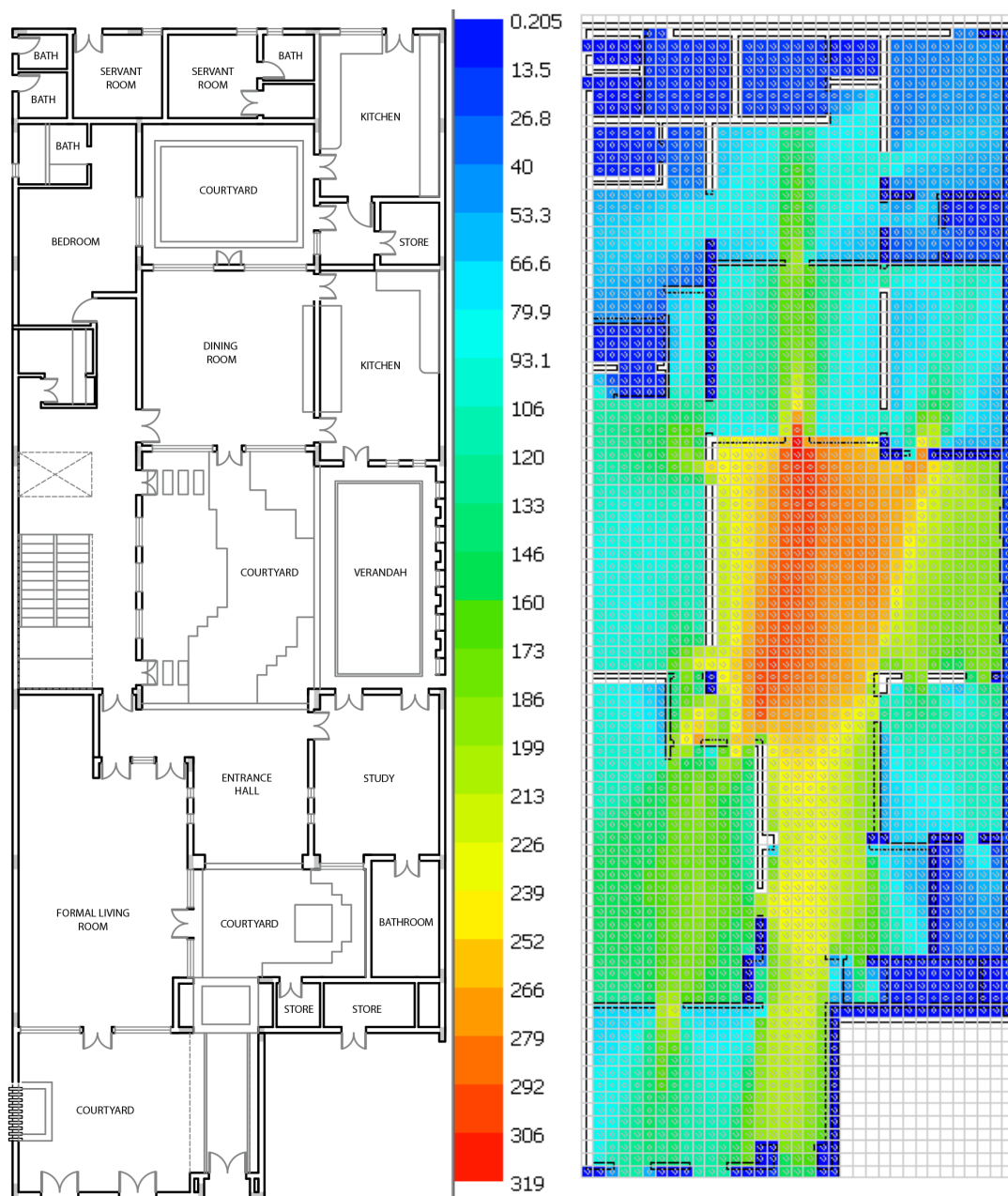
As seen before, grease kitchen is more segregated with less spaces around it and less direct connections to adjacent space as many members will not need to enter this space plus to eliminate smells, and exhaust coming from this space.

5.2.3 Case study 6: Khalid Mahmood Residence

The sixth case study is the Khalid Mahmood Residence, with its ground floor plan and visibility graph shown in Figure 5.11, followed by the tabulated data for the ground floor in Table 5.11. The floor plan and visibility graph for the first floor is shown in Figure 5.12 and the corresponding tabulated data in and Table 5.12.

