



Title: **A Tale of Two Singapore Sky Gardens**

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Abstract

This paper examines the effectiveness of the design strategies used in two HDB developments for encouraging active usage and social interaction. The study was conducted through systematic user surveys and site observations, the findings of which were then corroborated with the literature review. The study was successful in making the following conclusions: diversity in scales and design characteristics creates more opportunities for residents to use sky gardens; provision of varied programs in the sky gardens can contribute to their utilization, offsetting the deterrence posed by inaccessibility; direct visual connection between the residential units and the sky gardens should be avoided, due to concerns about privacy; and the usability of the sky gardens can be maximized by complementing the programs with improved accessibility, scale, and environmental protection.

Keywords: Sky Garden, Social Interaction, Density

Introduction

With a population density of 7,797 people per square kilometer, Singapore is one of the world's densest countries (Singstat 2016). Due to Singapore's high population density and limited land area, expanding vertically was considered as the most viable option. This model has been developed by the Singapore Public Authority, which resulted in the Housing Development Board (HDB) blocks that currently house about 85% of the residential population. The height of HDB blocks averaged 10 to 12 stories in the 1960s and increased to 30 stories in the 1990s (Yuen 2009). Developments since 2000, such as Pinnacle@Duxton and Skyville@Dawson, have risen more than 40 stories, and future developments are likely to rise even higher (see Figures 1 and 2).

Despite the generally positive perceptions that Singaporeans have of high-rise public housing, it is important to note that high-rise living carries the disadvantages of inconvenience and negative effects on the health and well-being of residents (Williams 1991; Gifford 2007; Evans et al. 1989). Negative effects include fear, dissatisfaction, stress, behavior problems, suicide, poor social relations, reduced helpfulness and sociability, and hindered child development. However, studies have shown that there is marked improvement in performance and behavior of residents with increases in the apparent "natural-ness" of views in high-rise living (Taylor, Kuo & Sullivan 2002). It was also found that the negative effects of high-rise living could be alleviated by providing access to green spaces within these vertical environments, a strategy that has been widely adopted in highly urbanized Singapore.

Literature Review

Sky gardens and sky decks are contemporary interpretations of Le Corbusier's concept of "streets in the sky," communal spaces found above ground level. Bridging high-rise towers at intermittent levels creates neighborhoods in the sky that tie programs together, integrate green spaces within structures, and enhance secure egress and mobility, while creating new vantage points from which to view the city. Such spaces often serve as

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Figure 1. Skyville@Dawson, Singapore. © WOHA



Figure 2. Pinnacle@Duxton, Singapore. © ARC Studios

platforms where residents are able to bridge the divide between the otherwise vertically segregated levels in a high-rise tower. The insertion of sky parks into residential towers brings recreational activities closer to the high-rise residential units, accommodating residents who would otherwise be deprived of convenient access to recreational spaces (Pomeroy 2012). Greenery becomes an integral part of these sky parks, providing restorative effects on users' health, attitude, and perceived stress levels (Clay 2001; Nielsen & Hansen 2007).

Sky gardens in Singapore originally evolved from the greening of car-park roofs in HDB

New Towns. Whilst they contributed to visual delight, they were not successful public or social spaces, due to the dominance of open-ground floor area (void decks). A survey of roof gardens in a typical HDB New Town, Choa Chu Kang, revealed that only 10–20% of the surveyed respondents visited the rooftop gardens regularly (Yuen & Wong 2005). Issues with accessibility, programming, and lack of thermal comfort were identified as the key reasons for poor usage (see Table 1). The underutilization of such spaces leads to the creation of further redundant spaces that add stress to the issues of land scarcity and housing quality in the context of increasing densities. This supports the need to improve

sky garden designs, so that the issue of underutilization can be ameliorated.

In recent years, there has been a shift from repurposing HDB New Town carpark roofs into gardens to more purpose-built sky gardens that play an integral role in the development. Implementation of the Landscaping for Urban Spaces and High-Rises (LUSH) program and the Green Plot Ratio (GPR) standard have increased the appropriate proportion of green- to built-up areas, such that their aforementioned benefits are enjoyed by the inhabitants (URA 2014; Ong 2003). Some studies relate the success of such spaces to dedicated functions and unrestricted access to the public (Hadi, Heath & Oldfield 2014).

