Frontiers of Architectural Research (2020) 9, 20–33

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journal homepage: www.keaipublishing.com/foar

Research Article

Neighborhood spaces in residential environments: Lessons for contemporary Indian context

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Received 18 May 2019; received in revised form 24 July 2019; accepted 9 October 2019

KEYWORDS
B.V. Doshi;
Charles Correa;
Contemporary Indian housing;
Raj Rewal;
Residential neighborhoods;
Traditional Indian housing

Abstract The importance of open and unbuilt neighborhood spaces in residential developments has been established by numerous scholars. Having a diverse nomenclature in varied contexts, these areas are indispensable yet often neglected and designated as leftovers in contemporary planning practice. With their usefulness in the Indian context of socially active and sometimes even intrusive communities, such spaces are rapidly losing their place in present-day residential environments due to the pressure of providing for the rapidly growing population coupled with mass migratory patterns. These neighborhood spaces that impart physical, psychological, and perceptual comfort to residents have been present in spontaneously developed traditional Indian cities due to their inherent order and integrity. Moreover, some contemporary housing environments by eminent designers have also utilized the virtues of well-designed neighborhood environments. This study is a comparative analysis of three selected projects, which aspire to devise suitable methods for contemporary Indian context and achieve neighborhood comfort and an overall sense of belongingness among residents.

1. Introduction

Neighborhood spaces in a residential development are unbuilt, open or semiopen areas, which are in consonance with built areas that serve as facilities for interaction, community bonding, and other supporting activities. Having a diverse nomenclature in varied contexts, they are indispensable yet often neglected and designated as leftovers of the built form that constitutes major living areas. Numerous scholars have emphasized that these neighborhood spaces are crucial for the holistic development and overall comfort of residents. In the Indian context, these spaces are important because socially active, sometimes intrusive communities have lived, prayed, celebrated, and

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Peer review under responsibility of Southeast University.

https://doi.org/10.1016/j.foar.2019.10.002

mourned together for years in an informal space arrangement of spaces.

Majority of spontaneously developed residential settlements in traditional cities have been able to maintain this sense of balance and belonging by virtue of their inherent integrity. However, due to rapidly growing populations coupled with mass migration patterns and lack of concern by builders, most contemporary housing projects do not provide such environments, especially in small towns. Thus, residents yearn for physical, psychological, and perceptual comfort. Some projects by well-known architects of the country have utilized the virtues of well-designed neighborhood spaces by considering such concerns. Among these projects, three have been selected for an in-depth analysis to determine suitable methods for achieving neighborhood comfort in residential environments, especially those of the midrise scale in the Indian context.

2. Method and case

The three selected projects, namely, Asian Games Village at New Delhi by Raj Rewal, GSFC Housing at Vadodra by B.V. Doshi, and Belapur Housing at Navi Mumbai by Charles Correa, were designed by eminent architects with sensitivity to the needs of residents regarding indoor and outdoor environments. After reviewing preceding scholarships, the systematic mode of qualitative research was adopted and conducted through participant observation, field notes, conversation and informal surveys with residents, and graphic sketches (Figs. 1—10), whereby the respondents expressed their deep-seated thoughts. Moreover, an in-depth study of spaces at macro to micro scale was performed by analyzing extensive project drawings (Figs. 11—13) to ascertain suitable co-relationship attributes that respond to identified factors and are conducive to activity and usage patterns.

3. Significance of the study

A neighborhood can be literally explained as an "area surrounding a place; person or object" (Oxford, 2012, 482). Under this premise, a neighborhood space signifies unbuilt, open or semiopen indispensable areas in consonance with built areas. Generally, a residential neighborhood is a comprehensive whole that comprises housing units that may be plotted, multistoried, rowed, or clustered, in addition to associated facilities, such as community, commercial, and convenient shopping areas. Infrastructural facilities and services are required to support living in a specific neighborhood unit. Hence, in addition to the open areas, semiopen spaces are left for the smooth discharge of such activities. These spaces may have a diverse nomenclature in varied contexts. While they have been regarded as streets, squares, and transition areas in traditional settlements, they constitute vehicular roads, pedestrian pathways, open green parks, road widening setbacks, and

Fig. 1 Asian Games Village: Varied degrees of interaction in different spaces (by Author).

Fig. 2 Asian Games Village: Varied degrees of interaction in different spaces (by Author).

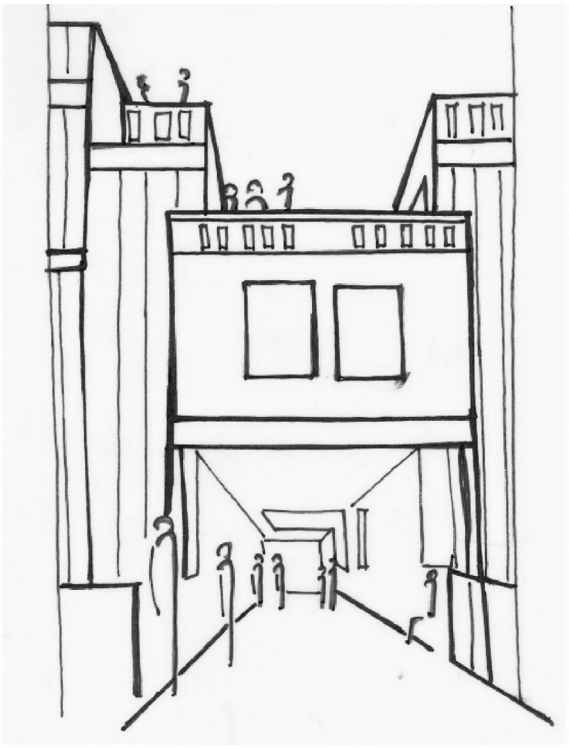


Fig. 3 Asian Games Village: Varied degrees of interaction in different spaces (by Author).

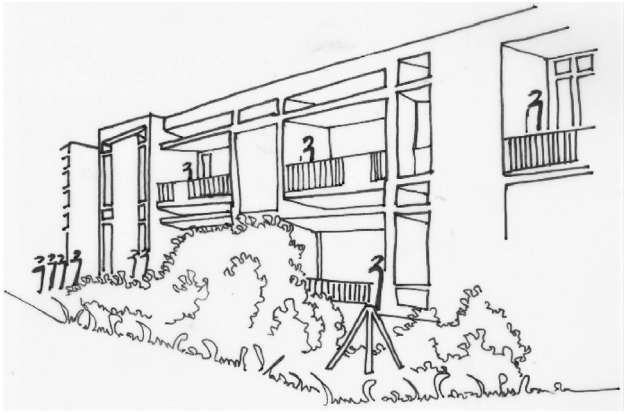


Fig. 4 GSFC Housing: Different activity levels (by Author).