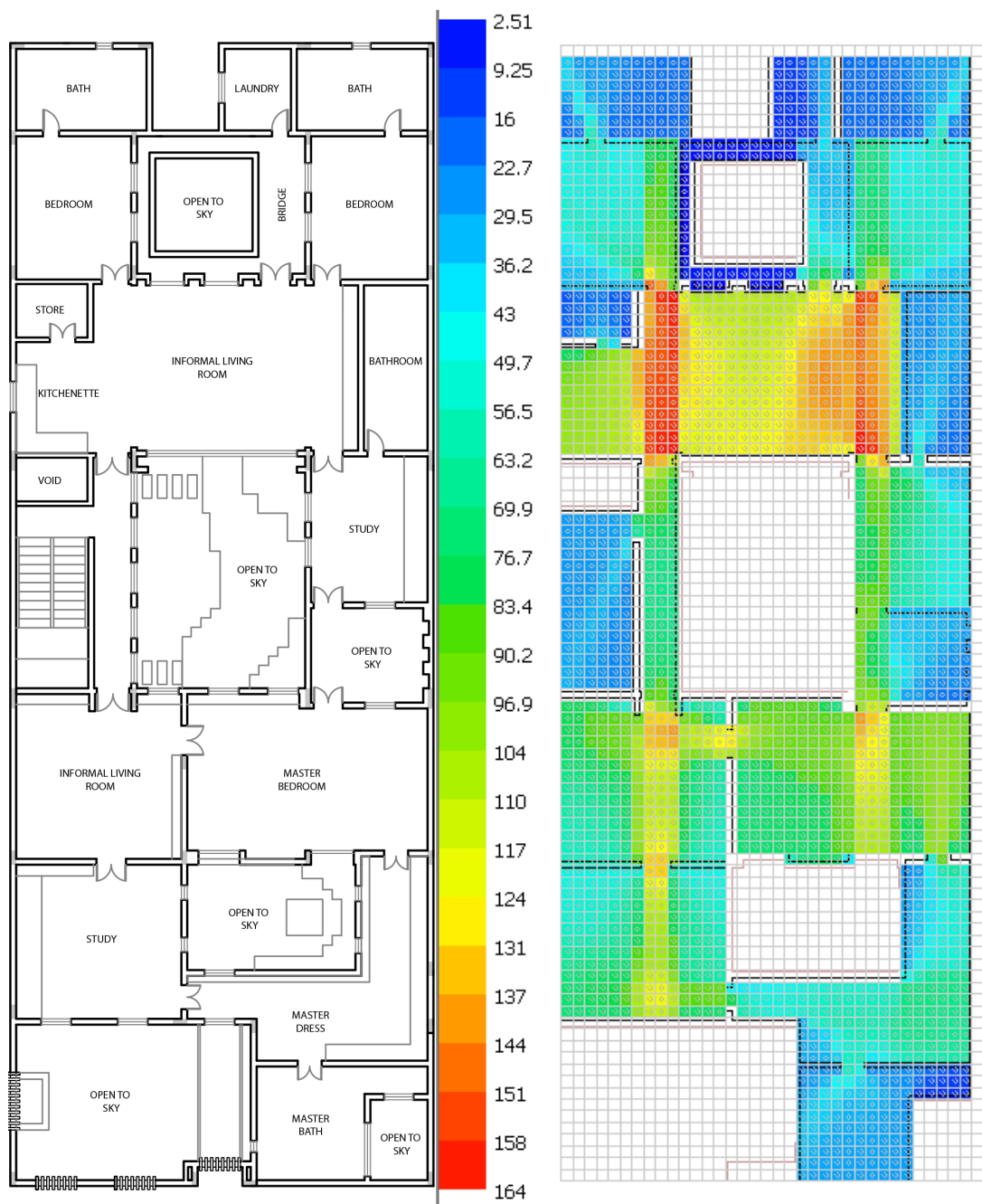
Table 5.11 : Khalid Mahmood Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m ²)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bedroom1	66.8	70.1	1.0	75.4	226.7	2.6	212.8
Bedroom1 Bathroom	16.5	23.9	0.7	35.5	52.0	3.4	36.6
Study1 Bathroom	41.6	59.3	0.7	86.6	135.1	2.7	149.1
Courtyard1	97.9	101.3	1.0	106.3	329.9	2.3	363.0
Courtyard2	271.2	213.8	1.3	169.2	934.3	1.9	1307.1
Courtyard3	181.1	140.3	1.3	111.1	622.0	2.0	873.8
Courtyard4	113.7	97.4	1.2	85.3	397.2	2.3	474.3
Dining Room	122.0	133.8	0.9	151.2	412.2	2.1	540.8
Powder Room	17.5	26.1	0.6	40.3	57.9	3.2	53.8
Entrance Hall	235.3	186.4	1.3	148.3	810.9	1.9	1154.6
Study1	103.0	117.9	0.9	136.6	352.6	2.3	440.2
Formal Living Room	154.3	143.0	1.1	135.6	529.5	2.2	662.4
Servant1 Bathroom	3.9	8.7	0.4	19.5	10.4	1.0	0.1
Servant1 Bedroom	13.9	16.0	0.9	18.4	43.0	1.0	0.0
Servant2 Bedroom	18.8	29.8	0.6	48.1	57.5	3.1	39.0
Servant2 Bathroom	9.1	17.4	0.5	33.8	26.6	4.1	14.3
Kitchen1	51.5	53.7	1.0	56.7	166.7	2.8	140.2
Store	12.3	23.6	0.6	48.0	42.7	3.3	32.7
Kitchen2	94.1	105.4	0.9	120.5	321.1	2.3	400.5
Store2	28.6	30.4	0.7	37.0	104.3	1.5	125.4



GROUND FLOOR PLAN

Figure 5.11 : Khalid Mahmood Residence - Ground Floor Plan & Visibility Graph.



