Socio-climatic design for high-rise dwellings

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ABSTRACT: This paper discusses the relationship of two major concerns, social-cultural and climatic-ecological issues, in urban environmental systems in the high-rise high-density context. Through centuries, the ‘Socio-climatic’ design of the kampong (tropical vernacular villages) in the South-East Asian region, as well as many other regions, has evolved as equilibrium systems between social-cultural and climatic-ecological needs. A case study, Bedok Court Condominium, shows how such salient characteristics are re-adapted and re-invented successfully, in enhancing the quality of life in the high-rise high-density settings, as well as providing various passive modes of environmental control. This paper also discusses questions for further research into various aspects concerning the semi-open space and socio-climatic strategy for high-rise building design.

Conference Topic: 1 Sustainability and high-rise buildings
Keywords: sustainable architecture, high-rise high-density, socio-climatic, sustainability and community, tropical architecture

BACKGROUND

It is recognized that passive-design to climatic conditions for human comfort is a major aspect of sustainability in that it provides human thermal comfort with minimal operating energy consumption. The bioclimatic approach is one major trust mooted in the early 1950’s at a conference for design in the tropics by Victor Oglyay, 1952 [10]. Since then the concept remains dormant for designers considering passive response to the climate in design, including Ken Yeang, 1996 [13], who has taken it to high levels of sophistication in the urban skyscrapers. This approach to sustainability, like many other approaches, focuses largely on the performance of the physical environment. Concerns are on the biological behaviour, the material ecological, and energetic impact.

Very little social-cultural dimensions in the urban context are discussed in detail in relation to climatic aspects in the bioclimatic approach for contemporary design.

Through centuries, the ‘Socio-climatic’ design of the kampong (tropical vernacular villages) in this region has evolved as equilibrium systems between social-cultural and climatic-ecological needs. A case study, Bedok Court Condominium, shows how such salient characteristics are re-adapted and re-invented successfully, in enhancing the quality of life in the high-rise high-density settings.

2. A CASE OF SOCIO-CLIMATIC DESIGN

Large open entrance terraced courtyard to each apartment and air-wells mediate between apartment units and the linear common corridors, creating an environment of visual connectivity, light, ventilation and tropical comfort for various forms of activities (Fig. 1, 2 & 3). The physical character of the ‘corridors’ of Bedok Court Condominium literally resembles the streets in kampongs with views of verandas (semi-open forecourts) along the way, and the modern terrace housing estates with view of the garden-terrace entrance. However, there is a major difference; they are streets in the sky with more than one level of visual connectivity, 3-dimensional multi-layered streets, with much higher density.

Figure 1: Typical Bedok Court Condominium veranda space to each apartment that affords many long periods of environment that are conducive for many social activities (Source: Author)

2.1 Design objectives and inspirations

The design of this 280-unit development of mixed heights of 4 to 21 storeys, was conceived in 1980 by Cheng Jian Fenn of Design Link Architects, Singapore, and was implemented and completed in 1985. In an interview by the author, Cheng mentioned that his inspiration comes from his first-hand experience of the village verandas and the strong sense of security, relaxed friendly atmosphere and sense of community found in the kampong setting.
The visual connectivity corresponded so well with the social connectivity and familiarity, so that any visitor would be immediately noticed, alerting various households.

He also wanted to design apartments similar to terraced, semi-detached and single houses in the sky, with environmentally conducive open and semi-open spaces for gardening and various activities.

Figure 2: Bedok Court Condominium typical plan of high blocks, with verandas facing North (Source: Author, after plans courtesy of the Architect)

He mentioned that his other influence was the arguments given in a book of Jane Jacobs, 1962 [7], for the need of street life. However, Cheng also observed that in order to create such environment certain sacrifice of privacy would be necessary to gain familiarity and trust.

2.2 Configurations of verandas and apartment units

The verandas are generously big enough for maximum flexibility of use for gardening, hobbies, children’s play, study group activities, parties and even large enough for 4 to 6 outdoor dining tables. The living and dining hall opens out directly to these courtyards creating a porous spatial continuity and varying degrees of privacy or openness.

Figure 3: Typical Bedok Court Condominium semi-open veranda space to each apartment linked to circulation corridors from 1st level to the 21st level (Source: Author)

2.3 Survey of human response

A survey conducted by the author on the social aspects relating to the veranda spaces at Bedok Court Condominium showed various positive responses (Table I, summarised from Bay 2000 [1]).

