

Significance of Sky Gardens for Healthy High-Rise Living of Urban Children and Old Adults

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ABSTRACT

A new typology of sky gardens has been driving design of residential high-rises, which aims at offering communal green spaces at high levels for enhancement of social interactions and neighbourhood place-making while improving environmental conditions simultaneously. However, criticisms have been found that these communal green spaces are merely as gimmicky features and of a low occupancy rate. Indeed, children and old adults spend most of their time in residence. Are these gardens designed for their daily living?

This paper is an attempt to evaluate the effectiveness of these sky gardens contributing to social integration and health development of children and old adults in high-density high-rise contexts. Having reviewed policies, regulations and guidelines in Hong Kong and Singapore, the study investigates the desirable provisions of communal green spaces and amenities in support of a healthy living environment; and co-relates their applicability to the contexts of high-rise residential developments. Case studies of forty residential high-rises in Hong Kong and Singapore map out diverse spatial, functional and landscaping design of sky gardens. Qualitative comparative analysis identifies key design attributes to children and old adults' enjoyment and their everyday life.

The findings inform that the current designs of sky gardens follow nominal prescriptive requirements of the government's green incentives which emphasize environmental performances, but are less likely deliberated from users' perspectives with respect to social and psychological benefits. Seldom of them pay attention to creating children and elderly friendly communal spaces at high levels. Sense of safety and lack of active facilities at existing sky gardens are observed. Recommendations are made to the criteria of the green incentives not only appealing for residential high-rises with nominal amount of green but also qualifying the green to be liveable and enjoyable by daily frequent users comprising children and old adults.

Keywords: *policy and regulation, inclusive eco-design, sustainable neighbourhood*

1. BACKGROUND

The higher we live from the ground level, the more disconnected we feel from the natural world and even from each other within a community. The population of Hong Kong is expected to remain on an ageing trend, which urges for more health and recreational facilities. On the other hand, urban children are growing up detached from the natural environment and lacking face-face social interaction. How can we improve this situation in high-density high-rise contexts?

Meanwhile, a new typology of sky gardens has been driving design of residential high-rises and offering communal green spaces at high levels for enhancement of social interactions and neighbourhood place-making while simultaneously improving environmental conditions. Children and old adults spend most of their time in residence and are the most frequent users of sky gardens during the daytime.

This study is an attempt to evaluate the effectiveness of these sky gardens contributing to social integration and health development of children and old adults in high-density high-rise contexts. Having reviewed regulations and advisory guidelines in Hong Kong and Singapore, this study investigates the desirable provisions of communal green spaces and amenities in support of a healthy living environment; and co-relates their applicability to the contexts of high-rise residential developments. Case studies of residential high-rises in Hong Kong and Singapore map out diverse spatial, functional and landscaping design of sky gardens. Qualitative comparative analysis identifies key design attributes to children and old adults' health and wellbeing.

2. DEFICIENCIES IN HIGH-RISE URBAN LIVING

A study on residents' behaviour in a high-rise apartment concluded that there was a high degree of anonymity and social isolation, including pervasive ignorance about neighbours and little inclination to establish friendly relations with neighbours over forty years ago (Zito, 1974). These phenomena are not uncommonly found in residential high-rises nowadays. Six types of fears are found in high-rise residence, including a fear of neighbours' suicides, a fear of fire, a fear of collapse of the building due to earthquake, a fear of the building to be attached in the post-911 era, a fear of crime due to fear of strangers, and a fear of becoming ill due to spread of communicable diseases (Robert, 2007). Furthermore, children in high-rises have fewer chances to go outside to play. They are either to be kept indoors under over-protection or left relatively unsupervised outdoors far away from residences. Children have difficulty developing friendships in their living environment and result in behavioural problems or poorer social skills (Fowler, 2008).

3. COMMUNAL GREEN SPACES IN URBAN LIVING

Pleasant communal green spaces could encourage social interaction among neighbours are important to urban dwellers in high-rise living. Recent research findings have given an important message that we need adequate levels of nearby green spaces in urban living.