FIRST FLOOR PLAN

Figure 5.12 : Khalid Mahmood Residence - First Floor Plan & Visibility Graph.

Table 5.12 : Khalid Mahmood Residence - First Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Bedroom2	58.8	62.7	0.9	67.8	232.4	2.5	198.1
Bedroom2 Bathroom	26.3	30.8	0.9	36.8	100.7	3.3	58.5
Bedroom3 Bathroom	26.0	29.8	0.9	34.6	99.8	3.4	54.8
Bedroom3	58.6	61.4	1.0	65.2	236.0	2.6	191.1
Study2 Bathroom	29.1	43.5	0.7	66.5	119.1	2.9	79.1
Master Bedroom	93.6	75.0	1.3	61.2	356.1	2.4	291.8
Master Dresser	52.5	56.2	0.9	60.5	201.0	2.9	135.1
Master Bathroom	29.8	33.3	0.9	38.2	123.7	3.6	60.0
Courtyard5	50.1	60.8	0.8	75.6	196.3	2.7	157.3
Informal Living Room1	131.3	108.2	1.2	89.9	497.5	2.2	455.2
Study2	66.8	78.7	0.9	93.5	257.4	2.5	214.4
Study3	74.3	66.8	1.2	61.6	280.3	2.6	217.6
Informal Living Room2	87.4	80.2	1.1	74.7	335.3	2.5	279.9
Laundry Room	17.6	27.0	0.6	42.6	63.2	3.6	37.5
Store3	20.5	29.8	0.7	43.8	75.2	2.9	62.3
Kitchenette	107.4	75.2	1.5	54.0	409.1	2.4	381.2

There are 5 courtyards, 4 on the ground floor and 1 on the first floor. Courtyard2 is the most integrated (1307.1) and has the highest connectivity value (934.3) and the highest circularity (169.2) out of all the courtyards. The rank order of the most integrated to the last are Courtyard2, Courtyard3, Courtyard4 and Courtyard1. Courtyard4 is pushed to a corner and has the least amount of spaces packed close to it, hence the lowest circularity of all the courtyards (85.3). Courtyards 1, 2, and 3 act like traditional courtyards, as they serve multiple spaces for a variety of purposes. Courtyard4 is primarily dedicated to the formal living room.

Bedrooms 2, 3 and the master bedroom on the first floor have similar circularity values (67.8, 65.2, and 61.2 respectively). The connectivity for bedrooms 2 and 3 are virtually the same, and can access a greater number of spaces than the master bedroom. Saying that, the master bedroom is far more integrated than bedrooms 2 and 3 (291.8 vs. 198.2 and 191.1).

The formal living room is on the ground floor and there are two informal living rooms on the first floor. After courtyard2, dining room, entrance hall and study, the formal living room has the highest circularity value. It has a high circularity, connectivity and integration value, even though it is located in a corner, it is very well integrated. Informal living room1 has better circularity, connectivity and integration than informal living room2 (89.9, 497.5, 455.2 vs. 74.7, 335.3, 279.9 respectively).

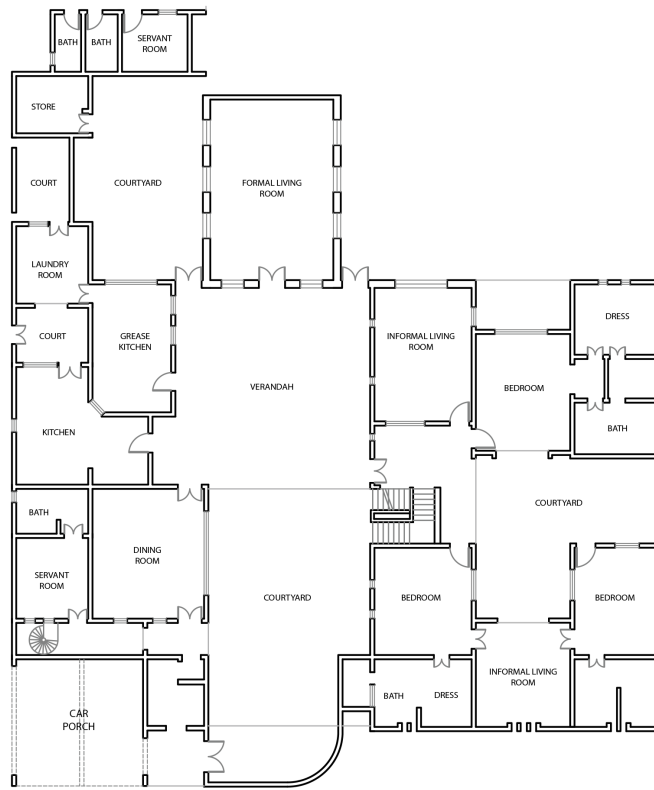
Kitchen2 has far greater circularity, connectivity and integration than Kitchen1, implying that kitchen1 is a grease kitchen only used by domestic staff and so there is less need for access, therefore causing it to be more segregated. The servant quarters are the most isolated areas as indicated by the integration values and can only be accessed from outside.