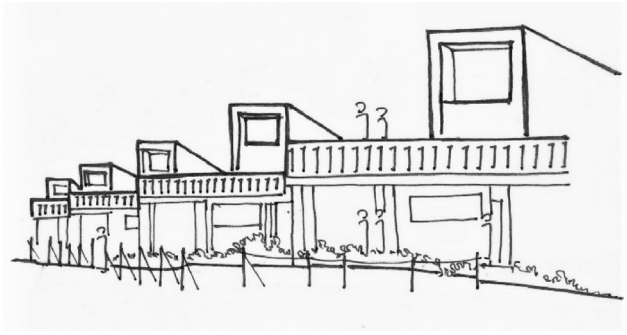


Fig. 5 GSFC Housing: Different activity levels (by Author).

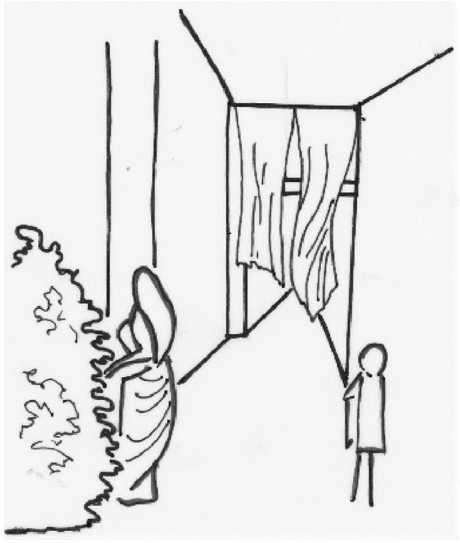


Fig. 6 GSFC Housing: Different activity levels (by Author).

even parking lots in modern developments. As a whole, these neighborhood areas have been considered a crucial part of a housing development and intrinsically open areas that include traditional spaces, such as parkland and play areas, service spaces, roads, walks, private gardens, and parking areas, which are meant to be used and experienced (Untermann and Small, 1977, The Compact Oxford Reference Dictionary, 2001).

Fig. 7 Belapur Housing: Varied Interactive spaces (by Author).

Fig. 8 Belapur Housing: Varied Interactive spaces (by Author).

4. Early precedents and contemporary applicability in Indian context

Neighborhoods have been a much deliberated research topic from as early as Jacobs (1961) call, which considered social settings around homes, to Appleyard (1981) establishment of the expediency of livable streets as secure and healthy places for playing and learning in residential environments. Other studies include Newman's (1972) quest for defensible spaces in residential environments; Lynch (1981) theory of a good city, which has settlements with five performance dimensions (vitality; sustenance; psychological, social, and physical safety; and consonance); and Marcus and Sarkissian (1986) emphasis on child-friendly spaces in laying out aspirations from a built environment. The above works have been crucial in reiterating the value of neighborhood spaces in residential areas.

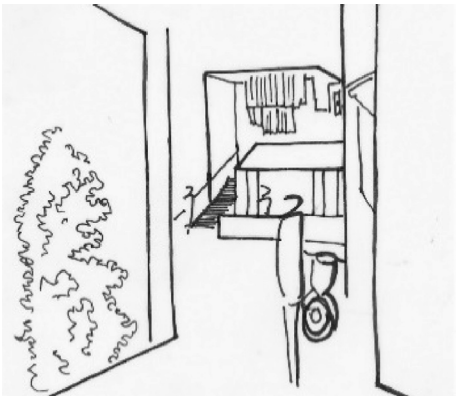


Fig. 9 Belapur Housing: Varied Interactive spaces (by Author).

Fig. 10 Belapur Housing: Varied Interactive spaces (by Author).

Similarly, Gehl (1987) pursuit of space usage dependence between buildings on their proportions, Hillier (1996) theory of space configuration, Bonaiuto et al. (1999) observation on the sense of belonging as a relevant factor for neighborhood satisfaction, and Taylor and Harrell (1996) assertion of residents' preference for an environment that depends on social conditions besides safety and security have all presented a substantiated role of neighborhoods. Moreover, recent studies by Oktay and Rustemli (2010) and Rashid et al. (2013) have echoed the relevance of satisfaction from neighborhoods in residential environments at present.

The functional attributes of such spaces have been well explained in different settings by the aforementioned researchers, who have highlighted the need for small, supervised spaces for toddlers; large grounds for teenagers; and traffic-free nonhazardous places to explore, relax, and conduct social activities of different scales. However, a fulfilling neighborhood environment is not only about functionally efficient areas; it also depends on effective, well-designed spaces that are conducive for different activities in a residential development. Human and environment studies have reported that the physical form of an environment evidently affects human perception and behavior. A housing environment is where people spend most of their time consciously or subconsciously. Thus, it should be designed for exceptional comfort and stimulation for the physical and mental well-being of residents.

In the Indian context, gratifying neighborhood spaces are especially imperative for the wholesome growth of society. Socially active, even intrusive, Indians can be generally defined as vociferous, warm-hearted, and vibrant beings, for whom relationships amid community are vital. Large extended families that live, pray, and fast together are not merely signs of rituals but the attachment that people share. Strategically comfortable locations in existing conventional residential neighborhoods have been ascertained for routine activities because of an inherent spatial character and response to the environment. Over years of living and simultaneous growth, these spaces have acquired intrinsic qualities that are effective for the user communities to thrive and grow. However, transformations have occurred due to migration and other growth-related factors, and a yearning for similar comfort, belonging, and identity are becoming increasingly evident in the behavioral pattern of contemporary Indian community.

5. Indian contemporary housing: lack of effective neighborhood spaces

India is a fast developing country where housing has been a chief concern due to the rapidly growing population coupled with surging urbanization. In pursuit of providing sufficient numbers and as a result of wide-ranging negligence, contemporary housing neighborhoods are nonconducive to the well-being of inhabitants. Inspired from initial western models to an extent, these housing schemes are being replicated in small towns without concern for their effect on the living patterns of a transforming Indian society. Taylor and Thapar explicated how "the metaphysics of space and the quest for serenity, recurrent themes in Indian Architecture, are confronted with homeless migrants and the frantic needs of an emerging middle-income consumer society." (Taylor and Thapar, 1992, 26).

Numerous macro-level problems associated with present-day housing environments include the lack of hierarchical open spaces and movement patterns, loss of enclosure and scale, nonsuitability of open spaces, absence of informal character, indifference to prevailing climatic conditions, and missing visual relief and spatial character among others. As a result, in most housing schemes, neighborhood spaces and outdoor areas are mere leftover negative spaces rather than purposely designed activity or interaction areas. This phenomenon is not only visible in low-income housing but also starkly evident in high-end luxurious developments; the greater the expenditure, the less livable the spaces. As a result, most Indian contemporary housing projects do not have effective neighborhood spaces for creating a wholesome and livable environment.