Psychological performance

Urban dwellers have a strong request for pleasant communal activity spaces and greenery (Chien & Wang, 1999; Huang, 2006). Urban green spaces with the natural setting can provide some peace and quiet away from the hustle and bustle of the city, and contribute to health and wellbeing (Baur & Tynon, 2010). Natural elements such as trees facilitate social interactions amongst neighbours (Kuo et al., 2002). The mental and physical health benefits are associated with time spent exposed to green spaces (McCurdy et al., 2010).

Social performance

Community treasures the value of communal green spaces. Pleasure-derived leisure experiences are found in a garden. The garden serves as a social arena for group gathering or a quiet, contemplative space to enjoy its peace and beauty (Connell, 2004). Community garden as a potential useful strategy to improve individual health and strengthen neighbourhoods, where each community member has a duty to maintain and foster vegetation of the garden, can enhance social connections, reciprocity, mutual trust, collective decision-making, civil engagement and community building through people's interactions among their neighbours and planning vegetation (Amulya, 2009).

Environmental performance

Cooling of the urban environment is of a priority in urban and building design for a subtropical region. Urban microclimate can be improved through urban greening and permeable building fabrics (Levermore & Smith, 2008). Effective landscape design creates thermal comfort and energy efficiency. Vegetation is a real tool for control of microclimatic conditions in external areas (Picot, 2004). Consideration in selection of trees commonly used in the landscape comprises solar transmissivity range in summer and winter, periods of foliation and defoliation, and maximum expected height (Brown & Gillespie, 1995).

Ecological performance

People living in cities are increasingly disconnected from the nature world, witnessing an extinction of experience (Goddard et al., 2009). Urban green spaces have considerably benefits that maximize the biodiversity of urban ecosystems and minimize the extinction of species and the extinction of the human experience of wildlife. The importance of urban green spaces with natural structures is to maintain high ecological diversity (Sandstrom et al., 2006).

Children-friendly urban environment

Biophobia may be developed due to people's fear of living things and unexpectedness from nature. It is not uncommonly observed at urban children especially for those living in metropolitan areas. Contact with nature can evoke negative feelings such as fear, scary, disgusting and uncomfortable; for instance, children raised in urban areas are afraid of being in the woods and were disgusted by the dirtiness of the outdoors (Collado et al., 2015).

Neighbourhood shared spaces and greenery are essential for children's healthy development. Findings of various studies revealed that children in the city become nature-deficit disorder with physical inactivity, social and psychological ramifications and increased chronic disease trend. In Lee and Min's research (2006), children's neighbourhood environment plays a key role in shaping their personality.

Children having more daily contact with nature are able to cope better with adversity. Urban children spending more time in nature enhance environmental attitudes and ecological behaviours. Activities with nature such as picking fruits, planting seeds or taking care of vegetables improve children's pro-environmental attitudes. (Collado et al., 2015) Garden activities should also be organized in a way that children have an opportunity to freely use and shape the environment's affordances, and a well-designed children's garden is recommended (Laaksoharju, 2012).

The elderly-integrated neighbourhood

Aging population poses strong demands on recreational facilities. They are the major daytime users of green spaces and amenities in or adjacent to their living premises. Gardens facilitate their daily activities including doing exercises, playing chess, reading newspapers, chatting with their friends and neighbours and playing with their grand children. Delvin and Zaff (1998) researched that elderly people prefer garden apartments than high-rises and have a greater sense of community there. Kweon et al. (1998) revealed that green common spaces benefit the social integration of inner-city older adults. Such strong social integration among older adults could also indirectly lessen public expenditure on individual elderly services.

4. SKY GARDENS DEVELOPMENT IN HONG KONG AND SINGAPORE

Sky garden is a micro-environmental design for improvement of wind environment in urban districts. It is also a recreational garden space for communal use. Vertical landscaping and open spaces at the intermediate or high levels of the high-rise are not only for benefits of microclimate but also fostering neighbourhood (Yeang, 2002).

The Hong Kong government issued 'green incentives' for sky gardens in domestic buildings in 2001, including Gross Floor Area (GFA) exemptions and relaxation of the allowable overall building height in regard to provision of sky gardens. Figure 1 illustrates a typical high-rise residential development where podium and sky gardens are for communal use and roof gardens are within the private premises of duplex units at the uppermost storeys.