5.2.4 Case study 7: Zaheer Adamjee Residence

The seventh case study is the Zaheer Adamjee Residence, with its ground floor plan and visibility graph shown in Figure 5.13, followed by the tabulated data for the ground floor in Table 5.13. The floor plan and visibility graph for the first floor is shown in Figure 5.14 and the corresponding tabulated data in and Table 5.14.

Table 5.13 : Zaheer Adamjee Residence - Ground Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Servant1 Bathroom	6.7	11.8	0.6	20.8	10.4	1.1	0.2
Servant1 Bedroom	14.0	16.2	0.9	18.8	19.9	1.1	2.9
Master Bedroom	162.0	143.4	1.1	127.9	267.4	2.3	224.1
Master Dresser	40.8	63.4	0.7	100.8	66.9	2.9	43.9
Master Bathroom	28.3	44.2	0.6	69.6	45.8	3.1	25.2
Bedroom1	66.6	76.7	0.9	89.2	106.1	2.8	73.3
Bedroom1 Dresser	35.7	46.2	0.8	59.8	51.0	3.0	32.0
Bedroom1 Bathroom	15.1	28.7	0.5	54.7	21.3	3.7	9.4
Bedroom2	72.4	83.4	0.9	96.7	120.2	2.7	82.3
Bedroom2 Bathroom	25.7	38.7	0.7	58.8	41.1	3.5	20.5
Bedroom2 Dresser	40.2	51.4	0.8	66.3	67.9	3.2	38.7
Servant2 Bedroom	26.8	30.0	0.9	34.0	38.0	3.5	17.5
Servant2 Bathroom	12.8	19.1	0.7	28.4	20.7	4.2	7.9
Courtyard1	176.4	112.3	1.6	73.0	290.1	2.4	275.6
Courtyard2	37.5	56.6	0.7	87.9	64.4	3.0	37.3
Courtyard3	52.0	57.3	0.9	63.6	85.9	3.0	52.8
Verandah1	380.2	195.4	2.0	101.7	655.3	2.0	701.0
Courtyard4	170.5	134.3	1.3	109.6	280.4	2.4	237.3
Courtyard5	381.7	208.6	1.8	114.4	656.6	1.9	705.1
Formal Living Room	162.6	94.1	1.7	56.4	285.6	2.4	268.3
Informal Living Room1	65.2	63.2	1.1	62.9	117.3	2.7	80.9
Informal Living Room2	147.5	117.0	1.3	93.1	247.2	2.6	188.3
Main Entrance	86.6	72.7	1.2	64.3	143.6	2.6	111.6
Powder Room	42.5	65.9	0.7	105.1	69.5	2.5	68.7
Dining Room	110.7	98.0	1.1	87.4	179.2	2.4	162.6
Store1	30.7	40.0	0.8	55.0	43.9	3.1	31.5
Laundry Room	62.9	81.3	0.8	107.2	104.2	2.7	68.8
Grease Kitchen	75.2	79.1	1.0	86.0	125.5	2.5	112.9
Kitchen1	96.5	86.2	1.1	80.5	162.5	2.4	153.3



GROUND FLOOR PLAN

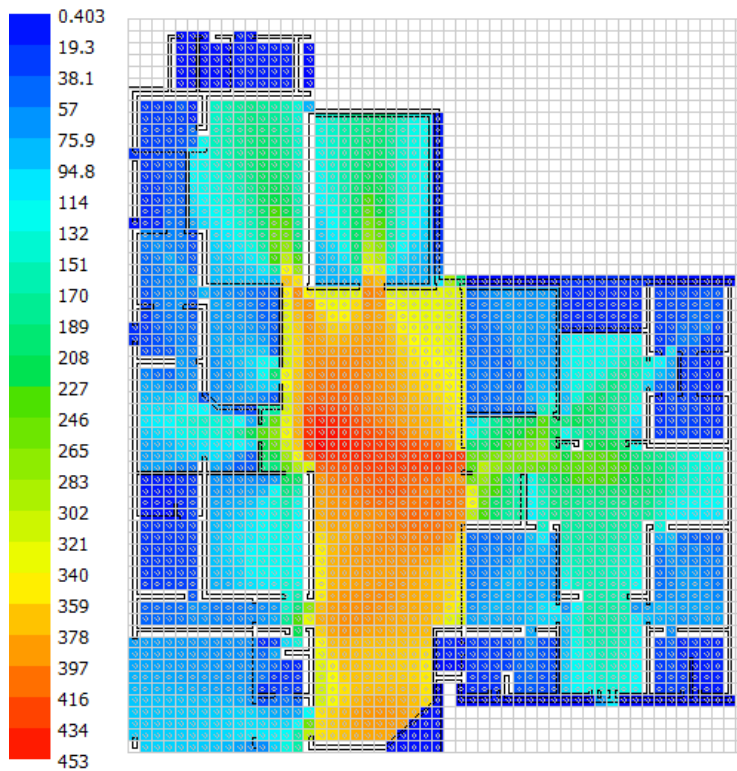
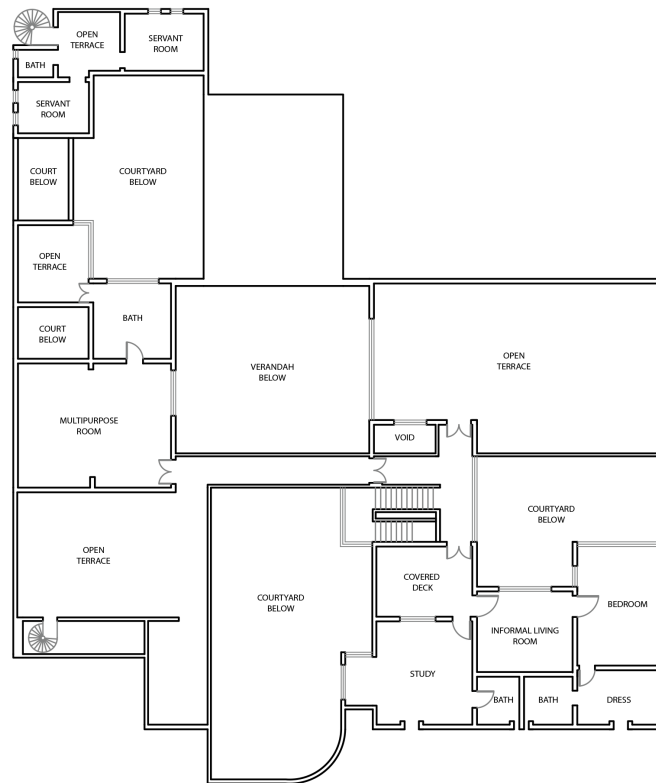