The aforementioned deficiencies are evident in modern housing arrangements, which should have individual dwelling units placed for efficient area management connected by wide vehicular roads and green spaces. However, these rigid and alienating systems exhibit lack of hierarchy from private to public and absence of gradual transition, with drastic transformations of spatial enclosure, proportions, and scale. Thus, the comfort level of residents is

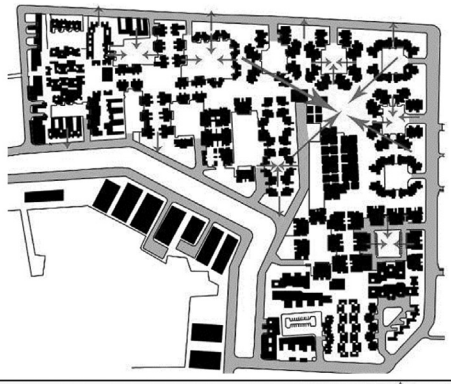
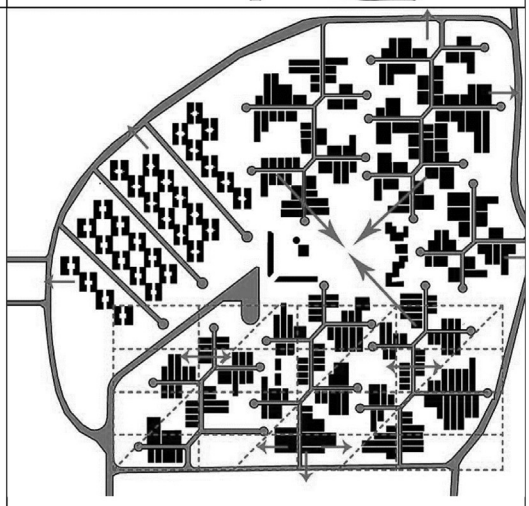
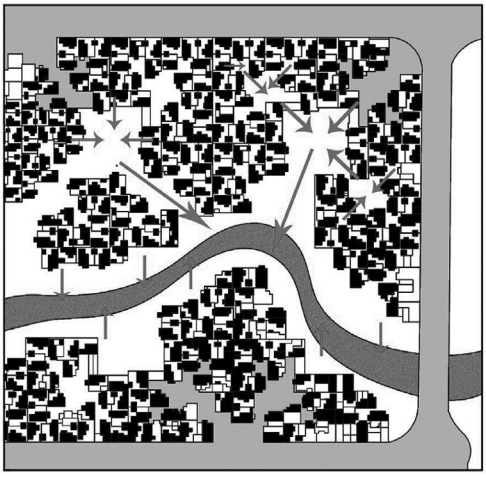
ASIAN GAMES VILLAGE HOUSING AT NEW DELHI BY RAJ REWAL	SITE AREA: 35 ACRES (141680 SQ.M) GROUND COV: 57229 SQ.M TOTAL OPEN AREA: 84451 SQ.M TOTAL BUILT AREA: 1090936 SQ.M NO. OF UNITS: 700 UNITS GROSS F.S.I.: 0.77 DENSITY: 28 UNITS/ACRE	
GSFC HOUSING AT VADODRA BY B.V. DOSHI	SITE AREA: 140 ACRES (566720 SQ.M) GROUND COV: 58000 SQ.M TOTAL OPEN AREA: 508720 SQ.M NO. OF UNITS: 617 UNITS 1417 FAMILIES GROSS DENSITY: 4.4 UNITS/ ACRE 9.3 FAMILIES/ ACRE POPULATION: 465/ACRE	
BELAPUR HOUSING AT MUMBAI BY CHARLES CORREA	SITE AREA: 13.3 ACRES (53838 SQ.M) GROUND COV: 25000 SQ.M TOTAL OPEN AREA: 28838 SQ.M NO. OF UNITS: 550 UNITS GROSS DENSITY: 40 UNITS/ ACRE POPULATION: 200/ACRE	

Fig. 11 Layout Plan of selected cases. Developed by author from published drawings.

neglected. Furthermore, open-grid vehicular networks designed to facilitate automobiles cause thoroughfares that result in blurred pedestrian transition. In addition, vehicles have also made these environments unsafe, even hazardous. The excessive visibility of packed parking lots is also an unsightly view in residential developments.

Moreover, this loss of defined small-scale neighborhood spaces has diminished the feeling of belonging and even privacy, thereby causing a further loss of orientation and territoriality. In such undefined areas, most residents remain impersonal without a feeling of belonging, leading to a lack of maintenance of the open areas and loss of associated pride among inhabitants. Large open areas work for planned, sometimes forced, formal activities, but they do not foster casual, informal, and social interaction, or community relationships due to the lack of enclosure, nonhuman scale, and inappropriateness to tropical Indian climate. In addition, the visual and spatial character of

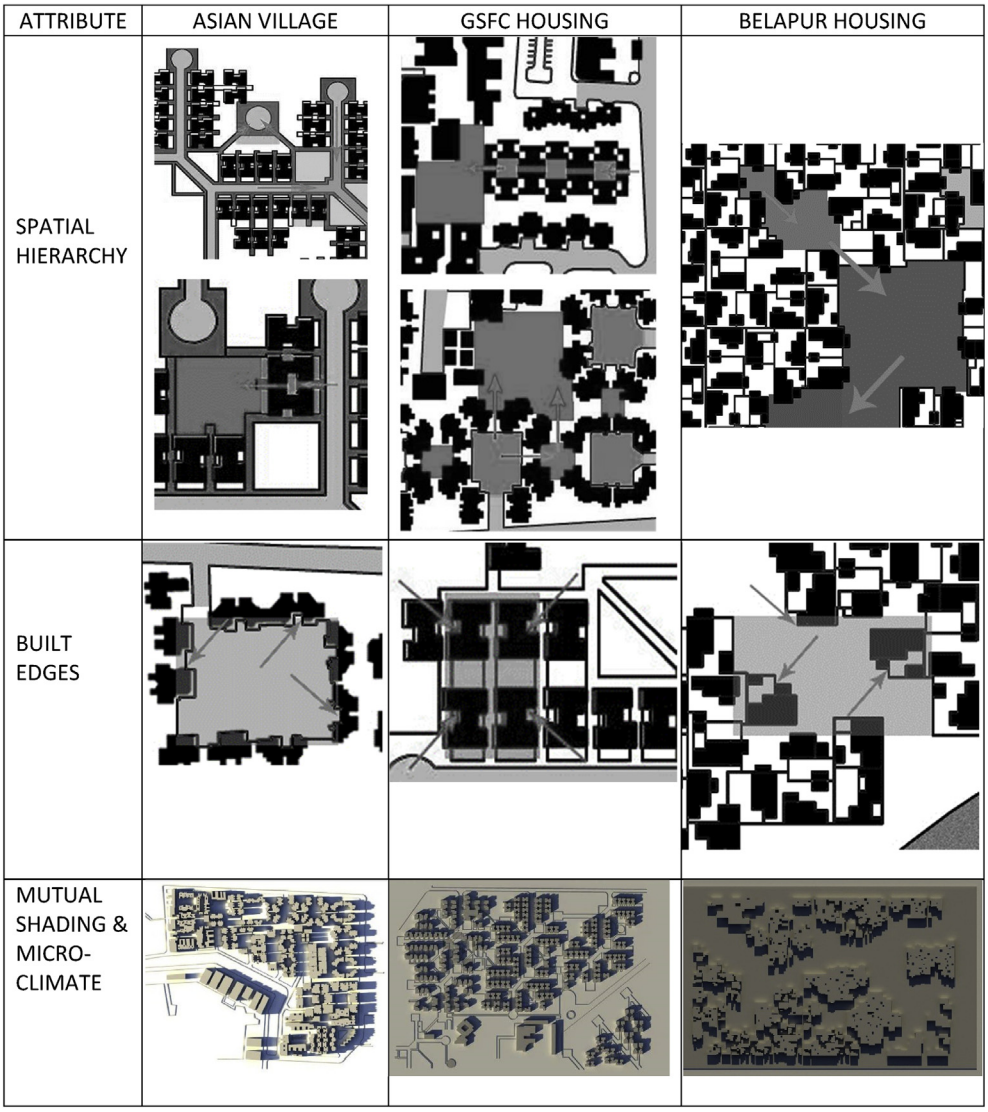


Fig. 12 Comparative attributes of the selected cases: Developed by author from published drawings.

most contemporary housing is monotonous and uninteresting. This housing neither relates with the sky nor with the ground, thereby resulting in a loss of visual relief.