Figure 1: Podium garden, sky garden and roof garden at a residential development in Hong Kong.

Policies on promoting sky-rise greenery are also found in Singapore. In 2009, the Singapore government announced a target of adding 50 hectares of sky-rise greenery by 2050 and its intermediate target of 30 hectares by 2030. These targets were written in the sustainable development blueprint which was developed by the Inter-ministerial Committee on Sustainable Development.

Two governments' emphases of purposes of sky gardens are fundamentally different from each another in accordance with their incentives and guidelines. These differences also drive the as-built sky gardens in diverse typologies. Hong Kong's sky garden is relatively environmental driven while Singapore's is socially-oriented. Hong Kong's requirements restrict locations and numbers of sky gardens, and more prescriptive details there. For instance, sky gardens are at least at ten storeys apart from each other or podium garden unless under exceptional circumstances where strong environmental justifications are requested. Doorstep green communal spaces scattered at various storeys or seamlessly integrated with common circulations to facilitate incidental neighbours' interactions are observed in Singapore but not Hong Kong. Table 1 summarizes detailed comparison of governments' incentives of two cities.

	Hong Kong	Singapore
Government Policy	Joint Practice Note (JPN) issued by Buildings Department, Planning Department and Lands Department.	Circular to Professional Institutes issued by Urban Redevelopment Authority. (Circular No. URA/PB/2009/12-DCG)
Year	First issued in 2001; revised in 2011	First introduced in 1997; revised in 2009
Sky Garden Objectives	Sky gardens provide natural ventilation, greenery and recreational garden space for communal use.	Sky gardens serve as quality communal spaces; and contribute towards the overall greenery and environmental quality.
Configuration	The minimum headroom is 4.5m and it is open-sided on at least two opposite sides for cross ventilation.	The proposed depth should be at least 5m.
Quantities	The maximum number of sky gardens provided is equal to or less than the number of residential storeys divided by 15. Such garden can be split into multi-levels but it occupies not less than one-third of the area of the floor plate.	Flexibility of quantities and configurations. Areas of a 45 degree projection line and a meaningful size of 5m in depth. No maximum number of sky gardens is specified
Locations	Locations of sky garden are recommended to be determined by wind tunnel test or computation fluid dynamic modelling but it is not compulsory. The first sky garden is located at not more than 10 storeys where more than one sky garden is provided and where there is podium garden.	No specific requirement.
Openness	Open-sided above safe parapet height on at least two opposite sides to provide cross ventilation	At least 40% of the perimeter should be open and 60% for additional GFA exemption.
Height	A clear height should not be less than 4.5m. There is no concern from Planning Department on the overall building height.	The guideline, which states areas of a 45 degree projection line for GFA exemption and a meaningful size of 5m in depth, implicitly defines the min. headroom is 5m.
Connectivity	It is accessible from the common area only.	One set of communal access via a lift or staircase serves the sky garden. If the sky garden is less than 60% of the floor plates, it should serve a minimum of 2 strata units to ensure its communal use in nature.
Greenery	Not less than 15% of the garden area is to be planted with greenery.	Lushly landscaped with a suitable variety of plants is required. The greenery should be enjoyed by the building users and be visible from the surrounding environment.
Incentives	GFA exemption for sky gardens if the above requirements are complied. However, floor height of sky gardens may not be exempted if the overall building height is capped under the OZP or the land lease.	GFA exemption: Flexibility of quantities and configurations. Areas of 45 degree projection line and a meaningful size of 5m in depth. No maximum number of sky gardens is stated. Additional floor height allowance for predominant sky gardens.

Table 1: Governments' incentives and guidelines on sky gardens in Hong Kong and Singapore

5. DISCUSSION ON EFFECTIVENESS OF SKY GARDENS IN HIGH-DENSITY HIGH-RISE RESIDENTIAL DEVELOPMENT FOR URBAN CHILDREN AND OLD ADULTS

To exemplify the benefits to promote health and well-being in urban living, case studies of forty residential high-rises in Hong Kong and Singapore map out diverse functions, configurations, connectivity and amenities of sky gardens.