Figure 5.13 : Zaheer Adamjee Residence - Ground Floor Plan & Visibility Graph.



FIRST FLOOR PLAN

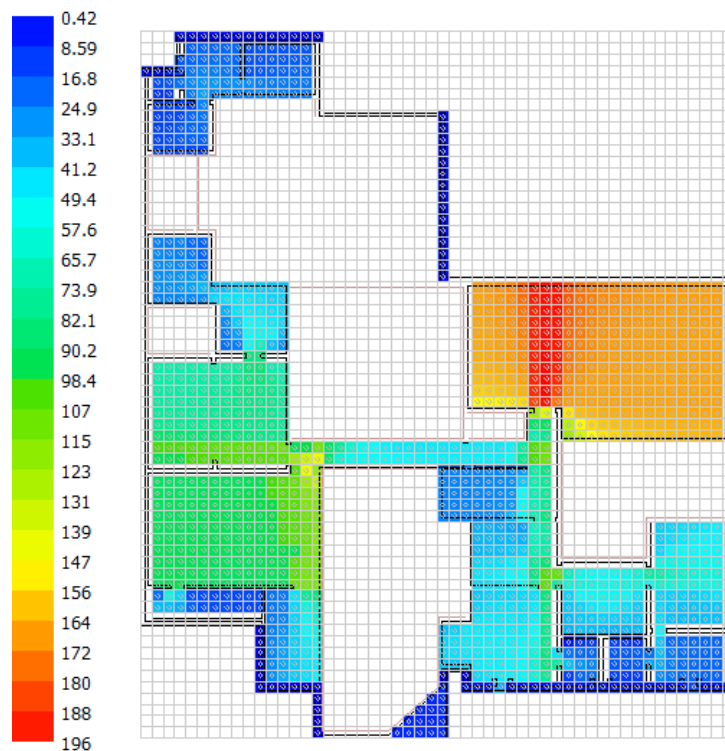


Figure 5.14 : Zaheer Adamjee Residence - First Floor Plan & Visibility Graph.

Table 5.14 : Zaheer Adamjee Residence - First Floor Syntax Analysis Results.

Room Name	Mean Isovist Area (m2)	Mean Isovist Perimeter (m)	Mean Compactness	Mean Circularity	Mean Connectivity	Mean Depth	Mean Integration x10 ³
Servant3 Bedroom	17.5	23.0	0.8	30.6	30.3	1.9	1.7
Servant4 Bedroom	21.0	25.6	0.8	31.5	36.0	1.8	2.2
Bathroom1	45.6	53.2	0.9	63.2	76.6	3.3	18.3
Bedroom3	48.4	45.6	1.1	43.3	73.7	3.6	16.3
Bedroom3 Sitting area	48.0	48.2	1.0	49.3	75.3	3.1	19.3
Bedroom3 Dresser	21.9	29.3	0.8	39.6	33.2	4.6	5.1
Bedroom3 Bathroom	16.1	24.7	0.7	38.8	26.3	4.8	3.9
Study1 Bathroom	21.0	27.4	0.7	39.0	36.4	3.4	9.2
Open Terrace	28.7	32.2	0.9	36.9	45.4	4.0	8.7
Open Terrace2	66.1	44.1	1.4	31.8	114.5	3.3	28.7
Open Terrace3	167.2	63.9	2.7	25.3	285.0	2.8	87.9
Multipurpose Room	82.3	59.6	1.4	43.7	130.3	3.0	36.7
Study1	52.9	50.3	1.1	48.8	85.8	3.0	24.4

This residence has 5 courtyards. In terms of integration, Courtyard5 is the most integrated (705.1), followed by Courtyard1 accessing the verandah and store (275.6), Courtyard4 serving the two bedroom (237.3), Courtyard3 serving the kitchens (52.8) and finally Courtyard2 serving just the laundry space (37.3) as the least integrated courtyard. Courtyard5 is comparatively similar to the traditional courtyard and also connected to the verandah as seen in older homes. This shows how the courtyards have transitioned from serving as multipurpose spaces to having specific functions serving specific spaces. Size and shape of these courtyards also depend on their functions.