6. Factors affecting comfort in neighborhood spaces

In residential environments, the quality and suitability of spaces emerge from human needs. Neighborhood areas should provide comfort and a sense of belonging to occupants. A comprehensive review and synthesis of existing scholarships by Lawrence (1987), Untermann and Small (1977), a GLC study (1978) Alexander (1977), Lang (1987) Marcus and Sarkissian (1986), along with Vastu-Shilpa Foundation (1988) among others, have ascertained that the resident's satisfaction from a built environment depends on physical, psychological, perceptual, social, and economic aspects.

The physical aspects primarily rely on the climatic comfort of closed and open spaces, as well as accessibility, convenience, and smooth discharge of facilities and transitions from one type of space to another. The psychological needs of individuals in residential environments comprise privacy, safety, and territoriality. Given individual identity, visual pleasure and comfort form the most important features of the perceptual needs of a human being from residential environments. Social needs, such as passive and active modes of interaction, are also important for the well-being of residents. A combined effect of all these aspects contribute to making a fulfilling and wholesome environment.

6.1. Physical comfort

The physical comfort of residents is established by the climatic comfort of neighborhood spaces, and having "pleasant indoor and outdoor living spaces suited to the social conditions of inhabitants" is imperative (GLC, 54). In the tropical Indian climate, heat, sunshine, and wind must be managed depending on the region's conditions.

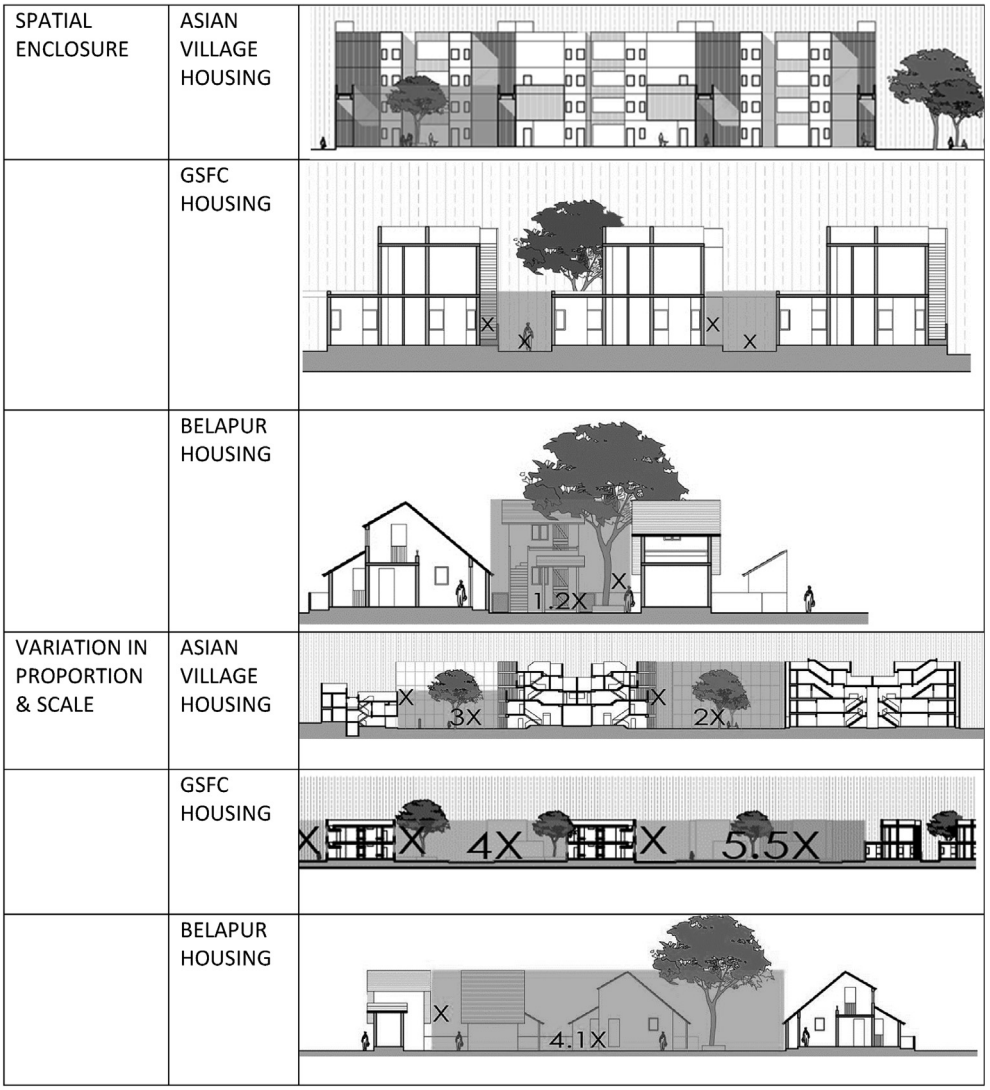


Fig. 13 Comparative attributes of the selected cases: Developed by author from published drawings.

Accordingly, physical comfort depends on the form, planning, and orientation of building blocks and open spaces with respect to sun and prevailing winds. Moreover, strategically designed landscape, water bodies, vegetation, and topography also improve the comfort conditions of these spaces. Convenience is another important attribute of physical comfort achieved by suitable accessibility and efficient conduct of activities. It includes transitions within the dwelling units to its immediate environment, among each other, and even outside the premises. Issues of vehicular movement, ease of pedestrian transition, and parking are integrated in this aspect.

6.2. Psychological needs

The psychological needs of inhabitants are also a prime concern in a residential environment. These needs encompass the issue of privacy and signify physical isolation between the public and private domains for maintaining suitable relationships within the neighborhood. Roderick Lawrence described privacy as "controlling access to spaces," which means that no one bothers the resident or is even alone, and "controlling access to information," which denotes the aspect of overviewing (Lawrence, 1987, 163). Even though social interaction and contact with neighbors are imperative for living, privacy is an essential component for mental and emotional well-being. Over intrusion from adjoining neighbors, other residents or even passers-by can become a menace in an otherwise favorable environment. Thus, the need for a gradual evolution between the public and private realms is validated. Furthermore, the idea of safety in a residential neighborhood also forms an important psychological prerequisite. Safety broadly concerns the protection of children and elders from vehicular movement and other hazards while simultaneously providing secure and enjoyable pedestrian movement in a neighborhood space. Notions of territoriality were explained by Lawrence as "taking possession or defense of that area" (Lawrence, 1987, 150) along with surveillance. Therefore, watching out for one another, especially in outdoor areas, also constitute important psychological needs. However, "a delicate balance must be

struck between designing for ease of surveillance and designing for privacy" (Marcus, 1986, 271).