Design intents of sky gardens commonly found in Hong Kong are to increase of the overall building height; demarcate zones of residential units in different sizes and property values; add value to refuge floors; offer extended areas of and/ or circulation to clubhouse areas; increase of greenery; and enhance building permeability. Most of study cases of sky gardens in Singapore that offer unique, pleasant, well-equipped communal green spaces that may outstand from other garden spaces at podium or street level; moreover, they are promoted as key marketing selling points for adding property values.

The most popular amenities in sky gardens are tea leisure area, sitting area, viewing platform, Taichi square, foot massage trail and strolling path. However, apart from good accessibility in connection with clubhouse, the developers may be lack of confidence on the performance of sky gardens and are unwilling to allocate management-intensive recreational facilities in sky gardens, in which discrete locations at high levels incur safety and security concerns. Structures and fire services provisions restrain spatial configuration of sky gardens, in particular sky gardens as refuge floors. It results in narrow spaces as illustrated in Figure 2 and Figure 3.



Figure 2 and 3: Spatial quality with 4.5m headroom but narrow spaces in a sky garden in Hong Kong.

Design of children and old adults friendly sky garden

Healthier and more active lifestyles, day-to-day interactions between human and the built environment are encouraged. Daily activities in green spaces, including 5-min green exercises, gardening, walking and even viewing of nature, can offer psychological and physiological benefits to urban dwellers. The respective contributing factors to promote health and wellbeing are summarized in Figure 4.

Indeed, children and old adults are the frequent users of sky gardens or communal green spaces during the daytime; meanwhile, childhood experiences with nature affect environmental attitudes and ecological behaviours. Key design considerations of advocating friendliness for children and old adults are as follows:

- Vegetation volume and multi-dimensional vegetation of rich in species enhance the level of naturalness.
- Communal green spaces indirectly help supervising children and old adults in impoverished urban neighbourhoods, and enhance their time exposed to nature and outdoor activities.
- Activities with nature, such as picking fruits, planting seeds or taking care of vegetables, nurture positive, ecologically responsible attitudes. Meanwhile, garden-based activities help to develop children's ability to cope with adversity and zone of proximal development; and to foster their environmental attitude and ecological behaviours.
- A safe, secure and spacious environment but offering a feeling of adventure and semi-wildness simultaneously is an ideal. Children are able to freely use and easily modify materials in building their own world. Special features like water features and recreation amenities catch their attention.

- Children are encouraged to see, touch and live with flora and fauna rich in diversity and learn to appreciate native species and eco-systems. As one step further than sustainable design that minimizes adverse environmental impacts, biophilic design advocates positive effects on the natural environment and enhances quality of habitats for human and wildlife.
- Design of soft landscapes shall consider native or non-invasive species of plants, vivid vegetation structures, appropriate soil depths and substrate compositions, and features that attract or facilitate bio-habitats.
- Sky gardens are scattered at multi-levels and close to living areas of residences to stimulate intimate touch with greenery in daily life. Doorstep gardens are recommended and residents are encouraged to maintain the vegetation and even plant their own vegetation there to enhance the ownership of communal green spaces and develop a deep affinity with nature. More importantly, children are allowed to play outdoors with neighbouring children under better supervisions with their parents. Old adults have more chances to stay outdoors.