Additional points of interest on this plan include the fact that two sets of bedrooms are in the public zone and that the Formal living room is on the opposite end of house, away from the main entrance, having access via courtyard 5 and verandah, perhaps disrupting privacy. However, it is still well integrated (268.3) and not segregated as expected.

Grease kitchen relatively well integrated into residence and not segregated as seen in other plans, indicated by the relatively high circulation value of 86.0, connectivity value of 125.5 and integration value of 112.9. There are surprisingly more spaces packed closely around it than the main kitchen.

5.3 Comparison between Type I and Type II Houses

To compare the different Type I and Type II houses, the need existed to combine and simplify across the different houses and layouts. Therefore, the averages were taken for each room type in each house, and then the mean value across the houses in each type was taken. As an example, in Table 5.15, the value of 25.5 for the Average of Mean Isovist Area (m²) for Bedroom in Type I is the average of Mean Isovist Area of all the bedrooms in all the Type I case study houses.

Table 5.15 : Comparison of Averaged Syntax Analysis Results between Type I & Type II Houses

	Average of Mean Isovist Area (m ²)		Average of Mean Isovist Perimeter (m)		Average of Mean Compactness		Average of Mean Circularity		Average of Mean Connectivity		Average of Mean Depth		Average of Mean Integration (x1000)	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
Bedroom Area														
Balcony	9.5	11.4	22.1	21.2	0.4	0.5	54.8	41.0	88.6	68.2	3.3	4.8	44.1	31.8
Bathroom	10.0	20.2	19.6	29.0	0.5	0.7	45.7	43.8	83.6	69.3	3.6	3.6	37.0	39.1
Bedroom	25.5	51.6	34.3	52.7	0.7	1.0	48.2	56.1	212.4	179.4	2.8	2.8	131.4	134.6
Dresser	16.3	30.8	26.1	41.4	0.6	0.7	42.6	57.8	144.8	113.2	3.4	3.6	67.9	68.6
Sitting Area	27.5	48.0	38.2	48.2	0.7	1.0	54.1	49.3	252.8	75.3	2.5	3.1	131.6	19.3
Courtyard Area														
Courtyard	60.5	138.7	69.3	107.3	0.9	1.2	80.2	89.2	477.4	418.9	2.1	2.4	426.2	480.5
Terrace	53.3	104.4	44.7	56.3	1.1	1.7	42.1	35.2	470.8	287.4	2.3	3.1	445.7	146.3
Living Areas														
Dining Room	46.0	110.6	55.8	99.5	0.8	1.2	69.8	93.3	384.5	367.8	2.3	2.3	313.3	431.4
Entrance Hall	48.0	150.0	68.6	117.3	0.7	1.3	104.8	94.4	384.7	532.5	2.2	2.2	330.6	697.7
Formal Living Room	58.9	123.8	62.7	92.7	1.0	1.4	69.1	73.6	367.9	398.0	2.3	2.4	284.2	451.7
Multipurpose Room	26.5	69.0	32.8	56.6	0.8	1.2	41.0	47.8	375.1	224.6	2.4	3.1	268.9	141.4
Powder Room	21.4	20.5	38.5	31.2	0.5	0.6	74.9	50.3	174.4	58.0	2.5	3.2	155.0	56.1
Informal Living Room	46.1	101.4	54.0	89.2	0.9	1.1	65.8	80.6	406.2	371.3	2.4	2.5	333.4	320.8
Study	23.3	78.2	28.0	73.7	0.8	1.1	34.6	74.9	219.5	280.2	2.8	2.7	115.5	231.6
Services Area														
Laundry Room	15.8	40.3	29.6	54.2	0.5	0.7	56.8	74.9	182.1	83.7	2.6	3.1	130.5	53.2
Pantry	30.7	40.2	54.9	56.0	0.6	0.7	102.0	79.3	194.9	131.8	2.4	2.6	140.3	95.2
Store	13.0	21.7	24.7	30.8	0.5	0.7	51.6	49.4	84.7	69.6	2.9	2.8	47.5	68.9
Servant Bathroom	5.8	6.8	13.9	14.4	0.4	0.5	34.4	31.2	57.4	20.2	3.7	3.2	24.9	7.1
Servant Bedroom	12.7	15.2	24.1	22.0	0.6	0.7	47.1	32.7	123.6	47.0	3.1	2.7	61.7	17.5
Kitchen	20.3	67.5	35.3	70.3	0.6	0.9	62.5	78.2	154.1	226.4	2.7	2.6	111.6	228.3

Looking at the values in detail for each category, in the Courtyard Area, the courtyards for Type II have an Isovist Area (138.7) and Isovist perimeter (107.3) greater than Type I with 60.5 and 69.3 respectively – many courtyards vs. one large courtyard. There is little syntactical difference in terms of compactness and circularity between the two types, which implies that the courtyards in both scenarios have adjacent spaces packed closely together. In terms of connectivity, Type I courtyards are directly connected to more spaces than Type II due to the shallow plan vs. the deep plan of Type II. So one courtyard is linked to multiple places vs. multiple courtyards linked to fewer spaces. Type II has a greater integration value than Type I (480.5 vs. 426.2). As courtyards appear in greater numbers, it is easier to access any one depending on the individual's location in the house.