<table>
<thead>
<tr>
<th>Responses about the veranda space</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscious of and chose the veranda area as the most desirable physical design space compared to the interior, balcony, lift, lobby, playground, swimming pool, car-parks</td>
<td>86%</td>
</tr>
<tr>
<td>The verandas were the spaces with the highest frequency of seeing other neighbours</td>
<td>80%</td>
</tr>
<tr>
<td>Used more than once a week</td>
<td>86%</td>
</tr>
<tr>
<td>Used as extended living area including receiving guests</td>
<td>52%</td>
</tr>
<tr>
<td>Giving parties</td>
<td>56%</td>
</tr>
<tr>
<td>Gardening</td>
<td>80%</td>
</tr>
<tr>
<td>Children’s play</td>
<td>72%</td>
</tr>
<tr>
<td>Laundry</td>
<td>72%</td>
</tr>
<tr>
<td>Felt more in touch with nature</td>
<td>80%</td>
</tr>
<tr>
<td>Good environment to bring up children</td>
<td>84%</td>
</tr>
<tr>
<td>Greet each other more than once a week</td>
<td>64%</td>
</tr>
<tr>
<td>Visited each other at least once a week</td>
<td>60%</td>
</tr>
<tr>
<td>Did not feel a lack of privacy</td>
<td>90%</td>
</tr>
<tr>
<td>Felt a high sense of security</td>
<td>96%</td>
</tr>
<tr>
<td>Strong sense of belonging and ownership</td>
<td>90%</td>
</tr>
</tbody>
</table>

The overall conclusion of the social study is that Bedok Court, though not perfect, is a modern high-rise development that re-invented the regional Kampong nuances, with semi-private, semi-public spaces, personalized ownership, pieces of tropical ‘green’, and high frequency of casual semi-public meetings and interactions, and sense of belonging and security.

2.4 Survey on human thermal comfort

There are studies of thermal comfort for naturally ventilated interior of high-rise dwelling in Singapore (e.g. Wong 2002 [12]), but none for semi-open spaces. A survey of the human thermal comfort votes with measurement was also done in the hottest period of June-July 2003 (Bay and Lam 2004 [2]) for the activity of meeting people and chit chatting in the forecourt of the case of Bedok Court Condominium, in generally casual clothing. The comfort votes are charted against the mean radiant temperature in Figure 4. The results show a high percentage (70%) of votes for comfort -1, 0, 1 range for mean radiant temperature between 28 to 32 degrees, even for the warmest period of the day. About 20% of respondents expressed that they felt a little cool, which is a good
thing for the tropical environment where heat is more a problem. Only 10% express that they felt a little warm. This means that the overall thermal comfort condition is very good.

The conditions for evening and morning are generally cooler. The key reasons for the comfort are because the people could enjoy ample shading from the solar radiations from the sun while receiving lots of ventilation due to wind in the semi-open spaces. Also the shades and winds combined to keep the building cool through the afternoon, with less heating up of the building façade.

3. SOCIO-CLIMATIC RELATIONSHIP

In the case of Bedok Court Condominium, the verandas provide quite substantially for both of the social activities in terms of physical dimensions, as well as the thermal comfort aspects.

The verandas provide shade and ventilation, keeping the apartments cool and affording long periods of thermal comfort suitable for various activities. These in turn afford personal expressions, visibility and familiarity of the residents to neighbours, necessary for building neighbourliness and sense of security.

The semi-open spaces also facilitate gardening, which in turn improve the environment for social activities. At the same time one also reaps the benefit of plants in the urban environment to reduce heat island effect, pollution and improved air quality (Ong 2003 [11]).

The combined social and climatic benefits create the desire to maintain uncluttered verandas, preserving the equilibrium of the comfort conditions. Out of 280 units of apartments, only one family walled up their veranda space. Also majority of the owners expressed that they would wall up their balconies (looking away) if they needed more interior space, but they would not wall up their verandas (forecourts relating to common circulations and entrances) because of the high recreational and social value.

4. SUMMARY AND DISCUSSION

The bioclimatic approach and studies tend to treat human subjects as mainly biological beings, while most social-architectural study tend to avoid the parametric aspects of the environment. The high-rise dwelling tropical veranda spaces in the case study showed the related benefits of environmental conduciveness and quality of life.

Noting the value of the high-rise veranda and the relationship of the social and climatic factors, what further investigations can be made for guiding future design for high-rise dwellings?

What are some possible questions for research into the aspects of correlations of social and climatic factors, for improving designs for community and sustainability. The sizes and configurations of verandas constrain the types of human activities possible. What is the optimal size for various activities? Are there higher and lower limits for each social activity, and how do these relate to the thermal comfort conditions? (The design guideline and optimal size of this type of semi-open spaces in relation to the thermal comfort condition through shading is being discussed in another paper by Wang and Bay 2004 in PLEA 2004.)

How about acoustic and lighting considerations for comfort? It is important to have better understanding of the matrix of these inter-related factors for developing guidelines for future designs.
REFERENCES


