ENVIRONMENTAL PERFORATIONS, A LONGSTANDING URBAN STRATEGY

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ABSTRACT

The intersecting human and natural topographical proceedings within any space and time sets the stage for upcoming buildings and infrastructure, in the form of physical environment that is technically referred to as context. This study revolves around building interventions within a physical urban context and highlights the necessity of environmental sensitivity. The study explores thorough extractions from predominant natural potentialities, for improved building performance and reviews environmental efficient methods. Long-standing practices adopted for making buildings respondent to existing physical settings are studied. The focus henceforth is solar sensitization with reference to solid void orientation and solid void proximity.

Spatial surveys and analyses of model building envelopes are carried out to decipher environmental characters and its handling mechanisms. The buildings selected for analyses (Alhambra Complex, Granada, Islamia College, Peshawar and Agricultural University, Peshawar) are of incredible stature, and demonstrate prime importance while considering a particular era and locale. The analyses extents are infusing of building blocks and open spaces, mass void ratios, solid void orientations and proximity level.

The study suggests measures for solar sensitization and brings forth an indicative framework, comprising techniques and methods to break down solids and voids for maximizing environmental performance. Some objective design alternatives are recommended for overall massing of solids and voids to allow optimum daylight, air change and inwards-outwards vistas within an urban context while maintaining the integrity of prevailing settings. Several geometric configurations are hypothesized to diversify interpretations of the idea of environmental perforation.

Keywords: Environmental Sensitivity, Optimum Daylight, Inward-Outwards vistas, Solid Void orientation, Solid Void proximity

INTRODUCTION

Urban thinking and designing as put forward in Urban Design Guidelines for Hong Kong (1998: 121) is about setting “the framework for the physical and spatial arrangement and composition of built-forms and their three-dimensional relationship with the spaces around them and the surrounding settings for achievement of aesthetic and socio-cultural qualities”. Space as the foremost and reflexive educator could sensitize its inhabitants about environmental significance and responsiveness. This study aims to indicate some fundamental contextual processes that could form a rudimentary parameter for prospective urban interventions.

The study commences with several research implications that present a framework for the subject stated and further explores age old wisdom behind juxtaposing principles within building blocks and between building blocks and open spaces. The spatial analyses are carried out to interpret environment sensitive arrangement of quadrangles and considerate positioning of building blocks within pleasing enclosures. Predominant natural potentialities, specifically light and wind are given thorough considerations, not only for visual depths, but aerating corridors are formed to cope with intensity of temperature in hot regions. This is a common design strategy implemented in different forms. Design attitudes are surveyed to coin upcoming urban and regional developments responding to existing settings. Design considerations in urban context are investigated and various recommendations are put forward towards the culmination of this study. Some environmental opportunities, such as courtyards and sun envelope, are reviewed to help orient buildings in an existing urban scenario so that forthcoming developments mark positive impacts on its surroundings and extend a healthier contribution to living.

The study proposes some design considerations for overall placement of solids and voids to allow optimum daylight and cross-ventilation in an urban context, while maintaining the integrity of existing environment. Means are worked

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out for urban extension to enhance natural ventilation and efficient performance within existing settings without affecting surrounding building envelopes. Measures such as provision of light, wind and views towards and from neighboring buildings are thoroughly reviewed.

Research Objectives

Design strategies for a physical environment that will focus on the use of predominant natural potentialities, specifically:

- Light and visual perforation of and through building masses
- Winds and natural ventilation in urban settings.

Research Methodology

Pertinent research implications are analyzed for this research to form a roadmap and referential ground for further investigation. Spatial surveys and analyses of model building envelopes are carried out to decipher environmental characters belonging to these space envelopes and environment responsive handling mechanisms. The analyses include infusing of building blocks and open spaces, mass void ratios, solid void orientations and proximity level of the case studies selected.