The terrace in Type II is more compact than those in Type I, possibly due to their being more spaces on the first floor in Type II, whereas in Type I, the terrace forms

the left over space, excluding the bedrooms, related spaces and servant quarters. In terms of circularity, Type I has the greater value (42.1) by a small margin than Type II (35.2). With the combination of large area and few spaces on the first floor, Type I appears to have spaces packed closer together. In Type II, terraces, on the periphery of the residence with fewer spaces close by, are more segregated. In terms of connectivity, Type I terraces are far better directly connected to other spaces than in Type II (470.8 vs. 287.4). Also, terraces in Type II appear far more removed as located deep in the plan which is indicated by a Mean Depth of 3.1, therefore the integration value is also very low (146.3 vs. 445.7). Open terraces in Type II are very private and isolated. Type II terraces have a larger area, perimeter and compactness than Type I, but are not well connected to other spaces.

Looking at the second category, the Bedroom Area, Type II has a larger isovist area and perimeter for the bedrooms due to the increased number of rooms. Type II also has greater circularity but lower connectivity than Type I, and so it is packed closer to adjacent spaces but has less direct access to the spaces. Both types have the same mean depth of 2.8 and an insignificant difference in integration (131 vs. 134), suggesting that you don't necessarily need a traditional courtyard layout and that the new adaptation is working very similarly. Like the bedrooms, the dressing rooms in Type II have a better circularity (57.8 vs. 42.6) but lesser connectivity, and so greater privacy is afforded. The mean depth and integration of both types are syntactically very similar. The balconies in Type I are better integrated than Type II, as shown by circularity, connectivity and mean depth and integration values.

In terms of the Living Area Category, the entrance hall of Type II has an isovist area and perimeter which is far larger than Type I. Saying that, Type I has a greater circularity (104.8 vs. 94.4), but smaller connectivity (384.7 vs. 532.5). They both have the same mean depth but Type II is greatly integrated with other spaces (697.7 vs. 330.6). Again the informal living room in Type II has a greater area and perimeter due to the increased numbers. Type I has better connectivity whereas Type II has a better circularity. Both have the same mean depth and very similar integration values. Both are well connected to adjacent spaces and in the grand scheme, have an integration of 325 which makes the space semi-public/semi-private in nature. In regards to the formal living room, Type II has a significantly larger area but Type I and Type II are very similar in terms of circularity (69.1 vs. 73.6),

connectivity (367.9 vs. 398) and mean depth (2.3 vs. 2.4). The main difference between the two is that Type II formal living room is very much integrated whilst Type I is relatively segregated from other spaces (451.7 vs. 248.2).

And finally, looking at the Services Area category, the area and perimeter of the kitchens are greater in Type II again due to the number of rooms. Type II has a higher compactness, circularity and connectivity than Type I and specifically, the connectivity (226.4 vs. 154.1) and integration (228.3 vs. 111.6) are significantly greater. In terms of the servant bedrooms, Type I and Type II have practically the same area, perimeter and compactness. Type I has better circularity and connectivity and appears deeper in plan, but is far more integrated even though it appears on the periphery. The quarters in Type II are more isolated and have access to far fewer spaces.

6. CONCLUSION

Thus in conclusion, having recognized the issue of domestic architecture in Pakistan and the importance it holds in the everyday lives of its inhabitants by providing the most basic physical and psychological needs, it is crucial to plan and design for the future and attempt to restore that which has been lost over the years – both in terms of material and non-material aspects. Saying that, it is equally essential to appreciate that the society is ever-changing and moving forwards driven by cultural, economic, religious, scientific and technological forces. To explain this furthermore, the Pakistani society has evidently gone through a transformation from a *Gemeinschaft* community to a *Gesellschaft* one and continues to do so, whereby there is an increasing focus on the individual and his interests and needs over that of the overall community. Therefore, it appears that with the *Gesellschaft*-like society, there is a growing emphasis on a modern lifestyle of isolation and detachment. This was in sharp contrast to the earlier Pakistani society where people tended to live in joint family structures, either within the same household or in close proximity to each other due to having common understandings of social interactions, values and beliefs. Nowadays, in larger cities like Karachi and Lahore, individuals are increasingly more disconnected from their extended families.

Going into further detail, “primary territories” are exclusively controlled and owned by individuals and are central to their everyday lives, giving them a strong sense of place attachment and self-identity. In terms of territoriality, due to the strict observance of *purdah*, women would in earlier times, withdraw from the courtyard space into more secluded areas of the house with the arrival of the men. This has now changed for the most part, as segregation is not based on gender but rather according to age and activity usage of a space. An example of this is the “*Baithak*” which was a space designed specifically for male gatherings, meetings or practicing of a profession. Now, however, it has not only been altered to a formal living room that can entertain both men and women in mixed gatherings but its location has also changed as it is no longer detached from the house but instead within the confines.