The literature review evidences that existing studies of high-rise sky gardens primarily focus on assessing their design, environmental, behavioral, and social components individually. This paper, however, investigates the effectiveness of sky gardens implemented in two specific HDB developments, the Pinnacle@Duxton and the Skyville@Dawson, through an analytical framework focusing on their accessibility, program, and design characteristics holistically.

Methodology

The methodology involves triangulation of data obtained from the literature review,

Program	<ul style="list-style-type: none"> Ability to cater to different age groups Contribution to enriching residents' daily routines Ability to enable social interaction Ability to spur spontaneous activities
Accessibility	<ul style="list-style-type: none"> Activation of the space Presence of visual connectivity Physical connectivity to main circulation routes Management of public or private access Availability of amenities that allow for greater convenience Orientation of building
Design Characteristics	<ul style="list-style-type: none"> Presence of shelter from sun and rain Presence of breeze and natural ventilation Appropriate scale/size of space Presence of greenery Placement of sky garden – exclusivity Presence of vantage point for views

Table 1. Assessment framework for identifying desired characteristics of communal sky gardens in residential high-rises.

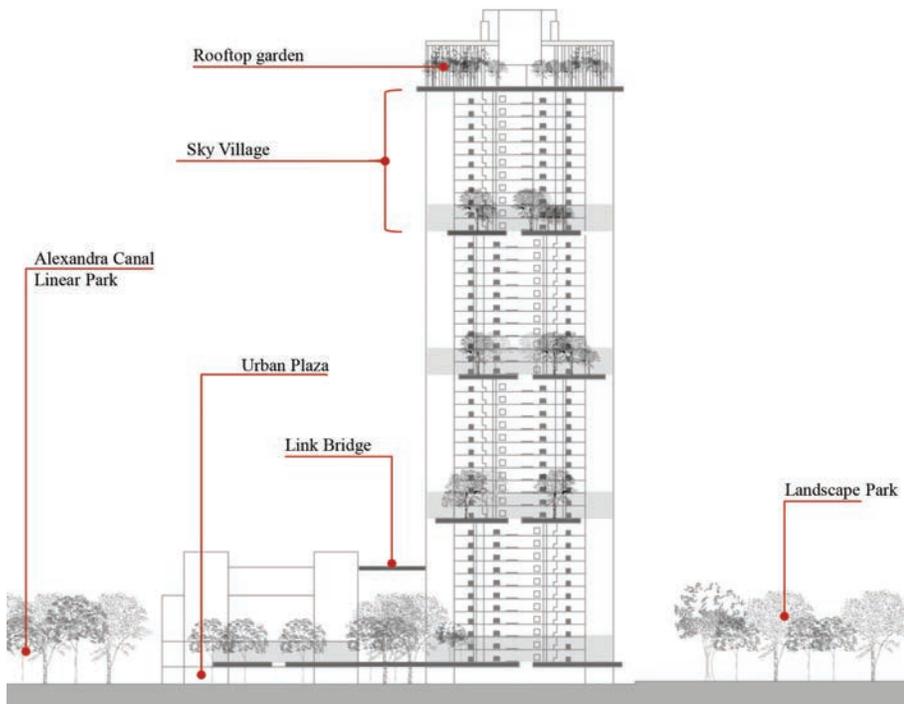


Figure 3. Skyville@Dawson section drawing.

on-site observations, and user surveys for the chosen case studies of Pinnacle@Duxton and Skyville@Dawson. Three main themes of accessibility, design characteristics, and program that were identified in the literature review (see Table 1) formed the broad analytical framework to assess the sky garden designs. Pinnacle@Duxton and Skyville@Dawson were chosen as case studies, as they are HDB estates that have integrated sky gardens within their high-rise, high-density housing typology. While other reputable developments in Singapore have integrated vertical greenery, their designs were not relevant to the scope of this study. On-site observations and user surveys were undertaken to provide insight into the users' perceptions of the sky gardens, and these were mapped across findings from the literature review.