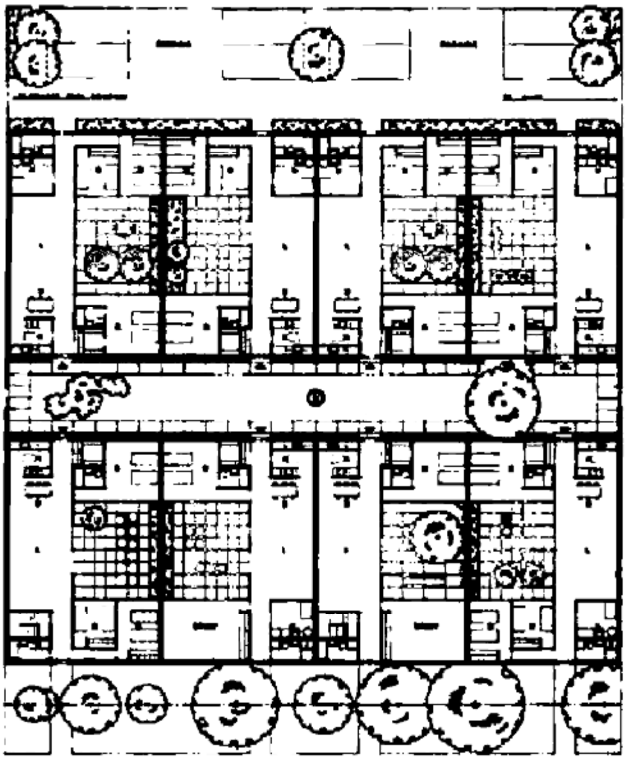

Figure-1: Chicago courtyard town houses (1961)
Source: Blaser, 1985

Literature Review

On the subject of open to covered space percentage Reynolds (2003) implies that a typical zoning regulation for courtyard-type neighborhood is that 25% of the site must be open to the sky, whether in one large or several smaller courtyards, to serve effectively as a conduit of light and air.

Blaser, (1985) in a critique on courtyard scheme of architect Y.C. Wong (Figure 1) puts forward the recommendation that humid summers and savage winters in a downtown residential district (Madison Park) can be controlled through courtyard planning. In the dwellings designed in 1961 with one (remote) parking space per dwelling, each courtyard served its house on three sides. Only two openings, each a door, penetrated the exterior of each row house. Half of these houses placed the living room to the north of the courtyard, where it could receive maximum winter sun.

A correlation between sunlight and window size (Figure 2), is established by Stein and Reynolds (2000). Daylight penetration from windows or doors is usually adequate in a zone that extends to a maximum distance of 2.5H from the opening; where H is the opening's height above the floor.

In terms of the width and depth ratio of rooms, rooms that face the courtyard should ideally be wider along the courtyard than deep. A typical proportion is three times as wide as the depth. In such designs, daylight from the courtyard can fill the room more evenly. Obviously, this limits the number of such "ideal" rooms that can face the courtyard.

Knowles (2003) argues that at the urban scale, the concept of solar envelope provides a means to regulate development within imaginary boundaries, derived from the sun's relative motion. Buildings within this envelope will not overshadow their surroundings during critical periods of the day and year. The solar envelope provides zoning for low impact development and opens new aesthetic possibilities for architecture and urban design.

On solar access Robinson and Graham (1938) argue that this idea goes back at least 3000 years to the colonial cities of ancient Greece (Figure 3). Gridiron plans, attributed to Hippodamos of Militus, were arranged in a manner that all houses faced the sun for heat and light.