Courtyards being the most important space of study in this thesis, it is interesting to note that they were considered a primary space in the dwelling through which all secondary spaces, such as verandahs, interior rooms, and terraces, would draw sustenance from by affording the same activity systems and behavior patterns. In certain contemporary houses, courtyards have retained their traditional function as multipurpose spaces that are centrally located with intermediary spaces around them. In other instances, courtyards begin to serve different functions for different spaces and particularly in multiple courtyard houses, can be seen on the periphery of dwellings in all shapes and sizes, to the extent that they even begin to lose their importance at times and start becoming intermediate to tertiary spaces in the grand scheme. Here, other adjacent spaces define the role of courtyards reducing them to pockets of green open spaces. Saying that, single central courtyard typology houses as well as multiple courtyard houses have maintained the ability to internalize the dwelling allowing for more private and secure spaces inside.

Based on the results from the syntax analysis, it appears that the contemporary multiple courtyard houses have retained the core elements from the traditional courtyard house and in fact provide residents with the ability to choose to participate in particular behavior settings based on their ability and desire to conform to the standing behavior pattern in a certain place. In other words, with the increased number of courtyards, household members are afforded more choice and freedom to participate and interact when, where and how they please. This is not the case for single courtyard houses where all members are expected to share a common space with certain codes of conduct. By increasing the number of courtyards as well as other spaces, personal space and privacy which are basic needs of all individuals requiring moments of solitude, isolation, security, intimacy and a place to be themselves, have been given more thought and consideration. Although, many of the new residences have designed according to the needs for greater privacy and personal space, in certain case studies it appears that the design pushes the limits and affords too much privacy, which could possibly leave the inhabitants feeling socially isolated within the dwelling. In other words, the architects at times are perhaps over compensating for the little privacy afforded in earlier courtyard houses where residents felt a general sense of crowding and congestion, ultimately affecting interactions and relationships in the household.

Moving on, the architectural design along with the addition of furniture in contemporary residences is at times severely reducing the affordances for different rooms and activities by defining the usage of each space in a more constrictive manner. This is also seen as a change because in older residences, spaces had no fixed function and could be adapted according to the needs present at the time. Another change observed through the analysis, was the transformation from Khadki style houses that were essentially dwellings joined to each other by common walls, forming rows with a common yard in between for social gatherings to a more Delo style which is an independent residence with its own private front yard, and enclosed by a wall allowing for each family to be relatively isolated from its neighbors. This is the current case in Karachi and Lahore as neighborhoods hold a variety of communities that are not necessarily of the same family or religious sect.

With all this in mind, before conducting this research, the belief and expectation was that single central courtyard houses would be the ideal typology as the spaces are far more compact and integrated, as stated in the hypothesis statement for this thesis. But based on the syntax analysis shared above, it appears that the multiple courtyard typology as an adaptation retains the core elements present in the single courtyard house and that syntactically, more houses could follow this layout. Saying that, functionally and sociologically, the courtyards in the houses based on multiple courtyard typology do begin to lose their importance and meaning, as they are not considered the primary space but rather serve the adjacent spaces for various purposes. However, the multiple courtyard typology also provides more privacy and personal space to the different family members according to the requirements of the changing society.

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APPENDICES

Appendix A: Glossary of Local Language Architectural Terminology

<i>Baithak:</i>	A semi-open space usually near the court; place for sitting, entertaining, congregation and meeting; any room or platform for public male gatherings.
<i>Chandni space:</i>	An enclosure on the upper floors of a <i>haveli</i> with high walls and no rooftop
<i>Charpai:</i>	A traditional woven bed
<i>Chowk or Chauk:</i>	An open space of various scales; e.g. open urban court space; forecourt; square; public space formed at meeting of two streets
<i>Delo style community:</i>	A settlement pattern with each house enclosed by a wall and accessible by a gate
<i>Haveli</i>	A large urban dwelling
<i>Jharoka</i>	A projected oriel or other window; one with an enclosing structure supported by projected masonry work and often supporting such masonry above
<i>Jhoola</i>	A traditional swing
<i>Khadki</i>	A long open space or enclosure that is lined by dwellings on both sides, accessed by a common gate. Often used for social gatherings, meetings, and functions
<i>Khadki style community</i>	A settlement pattern with dwellings joined to each other by a common wall with no separation between
<i>Khadki-room</i>	A room in front of the urban Hindu dwelling to receive clients, business associates or other male guests
<i>Mahal</i>	Palace

<i>Maidan</i>	Plaza
<i>Mardana</i>	Male; masculine
<i>Mohalla</i>	A neighborhood
<i>Purdah</i>	A screen to separate women from men or strangers; the concept of woman-man segregation
<i>Sahn</i>	Court
<i>Sarkanda</i>	A locally grown weed
<i>Sojala</i>	Mezzanine Floor in traditional urban housing
<i>Zenana</i>	Female; feminine

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