6.3. Perceptual needs

Moreover, the prime perceptual need of residents from their living environment is individuality or distinct identity within the prototype mass of dwelling units. Contemporary housing with similarly designed spaces and dwelling units should have a provision for shaping residents' individual and group spaces based on their aspirations and requirements. In this manner, residents can feel satisfaction and pride. Additionally, visual stimulation and comfort derived from the physical setting is a major contributing factor to the sensory comfort of inhabitants. The need for spaces, which arouse curiosity and sense of anticipation, can be satisfied by creating interesting volumes, avoiding monotony in building blocks and street facades, negotiating with the sky and ground effectively, and varying visual experiences within a residential environment.

6.4. Social needs

Social needs are also important for an individual's well-being. "The unavowed secret of man is that he wants to be confirmed in his being and existence by fellow men… not merely in his family …. but also in the course of neighbourly encounters" (Alexander, 1977, 94). Interactions between fellow beings fulfill human needs of affiliation and belonging while promoting individual growth and combating depression. These relationships and interaction, which are considered important in the Indian context, should be fostered in conducive neighborhood spaces. Furthermore, "Social interactions occur more easily when people's social needs are balanced by a sense of individual autonomy that comes with privacy, whether obtained by reserve or through territorial control" (Lang, 1987, 160). Variables that influence social interactions in a neighborhood space include proximity and orientation of dwelling units with respect to one another, their arrangement with respect to the site and open spaces, and their transition to streets and community spaces.

As a condensation of the aforementioned factors, while physical needs are satiated by climatically comfortable and safe neighborhood spaces, psychological needs are addressed by their privacy, safety, and territoriality. Perceptual desires can be satisfied by individual identity, visual variety, and comfort, whereas social needs require informal interactions. However, within the premise of this study, variables associated with all of the above should be amalgamated because their combined influence leads to a fulfilling and wholesome residential environment. On juxtaposition of these aspects, the factors that affect the physical, perceptual, and psychological comfort conditions of a neighborhood space within a residential environment are the spatial organization and relationship of dwelling units with one another with respect to the site and their transition from public to private areas, and vice versa. Moreover, physical access to the site, transition of movement, segregation of vehicular and pedestrian lanes, and linkages of the open spaces with respect to movement determine convenience, accessibility, and orientation. Furthermore, the physical comfort of neighborhood spaces further becomes dependent on the responses of the adjoining built form to macro- and microclimate conditions, such as sun path, prevailing wind direction, water bodies, vegetation, and topography, of the site. Factors that affect the perceptual and psychological comfort of these neighborhood spaces include their spatial hierarchy, enclosure and openness, proportion and scale, and effect of the built mass character on the open space. Aspects that determine the usability of these spaces include the relationship of the built form with open areas, the building edge treatment, the location of the community areas, and their linkages.

7. Overview of housing neighborhoods through history: an Insight into traditional Indian towns

Ancient and medieval history indicates that even in primitive cultures, the formation of villages or settlements is based on the organization of individual dwelling units into groups to enclose a community space and associated small interaction spaces. As populations increased, these villages became towns, and houses became further isolated from major public spaces. Secondary community spaces were developed in the form of pathways or streets leading to main interaction areas. Later, due to urbanization, some towns became intensive concentrations of population, and preconceived thought was required to plan these urbanized cities. Thus, "the informal pattern of incremental growth yielded to more formal large scale preconceptions of total city organization" (Untermann and Small, 1977, 3). The whole city started being planned in a rectilinear grid pattern, which gave rise to blocks and clusters from which settlements had started being governed by the rigidity of the block. During the entire process, organic self-built neighborhood spaces transformed to nonflexible areas governed by the stiffness of the built forms.

With the advent of industrial revolution and improved technology, new materials and inventions have changed the vocabulary of built forms. In addition, destruction due to world wars required numerous housing projects within a short period of time, and unwarranted migration to cities offered less space to build in. As a result, tall residential buildings, walk-up tenements, and apartments had a spurt in development. Consequently, users moved further upward from the land, and their interaction with ground became limited. An increased lack of sensitivity for open areas by designers caused neighborhood spaces to become mere leftover spaces according to the regulations and by-laws for movement and ventilation.

Meanwhile, in the Indian subcontinent, a definite response to neighborhood spaces has been observed since the primordial civilizations of Mohenjo-Daro and Harappa to the spontaneously developed cities of Varanasi, Jodhpur Ahmedabad, and Lucknow. Hierarchy, continuity, and spatial character have been visible in neighborhood spaces and have complemented built spaces. In the traditional Indian system, the caste groups and occupation initially and subsequently determined territorial segregation, respectively. Social structure influenced the division of caste groups into neighborhoods, hamlets, or streets. For ages,

people have lived together on the basis of caste, creed, and occupation, thereby signifying the need of humans to live in familiar and like-minded surroundings.

"Indian towns over time were characterized by the clustering of buildings, each juxtaposed with the other, with balconies overlooking streets, and courtyards providing public space within the house, and with a scatter of terraces permitting yet another set of activities. Houses had both public and private space; yet in many ways this space was different from that in the changing towns of the present day" (Taylor and Thapar, 1992, 21).

The religious city of Varanasi on the *Ghaats* of River Ganges is a spontaneous and organic organization of meandering streets and informal layering of form. The narrow lanes widen at junctions and other places to form squares. This hierarchical networking propels movement, pausing at important nodes, namely, the squares, whose scale and proportion are exemplary for comfort and relaxation, having *chabutras* and platforms supporting the activities. The two-to three-storied courtyard dwelling units clustered in an informal pattern naturally face hierarchical streets and create a close sense of community. As such, the opposing neighbors can contact one another at narrow sections. The gradual layering of space from the inside to the outside is visible in the transition from the *aangan* (courtyard) to *deodhi* (external platform) and then the *gulli* (street) to the informal squares.

Similarly, Ahmedabad, a medieval city in Gujarat, India, also emerged through an additive growth process. Inhabited by migrants after the commercial revolution of the 16th and 17th centuries, it was modified by culture and context. Safety and security were major issues, and the walled city was divided into *puras* and then *pols*. Ahmedabad resembles a maze with winding narrow lanes, forming a series of microneighborhoods, which are community-based organizations. Limited vehicular access through defined gateways lends individuality, territoriality, and safety to residents. A natural hierarchy from the internal courtyard to the *otla*, street and then squares facilitates the transition from private to public spaces. Varied spatial enclosure, judicious mix of solids and voids, and climatic suitability provide visual variety and comfort in the neighborhood spaces of these *pol* environments.