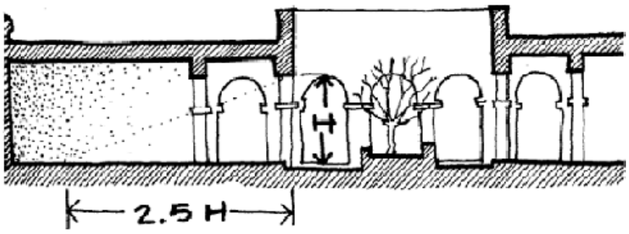

Figure-2: Drawing: Michael Cockram.
Source: Stein and Reynolds 2000

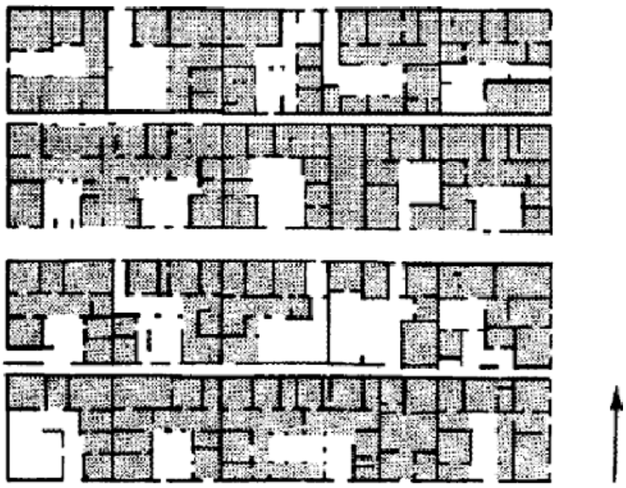

Figure-3: Plan redrawn from excavations at Olynthus: The Hellenic House
Source: Robinson and Graham, 1938

Knowles (1981) establishes that the distance between rows of houses should be just sufficient to avoid winter overshadowing of terraces and heat-storing walls (Figure 4). It was the observation of this critical relationship of building-height to shadow ratio that originally gave rise to the solar-envelope concept.

Spatial Analysis and Findings

Complex, Granada, Spain: In an analysis of the Al-hambra complex in Granada, Spain it was ascertained that diverse proportions and shapes are interwoven to achieve not only a visually balanced complex, but the design of Alhambra in Granada is a very precise response to the climate of Spain (Figure 5). Besides the lavish architectural details, the overall massing of this complex is well thought out as adequate climatic response. The open to built ratio of the complex is nearly 1:0.4. Almost 40 percent of the complex constitutes open spaces. Visual stability and ecological balance is achieved through enigmatic geometric composition. The North South orientation, with a tilt of approximately 17 degrees towards the north is a climatic response to solar angles.

Islamia College, Peshawar, Pakistan: The interplay of solids and voids is recurrent in this building, which was constructed during the colonial period (Figure 6). The usage of brick and architectural vocabulary represents its time of construction. Isolated courtyards are interconnected through bays running across building blocks with green avenues in central open areas. The overall composition of solids and voids is symmetric in geometry.

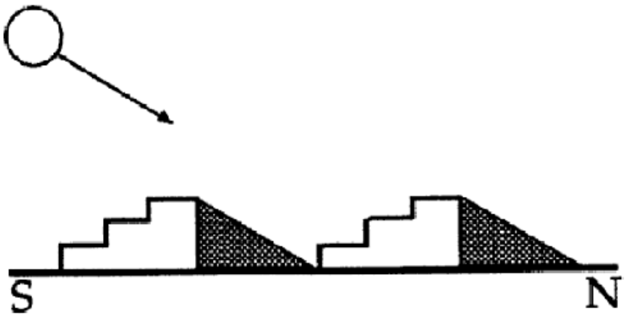

Figure-4: Rows of houses at Acoma Pueblo are strategically spaced, no further apart than necessary, to avoid winter shadows while conserving space on a small plateau site.
Source: Ralph L. Knowles, 2003

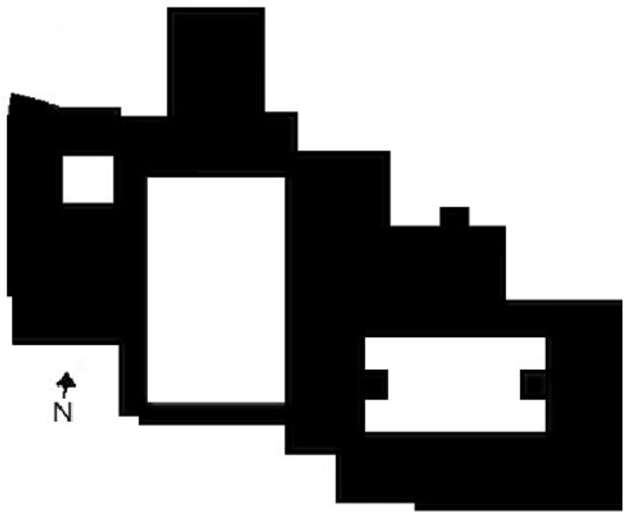

Figure-5: Alhambra: Fortified Moorish palace of the Muslim kings, built between 1248 and 1354 AD near Granada, Spain.
Source: www.googleimages.com, accessed 24/3/13