Forty residents were surveyed, 20 from Pinnacle@Duxton and 20 from Skyville@Dawson across three timeframes (8:00–10:00 a.m., 2:00–4:00 p.m., and 5:00–7:00 p.m.). An average sample size was ascertained, based on the participation of the residents during the various times of study, at both developments. Most residents were interviewed with a questionnaire at the

entry-level lobby spaces and at the sky garden levels to obtain an unbiased user mix. Visual surveys and observations were made intermittently to record a spectrum of weather-related phenomena and lifestyle scenarios.

The Pinnacle@Duxton, completed in 2009, is a well-established community, while Skyville@Dawson was only completed in 2015 and was not fully occupied at the time of the study. Therefore, the comparative preferences and sense of ownership exuded by the users at both developments has influenced the findings of the survey.

Case Studies

Skyville@Dawson

Skyville@Dawson is modeled around the idea of replicating the village typology, whereby the sky gardens act as social nodes at which the “village” community would typically gather (Zachariah 2015) (see Figure 3).

Sky gardens are located such that units throughout the building are at a maximum of five stories away from gardens. This has led to improved accessibility and increased visual

connectivity between them. The sky garden spaces at Skyville@Dawson are small in scale and uniform in program, and the activities observed within the sky gardens are predominantly limited to resting and other sedentary activities supported by the provided seating areas. Residents treat the sky gardens as extensions of their homes, using them to store bicycles and display potted plants.

Skyville@Dawson's sky gardens are well-sheltered from direct sunlight and rain. Furthermore, the centralized sky garden at Skyville@Dawson improves the visual connectivity between the greenery and the rest of the development. However, these well-sheltered sky gardens are underutilized (see Figure 4). Despite successfully establishing visual connections, the sky gardens are devoid of activity. Furthermore, it was observed that most units closest to the sky gardens were unoccupied, pointing to concerns over privacy.

Pinnacle@Duxton

Pinnacle@Duxton incorporates the concept of “streets in the sky,” featuring various themed mini-parks that enliven sky gardens with different activities, including playgrounds, exercise facilities, and seating areas. These moves increase the relevance of the sky garden to a wide range of users of different ages and interests, encouraging them to engage in various activities concurrently within the same sky garden (see Figures 5 and 6). Compared with Skyville@Dawson, Pinnacle@Duxton has the entire development sharing two sky gardens that are physically isolated from the units and consequently treated more like semi-public parks.

As both developments are of a quasi-public nature, many non-resident members of the public frequent the sky gardens. While the sky gardens at Skyville@Dawson are fully open to public, public access to the sky gardens at Pinnacle@Duxton is controlled using a resident card-activated gated barrier. The 50th-story requires visitors to pay a minimal entrance fee; the 26th-story sky garden is a residents-only communal space.



Figure 4. Units closest to the sky gardens at Skyville@Dawson are often unoccupied.



Figure 5. Various seating areas at Pinnacle@Duxton.

Furthermore, most of the leisure spaces in Pinnacle@Duxton’s sky gardens are unsheltered and exposed (see Figure 7). Despite this, the sky gardens at Pinnacle@Duxton appear to be better utilized than those at Skyville@Dawson and attract a large number of visitors.

Findings

Program

The study evidenced that a well-planned program is a critical factor in attracting residents to utilize the sky gardens, which may offset inconveniences associated with poor accessibility, as evidenced at Pinnacle@Duxton. The 50th-story sky garden has playgrounds and various seating areas, while the 26th-story sky garden houses exercise areas, community spaces, and play areas. Despite the lack of shelter from sun and rain, and additional card-activated barriers, the multiplicity of programs renders these two sky gardens much more successful than those at

Skyville@Dawson, which provide more shelter and unimpeded access.

The sky gardens of the two developments differ significantly in the range of amenities provided. Pinnacle@Duxton addresses a variety of functions, providing residents with a choice of activities in which to engage. Skyville@Dawson, on the other hand, only features seating, limiting use of the spaces to sedentary activities. In providing a wider array of amenities, the sky garden at Pinnacle@Duxton is more readily perceived as a recreational space where people can engage in a range of different activities, suggesting that programmatic variety encourages use. The amenities that support healthy lifestyles, such as jogging tracks and sky gyms with well-shaded, open and breezy rest areas, are the most desirable, as residents use such spaces as a form of relief from the confines of their residential units (see Figure 6).