Jodhpur, a geomorphic city of Rajasthan, revealing itself in patterns of the terrain, is based on a stringent caste system with layers that house various caste groups based on their hierarchy and position with respect to the fort. The clustered dwellings of the city expose a close-knit community who wants to be within proximity to members of the same caste and trade considerably that an outsider might feel discomfort or estrangement in their domains. Dwelling units, which are basically variations of the courtyard houses, open up to the streets already possessing a strong sense of privacy and territory. The transition from the dwelling to outside is through the *otla* a *verandah* having a high plinth blurring the division of outside and inside and forming the never-ending link to the ground of the entire city. Streets widen at junctions to form large institutions and commercial spaces, creating a natural hierarchical movement. Inherent spatial hierarchy is visible. Meanwhile, the close interweaved fabric creates enclosure in these gated housing communities where human scale is always respected, and human comfort is uncompromised.

8. Condition of post-independent Indian housing: several sensitive approaches

The contemporary form of housing in India has come a long way since it was first envisaged.

With no dearth of land and few populations, large standalone bungalows accommodated the elite, whereas commoners resided in single- or double-storied settlements (as the structure permitted) grouped together. The first existence of multifloor apartments for housing government employees could be traced back to 1911 in Delhi when British rulers founded it as their capital. However, after independence, the Central Public Works Department, which was responsible for large-scale housing plans, distributed numerous multilevel housing units with basic amenities around the 1950s to the massive migrant population resultant of post-independent partition. The corelation of these dwelling units to their neighborhood context was not even deemed important because overriding attention focused on their ever-deficient numbers.

In the early 1950s, varied development authorities were entrusted the job of monitoring housing development in large cities, thereby leading to increased sensitivity in the design of some residential neighborhoods. Architects also collaborated with industrialists to plan neighborhood-oriented residential schemes. Among these schemes, the Atira Low-Cost Housing, designed as a village with differently scaled community spaces, was remarkable in its approach. Around the same time, several other schemes were also envisioned by pioneering architects, some of which remained unbuilt. The 1960s and 1970s saw the initiation of some insightful approaches by GSFC Housing at Vadodara, French Embassy Quarters at Delhi, followed by the ECIL Housing at Hyderabad and Cablenager Township at Kota Rajasthan; some of which were townships that set the stage for the emergence of further responsive neighborhoods.

In later decades, the successful completion of the Yamuna Apartments in 1981 as a cooperative group housing scheme at Delhi crossed a milestone, that is, simultaneously distinguishing itself from other housing developments in the city, due to its conceptualization as an urban village with inherent hierarchical systems. Subsequently, Aranya Housing at Indore, which involve a diverse matrix of varied income groups, responded well to the human scale of living. Meanwhile, the Sheikh Sarai Housing and Asian Games Village, New Delhi (1983) set new benchmarks for residential neighborhoods. Furthering the cause of low-rise high-density housing, the Belapur incremental scheme (1985), which created hierarchical open courts following the concept of equity, was crucial in reinstating the significance of neighborhood responsive environments. The millennium's end brought amplified deliberation for the unbuilt, although most power wielding builders and promoters favored multiplying fortune in terms of saleable areas. Jal Vayu Vihar Bangalore attempted to address the issues of scale, territoriality, informality, and interaction. Cidco Housing at Belapur Mumbai

comprised spatial enclosures of varying degrees of lending informality. Udayan Housing Kolkatta displayed remarkable climate responsive neighborhood spaces even as Laburnum Gurgaon incorporated inward-looking hierarchical spaces conducive for interaction. Vertical neighborhoods were conceived in Sumeru Apartments, Mumbai, whereas Gharkul Khargar (also in Mumbai) facilitated common spaces in its own territory. Even development authorities realized the significance of neighborhood-sensitive environments and began giving precedence to such design proposals.

9. Analysis of selected examples

For a detailed analysis of the responses of built to neighborhood spaces in a residential environment, the three selected examples are GSFC housing at Vadodra, Asian Games Village, New Delhi, and Belapur incremental housing at Mumbai. All the three examples cater to similar middle-income groups of the region, and they are avant-garde solutions in their respective contexts of addressing concerns from built forms to resultant neighborhoods. Being feats of contemporary Indian masters, the designs of built spaces have been aimed as an integral part of their neighborhood environments and provide positive comfortable and useable spaces to their inhabitants.

The GSFC Housing at Vadodara, built as a self-contained township on a 140-acre site, consists of 1800 dwelling units conceived in relation to the community as a whole. "Inspired from the traditional Indian style of living the design responds to the overlapping uses of Indian life addressing the aspect of scale required for interaction in a housing setup. Also Doshi, here reveals his obsession with climatic and social features of the traditional courtyards and gates of old Indian towns" (Curtis, 1988, 68). By contrast, the Asian Games Village in New Delhi, which was conceptualized on the basis of urban streets and enclosures, was built on a 32-acre site comprising 700 dwelling units. The entire complex comprises two-to three-storied structures with eleven distinctly designed dwelling units. Its layout was described by Moniteur as recreating the North Indian traditional urban morphology of *"mohalla,"* transforming into a series of spaces interweaved with narrow mutually shaded pedestrian streets. (Moniteur, 1985). Meanwhile, the most important feature of incremental housing at Belapur by Charles Correa was the spatial hierarchy inherent in our traditional Indian system of living. This low-rise high-density housing scheme comprising 550 units built on 13.3 acres exhibits a strong spatial hierarchy, ranging from courtyards of the individual houses to community place, with the greatest public space being the *maidan* where primary schools and other similar facilities were located.

All the three selected projects were examined in detail on the basis of the established factors that affect various levels of comfort and satisfaction to deduce conclusive parameters. To this end, the selected cases were examined for their spatial organization, building blocking, street facade and character, as well as approach and movement systems. Moreover, the spatial hierarchy of neighborhood spaces, their degree of enclosure and openness, articulation of built edges, and response to existing climatic conditions are analyzed to determine their efficacy in providing comfort and satisfaction to residents.

As one of the most important attributes, spatial organization in a housing environment includes the arrangement of residential units with respect to site, one another, streets, and enclosing open spaces. It also determines the relationship of units to surroundings and their subsequent use by residents. Renowned author Christopher Alexander stated that "People are different, and the way they want to place their houses in a neighborhood is one of the most basic kinds of difference" (Alexander, 1977, 193). Thus, the location of units with respect to site and community areas establishes their level of social interaction and activity. In addition, findings have indicated that the total number of units in a residential environment should be almost equally divided into the isolated quiet part, middle activity area, and in the hub of activity and busy streets. Moreover, the transition of built form to its immediate surroundings is also significant and should be examined because it generates the desired level of activity.

Scrutiny revealed that the spatial organization of the dwelling units in the Asian Games Village is semiextroverted and clustered and looped together by a peripheral vehicular road, which focused on the almost central community area; a strong geometry is evident in the extroverted organization at GSFC, having housing clusters modularly configured together, with diagonal roads converging to a central green with an auditorium and water tower. Meanwhile, at Belapur Housing, the principle of hierarchy was translated in the spatial organization of units. The inward-looking clustered arrangements relate to one another through hierarchical open spaces that direct to the central community areas near the existing *nallah*. As such, the site is divided into almost half. Remarkably, in all three cases, unit clusters are linked to each other through varied scales of street and squares. Meanwhile, in the Asian Games Village, the linkage is due to the linear shifting of units inside or outside. At GSFC, the units linearly arranged along geometrical roads are open to intimate streets and courts in the rear. At Belapur, the hierarchical nonrigid clustered arrangement has similar results. In addition, the transition between units to immediate open spaces at the Asian Games Village and GSFC is sequential, opening to the front through a yard and to the rear through parking and green areas. Meanwhile, at Belapur, it is hierarchical through the personal court to the interactive ones.