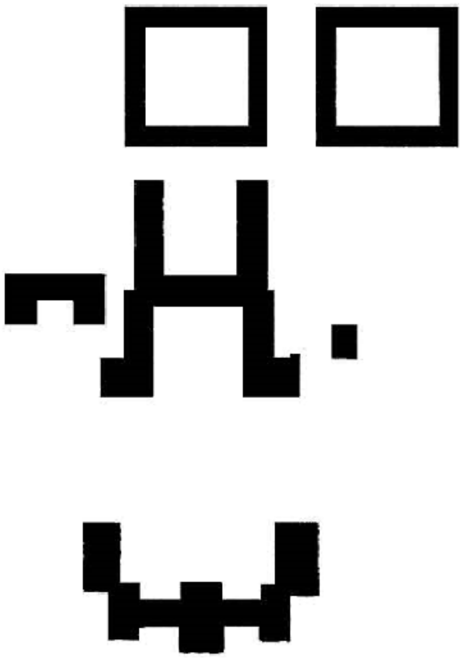

Figure-6: Islamia College Peshawar, built in the beginning of 20th century
Source: www.googleimages.com, accessed 24/3/13

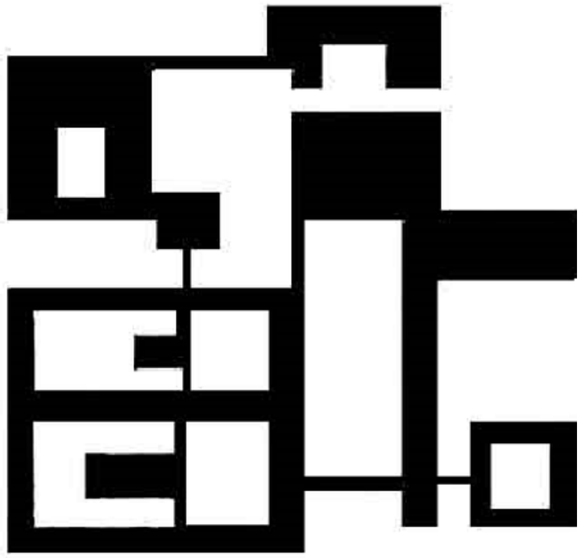

Figure-7: Agriculture University Peshawar, Skidmore Consultants, USA, 1990's

Agricultural University, Peshawar, Pakistan: Though completely disconnected in visual facets, a visible modernist handling of facades is predominant at the Agricultural University, Peshawar, Pakistan. The architectural firm Skidmore, USA, revives the ages old spirit of interwoven courtyards and building blocks in the overall behavior of masses (Figure 7). The solid and void ratio is relatively generous i.e. 1:1. The floating courtyards are blended mysteriously upon apparent close-ended long covered passages, that cusp with both the blazing sun of Peshawar, and the occasional precipitation.

Recommendations

Light and wind conduits for building chunks in urban settings are inevitable for creating healthier environment. Legislation in the form of tangible urban design guidelines is impelled to handle growing demand for higher occupancy, which is pushing urban dwellers to live devoid of fresh air and natural light. The concept of perforated urban communities and complexes might be advised as an essential part of new developments. This idea could be materialized by establishing a thumb rule like a proportion system e.g. proposals of Reynolds (2003) and Stein and Reynolds (2000). The idea of perforated masses, as demonstrated in (Figure 8), could