Furthermore, the study highlighted that in order to improve utilization of the sky gardens

they need to be designed as, or modified into, “social spaces” that encourage interaction. The survey undertaken by the authors evidenced that residents need leisure amenities (such as communal kitchens or activity centers), quiet spaces alongside temporary activities (such as markets or exhibitions), and convenience stores. This would enable varied user groups to engage in a multitude of activities, such that occupants have the opportunity to dwell longer in the sky gardens. To this end, varying spatial types in terms of scale, social exposure, and program may be required to address different residents’ needs.

Accessibility

Counterintuitively, good accessibility may have little influence on the patronage of sky gardens in HDB housing schemes; in fact, sky gardens isolated from the residential units may even be preferred due to concerns over privacy and the related issues of noise and littering. This may be attributed to the “City in a Garden” concept of Singapore, whereby the view of green spaces is usually available from



Figure 6. A bustling mini-park thrives at Pinnacle@Duxton.



Figure 7. Sheltered amenities in sky gardens at Pinnacle@Duxton prove to be the most popular.

“While striving to imbue sky gardens with engaging activities that reduce the necessity to descend to street level, it is important that designers don’t seek to precisely replicate the street conditions, but rather aim to complement them, to avoid the possible demise of street activities and life on the ground.”

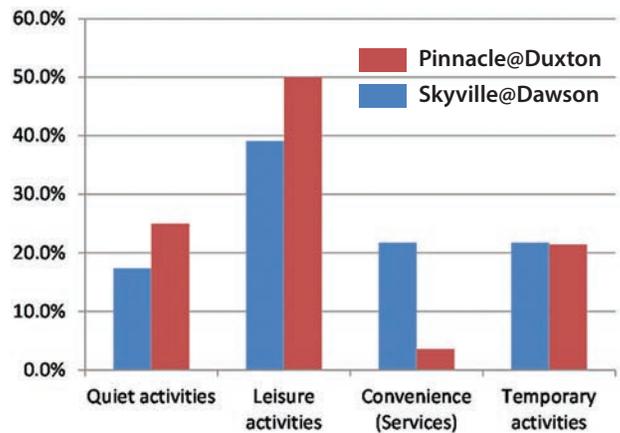


Figure 8. Responses to survey question: "What additional amenities would residents like to add to the sky gardens?"

residential units. Consequently, spaces whose sole attraction is visual access to greenery do little to attract people. This set of conditions might be specific to Singapore; however, it draws attention to the important role and relevance of greening policies in cities and suggests further implications.

Indeed, the location of sky gardens and their familiarity to residents may also be attributable to this behavior. Regardless of visual access, it is the functionality of such spaces that draws users. It could be argued that the "eyes on the street" theory, wherein users value visual access to common spaces in order to oversee elderly residents or children, may perhaps be somewhat redundant in the case of HDB schemes, owing to the surveillance and strict access controlling these

locations. Therefore, the study recommends that sky gardens and the residential units could be physically isolated, and that direct visual connectivity between them may also be avoided (see Figures 8 and 9).

Furthermore, connectivity across sky gardens is essential, as it encourages people to walk and exercise. However, the provision of connectivity should not compromise the privacy of the residential units. Buffers between the potentially bustling quasi-public sky gardens and the private residential units may be required.

Design Characteristics

In addition to diverse programs in the sky gardens, the scale of such spaces needs to be carefully considered.

Sky garden spaces of various scales can create opportunities to encompass a range of activities, from individual activities in intimate spaces to collective activities in more open and spacious areas, as shown in Figure 10. Most survey respondents in Skyville@Dawson preferred spending family time at the sky gardens, likely due to the presence of seating facilities. However, users at the Pinnacle@Duxton preferred using the sky gardens for exercise-related activities; hence the preference for larger, park-like spaces. Having more intimately scaled sky gardens that are shared by a smaller community of people may allow residents to feel more comfortable, and may create more opportunities for social interaction with a smaller, more familiar set of users, fostering a sense of belonging and identity.