In addition to spatial organization, built mass character and streetscape form important attributes for a visually interesting characteristic of a housing neighborhood environment. Constituting similar, repetitive, and even monotonous prototypes, a residential neighborhood has to have suitable blocking, facade treatment, and negotiation with sky and ground to prevent disparity, discontinuity, and raucousness. Moreover, it should relate to human scale and proportion while addressing issues of individuality, spatial definition, and visual relief. Such consideration is imperative to create a desired street character of neighborhood spaces. The examination of the three cases revealed that the built mass character at the Asian Games Village is an interesting play of solids and voids due to staggered units, projecting balconies, and terraces, whereas at GSFC the low-to midrise structures are given diversity by the

staircase blocks. The Belapur Housing uses its low-rise sloping built mass to contrast with the hilly backdrop. Furthermore, the varying heights at the Asian Housing attempt to break the monotony by bringing the sky in; however, human scale is evidently compromised at some places. At GSFC, focus is created by a tall central tank to address the issue of orientation and direction with tall trees; thus, spatial ceiling and suitable human scale are created. The alternately changing slope at Belapur Housing provides a varying skyline in which aspects of human scale and proportions are also compliant. The traits of territoriality and individuality are responded to by gateways, door colors, and similar materials in the Asian Housing. At GSFC, voids that define streets between dwelling units perform the same function. At Belapur Housing, incrementality lends territoriality and uniqueness, whereas coherence is addressed by similar materials and a uniform color.

Another attribute that is crucial for the environment of the neighborhood space is the organization of movement in the vehicular and pedestrian domains. This attribute includes the distribution of vehicular roads on the site, their transition from external main roads to minor and then pedestrian walkways, as well as their hierarchical movement and segregation. As aptly stated by Alexander, "Cars are dangerous to pedestrians; yet activities occur just where cars and pedestrians meet" (Alexander, 1977, 271). On this basis, although maximum interactions occur at the juncture of vehicular and pedestrian movement, making pedestrian areas safe and user friendly is unnecessary. In addition, the location, division, screening, and integration of parking within the housing developments also form a key issue in the movement system. Studies have affirmed that open parking lots should not occupy more than 9% of the total site area for optimal neighborhood comfort that should be distributed in small pockets screened from view and integrated with the residential areas. Favorable distances between these lots should be within a 35 m range. The scale, transition, and visual character of movement, along with the edge treatment, also decide network efficiency.

In this regard, the Asian Games Village, having a clear perpendicular transition from the external road, utilizes a peripheral vehicular road as a basic perimeter spine with no thoroughfare maintaining the character of neighborhood intact. GSFC Housing achieves the same with defined road networks by segregating the housing zone using a perimeter loop that is led off by geometrical secondary roads ending in cul-de-sacs. Then, Belapur Housing prevents thoroughfares in this scheme through a hierarchical movement system, with a peripheral spine culminating in large cul-de-sacs, which house the parking lots. These diverse strategies allow the three residential neighborhoods to be relatively car free while simultaneously reducing walking distances from parking to front doors. In all cases, the roads are sufficiently short, having curves of small turning radii, narrow entrances, and reduced visibility. Thus, the speed of moving cars is reduced, and integration with surrounding landscape and vegetation is suitable. The transition between the vehicular and pedestrian domains is achieved at the Asian Games Village by providing gateways and tapering road widths. Meanwhile, at GSFC, the pedestrian circulation forms a second orthogonal network perpendicular to the vehicular, thereby creating suitable transition and interesting interactive spaces. Belapur Housing exhibits a distinct segregation of vehicles and pedestrians by limiting vehicular access and providing hierarchical interconnected pedestrian courts that increase the walking distances in certain cases. All the selected cases have well-distributed parking lots with under 10% area allocated for them, although the distance between parking lots at Belapur is significantly greater than the prescribed limits.

9.1. Spatial hierarchy and enclosure

In response to the utility and scale of specific space, the hierarchy of an open space is a pattern-guiding movement from the smallest to the largest space or vice versa in a smooth undisturbed manner. Moreover, "outdoors, people always try to find a spot where they can have their backs protected, looking out toward some larger opening, beyond the space immediately in front of them" (Alexander, 1977, 558). At the level of the residential neighborhood, the dwelling unit opens to a large open space, street, or square, which forms a back to other large areas, culminating into the most public squares and greens. "Also for interest tight spaces should be contrasted with the larger open areas. Contrast is a basic principle in medium density design; that is, making each area identifiable" (Untermann and Small, 1977, 227). At the Asian Games Village, a distinct hierarchy exists in the open spaces where the contrast between streets and squares and the small and large courts define a spontaneous progression between public and private domains. At GSFC, the strongly bound private courts have narrow-framed vistas that open to large courts and then to the largest spaces, thus exhibiting hierarchical transition. At Belapur, spatial hierarchy is most distinctly visible where small private enclosed/semi-enclosed courts open to large ones and then to community spaces of public use.

In addition to hierarchy, appropriate spatial enclosure is important for the stimulation of human spaces. The spatial quality of each area, be it large or small, low or high, wide or narrow, has discernible characteristics relatable to feelings and reactions of human beings (Greater London Council GLC and Department of Architecture and Civic Design, 1978). The most important aspect creating the feeling of intimacy, protection, and security, as well as the definition of the residents' territorial boundary, is the degree of spatial enclosure and openness. It should neither be completely loose nor rigidly enclosed. The space should only be partially enclosed with paths or with some leading to other areas (Greater London Council GLC and Department of Architecture and Civic Design, 1978). The series of enclosures are most noteworthy in the Asian Games Village, where the space within the housing cluster creates a strong sense of location, privacy, and territory facilitating neighbourly surveillance and social contact, thereby effectively reducing vandalism. Here, primary elements are predominantly used to create an enclosure, whereas secondary elements, such as landscape, enhance and soften the degree of enclosures.

At GSFC Housing, streets between dwelling units lead the highly enclosed intimate courts to rear open greens

giving vistas within hundred feet. As such, the sense of enclosure is maintained. In other places, secondary elements, such as trees, screens, and boundary walls, are utilized to strengthen the feeling of enclosure. At Belapur Housing, the spatial relationships of open spaces are well defined. Particularly, the tight and highly enclosed spaces between units suitably contrast with large, open, semi-enclosed areas, thus creating identity and interest. Moreover, the movement from the private to the public realm is strongly hierarchical with the enclosing elements primarily becoming secondary in the transition to open areas.