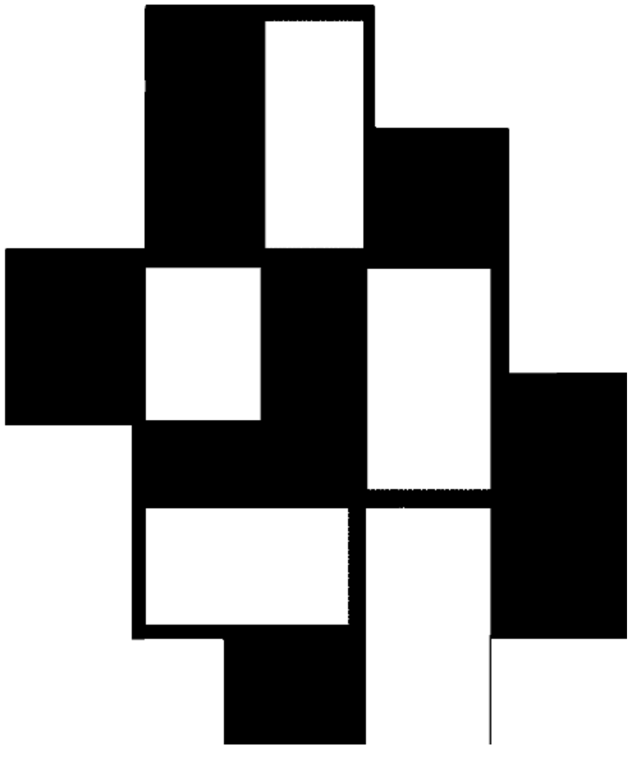

Figure-8: Idea sketch representing ages old wisdom of handling solids and voids.

have multiple contemporary interpretations. These interpretations would depend upon the nature and restrictions of functionality and site form, as well as on the emergent post-modern aesthetics of abstraction and aesthetic language.

Curvilinear representation: The concept of intermingling solids and voids that could be translated on an urban scale should be reviewed (Figure 9). This configuration will suit vehicular movements and would create less hurdles for urban mass transportation system. On a smaller scale this formation (Figure 9) would form smooth transition between solids and voids.

Abstract representation: The age old idea of perforating solids and voids is translated as juxtaposition of building chunks and breathing open spaces with enhanced connectivity, distance reduction and spatial unpredictability. This idea (Figure 10) could be translated on a regional level as well, for detailing a building block. To further augment its workability this formation could be oriented according to the wind's behavior.

CONCLUSIONS

Based on the research and analysis of case studies this paper argues that the interconnectivity of solids and voids with a range of ratios i.e. from 25% to 40% and beyond is a favourable urban configuration depending upon the nature of project and space availability. Solids and voids could be interconnected in a way that continuity and sense of infiniteness is achieved through interesting yet simple channeling of spaces. Solids could be broken down to cater for improved light, ventilation and for producing views and vistas by infusing landscape, and streaming across subtle geometric objects. The perforation would also cater for solar-envelope, a very important factor, advocated by Knowles (2003) and would hence create opportunities for daylight penetration and allow the designer to practice exact or similar ratios as implied by Stein and Reynolds (2000), which according to them are essential for healthier daylight. The ideal orientation for a building is north-south. The ideal placement of a single courtyard is southwards, for better performance of the building both in summers and in winters, however, it is preferred to have an open space on the north side for better performance in summers.

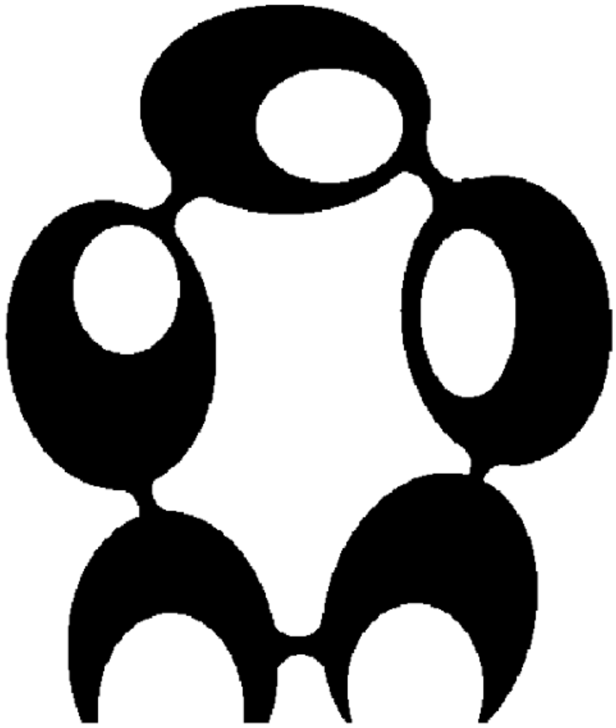

Figure-9: Sketch based on the concept of intermixing solids and voids with curvilinear representation.

Figure-10: Abstract Geometric configuration: Drawn out of two symmetric grids emerging from two different pivots.

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