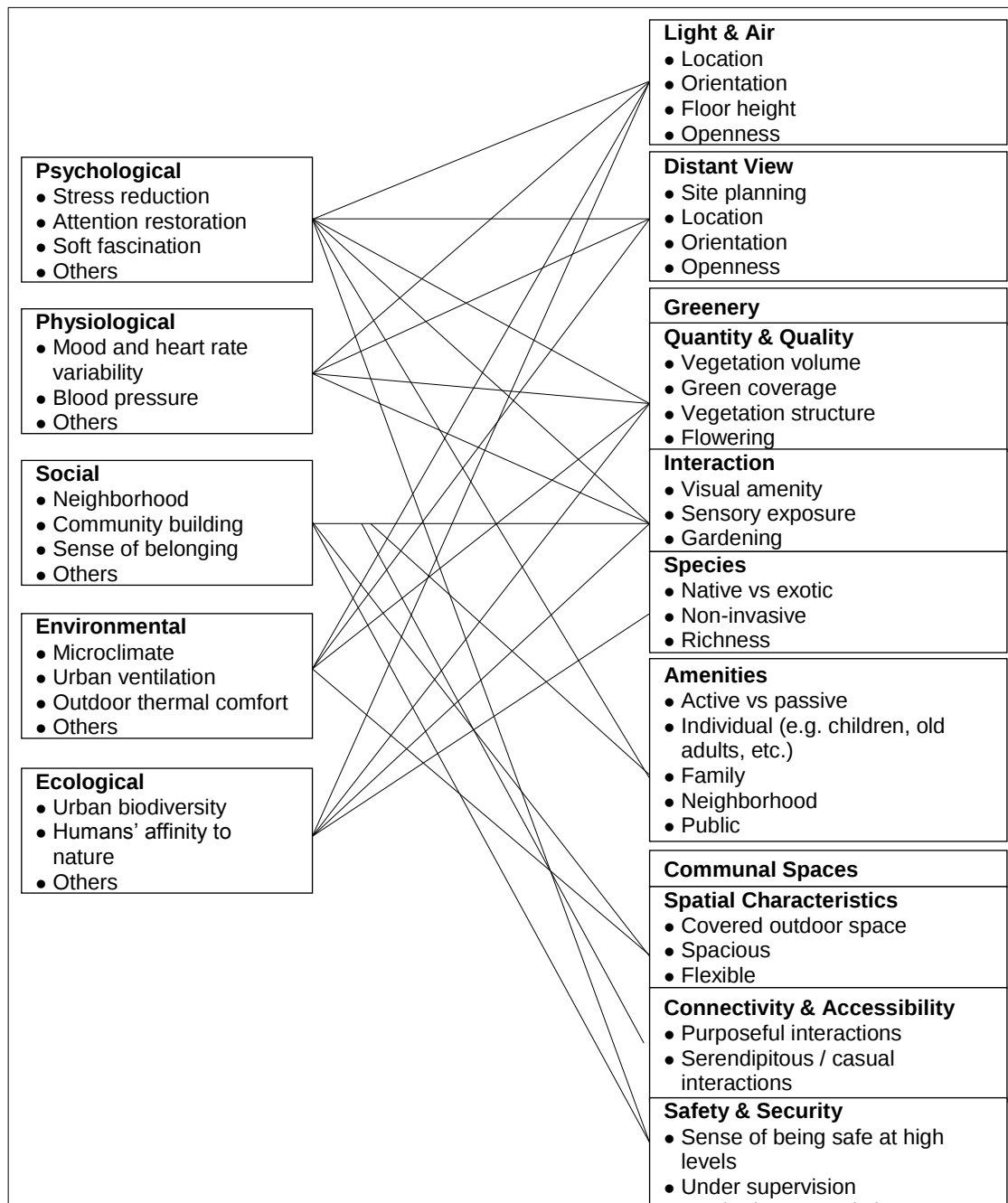


Figure 4: Contributing factors to promote health and well-being of urban living with sky garden

6. CONCLUSION

The higher we live from the ground level, the more disconnected we feel from the natural world and even from each other within a community. Quality urban living environment not only furnishes residents with convenient accessibility and adaptable conditions but also embodies welcoming communal amenities, enjoyable greenery and intimate human-nature interactions. Sky gardens improve environmental, social and ecological performances in urban living, and supplement deficiencies and needs in high density, high-rise residential developments, especially in Asian cities like Hong Kong and Singapore. With better understanding of typology of sky gardens, their benefits to the environment include improved human thermal comfort and urban microclimate; social cohesion by providing a community green space, provision of a place for individuals to escape from the busy city life, improved community integration for all age groups and improved health and well-being; and an awareness of and intimate contact with nature. Furthermore, the criteria of the green incentives shall not only appeal for residential high-rises with nominal amount of green but also advocate the green communal spaces to be liveable and enjoyable by daily frequent users comprising children and old adults.

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