9.2. Scale, proportion, and character of built edges

As stated by Ching, "Proportion refers to mathematical relationships among the real dimensions of a form or space whereas scale refers to how we perceive the size of a building element or space relative to other forms" (Ching, 1979, 296). Evidently, comfort in open spaces is determined by the proportion and scale of enclosures and the effect of built mass on human scale. In addition, all types of spaces, which include streets, squares, transition areas, and large community spaces, have diverse scales and proportions, thereby inducing varying feelings of protection, privacy, interaction, and territoriality. A height-to-width ratio for linear spaces can range from 1:1 to 1:2.5, as suggested by a GLC study (1978). Less or more of this ratio would make that space either claustrophobic or having a low feeling of enclosure, respectively. Lynch and Hack, in their book *Site Planning*, mentioned that an external enclosure is most comfortable when its walls are one half or one third as high as the width of enclosed space, whereas the space ceases to be enclosed if the ratio falls below one-fourth" (Lynch and Hack, 1984, 158).

All the three selected cases were examined on the basis of the aforementioned parameters. The results show that at Asian Housing, the scale and proportions of the intimate cluster courts vary between 1:2 to 1:3, which is within the optimum comfort limits. However, enclosures under gateways give the greatest human scale definition. Moreover, the aesthetic play of volumes, terraces and grooves on cladded facades accentuates the impression of human scale. Although the large courtyards exhibit large proportions (1:7), they are enhanced by secondary elements. GSFC Housing is notable for its recreation of a scale that is similar to that of conventional *pol* houses, which have intimate courtyards that respond well to human scale and gradually change in the narrow streets. Such courtyards offer numerous encounters. Proportions change from 1:1 to 1:9, but the use of secondary elements perceptually compensates the difference. At Belapur, the changing scale of courtyards define the activity areas, and the most intimate scale of 1:1.2 is evident near the residential units that progresses to 1:4 within clusters and 1:6 in the large open spaces. In such spaces, tall trees create a spatial ceiling that effectively mitigates the lack of enclosures.

In addition to scale and proportion, the built form edges, which result in the neighborhood spaces of these environments, are conducive to activity and interaction. Therefore, the built edges at the Asian Games Village are more than 6 ft deep, thereby favoring contact. Furthermore, the alcoves in streets between units at GSFC impart corners for informal activity, whereas articulation in the built form at Belapur Housing presents opportunities for everyday encounters.

9.3. Response of neighborhood spaces to climatic factors especially the sun

In areas with tropical climates, heat is a predominant issue, especially in outdoor areas where their location with respect to the sun, wind, and light determines the comfort levels at different times of the day and year. The semibuilt and unbuilt spaces in residential environments are significant in the Indian context because the multifaceted expressions of built form in warm to hot climates open up to a varying degree of enclosures in contrast to the cold climates of the western world. As one moves out of the built form, it opens to a verandah leading to a courtyard and then a tree onto a terrace and so on to different definitions of spaces (Khan, 1987). Traditional living environments have responded to such conditions by providing mutual shading in compact organizations oriented to favorable wind directions. Provision of shaded courtyards, verandahs, chabutras, and streets among other elements has mitigated the harshness of the climatic conditions in many cases.

The examination of the selected cases in terms of their response to respective climatic conditions shows that the Asian Games Village, which is set within the composite climate of New Delhi, utilizes linear clusters and courts of varied scale to counter the fierce heat in summers. As such, ventilation and sunny spots are provided during humid months and for winter afternoons, respectively. Although not successful at all spaces within the site, most areas can mitigate the effects of heat by suitable mutual shading. The GSFC Housing at Vadodara utilizes similar elements in a different manner, where "The thick brick walls, brick paved streets, pedestrian ways, courtyards, balconies and terraces give overall impression of substance and shade" (Curtis, 1988, 73). In addition, the narrow streets within the clusters funnel wind, whereas vegetation is the primary source of respite for the large areas. Meanwhile, at Mumbai, heat is one less problem, and Belapur housing mitigates the effects of intense radiation by successful mutual shading in the intimate clusters. The central water stream also alters the microclimate and creates comfortable outdoor spaces, although wind movement is effective mostly on terraces and upper floors.

10. Conclusions and recommendations

The previous segment already established the significance of well-planned neighborhood spaces in a residential environment for the overall holistic comfort of inhabitants. The need for such environments in the contemporary context has also been stressed with the growing population and mass migration patterns, which lead to poorly planned residential neighborhoods. Although traditional Indian

settlements can respond to these issues in an effective manner, contemporary examples are sometimes insufficient due to rapidly growing numbers, widespread negligence, and lack of concern. Resident comfort comprising physical, perceptual, psychological, and social issues must be addressed; thus, three contemporary examples by well-known designers are analyzed to devise useful strategies in the present day contexts. This analysis leads to the formation of the following recommendations and guidelines:

1. Residential environments are not just about built habitable functional spaces. They must be equally sensitive to the unbuilt, which has a larger role to play in the comfort of residents and users compared with the built.
2. Factors affecting comfort in such environments range from the physical to psychological and perceptual, along with the social needs of dwellers.
3. Physical aspects are dependent on climatic comfort, accessibility, and convenience suitable to the discharge of activities and effective transition from one place to another.
4. Psychological and perceptual attributes must respond to privacy, safety, and territoriality, as well as individual identity, visual pleasure, and comfort of inhabitants.
5. Social needs must also be satiated by passive and active interaction, as well as a sense of well-being.
6. The thorough examination of the three selected cases reveals that varied approaches by designers achieve similarly conducive living environments.
7. Although the spatial organization and arrangement of units within the site vary in the three cases, they rely in neighborhood spaces with effective connection, unity, hierarchy, and transition. Community areas and amenities are almost centrally placed in all the cases, and the movement of residents to common spaces is sequential. Therefore, the aspirations and comfort ability of users are addressed.
8. Built mass and character, along with the streetscape, is visually interesting by providing elements that contribute to the unique personal quality of the units while maintaining human scale. Gateways, door colors, and material usage contribute to territoriality, belonging, and general coherence.
9. In the three examples, vehicular and pedestrian movements are well defined and demarcated. Thoroughfares are avoided, and the transitional hierarchy is suitably addressed. Parking lots are well distributed to mitigate walking distances, and these are also well screened from view for optimum visual comfort.
10. Spatial hierarchy obtained by varying enclosures within housing clusters to the community areas contribute to a strong sense of location, privacy, and territory, thus favoring neighborhood surveillance and social contact and mitigating cases of vandalism and aloofness.
11. In all cases, the most intimate enclosure after the housing unit is almost 1:1 in scale and proportion and gradually changes to 1:3 up to 1:9. However, secondary elements, such as trees, boundary walls, and landscapes, are used at large areas to reduce the proportions perceptually for integrity.
12. The edges of the built form in all examples are articulated with alcoves and niches, favoring informal interaction, connectivity, and dialogue.
13. Despite being located in diverse climates, all the housing environments respond suitably to existing climatic conditions by providing mutual shading, suitable wind movement, and multiactivity spaces for changing seasons and weather.
14. None of these cases merit replication even in identical settings. This study directs the relevance of neighborhood spaces in residential environments and the diverse tools and strategies used by well-known designers in creating habitable conditions to promote a sense of belonging and wellbeing, especially in the Indian context.

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