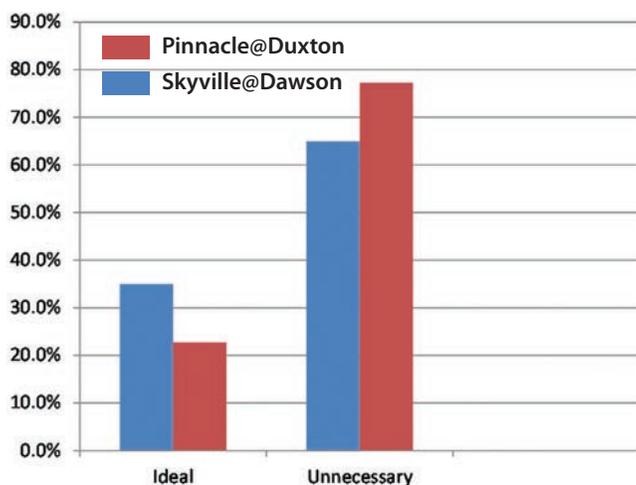


Figure 9. Responses to survey question: "What do the residents think about the visual access of sky gardens from the units and lift lobbies?"

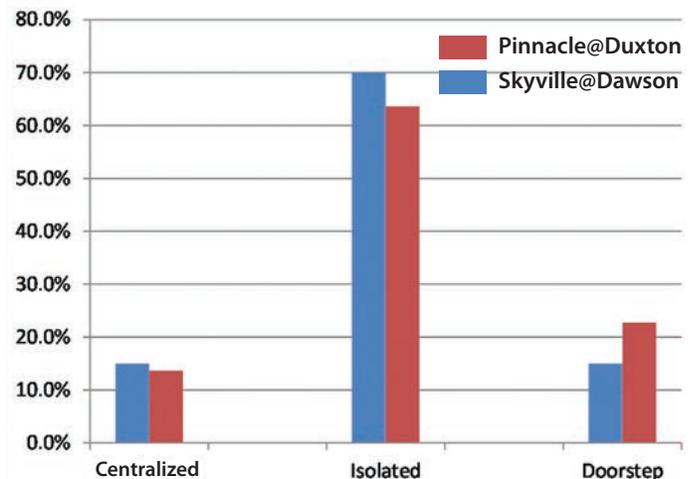


Figure 10. Responses to survey question: "Which placement configuration of sky gardens is preferred by residents – centralized, isolated from units, or at the doorstep?"

A diverse range of spaces with various design characteristics is desired, due to the potential for enabling spontaneous activities. While the presence of greenery may not directly improve the use of sky gardens, the health benefits associated with greenery could complement the diverse programs and augment the design characteristics of such spaces.

The usage of sky gardens at Pinnacle@Duxton is subject to the prevalent weather conditions due to the lack of sheltered spaces, a criticism recorded by 38% of the surveyed users. Meanwhile, 93% of the survey respondents prefer using the sky gardens in the morning and evening due to lower insolation and convenience to their daily schedules. However, it is largely understood from observation and surveying of residents in both locations that adequate provision of physical shelter from the sun, noise, and rain in the sky gardens can improve the usability of the spaces.

Conclusions

Given the prevalent use of sky gardens in dense urban environments, the study examined the effectiveness of the strategy at Pinnacle@Duxton and Skyville@Dawson in Singapore, in terms of program, accessibility, and design characteristics.

The study suggests that, in order to maximize the sky garden's potential as a well-utilized leisure space, a variety of amenities needs to be incorporated and that these adjustments to program should ideally be complemented with favorable design characteristics, such as the provision of adequate shelter, a variety of scales, and ease of access.

The provision of leisure activities and various other amenities within the sky gardens is desired, as it offers convenience to the building residents. Activities that promote healthy lifestyles and family bonding are particularly valued. These activities should be complemented by diversity of the design and scale of such spaces, so as to increase

opportunities for residents to appropriate spaces for desired uses (see Figure 11). For example, a balance of intimate rest spaces that foster a sense of ownership, and expansive, well-connected spaces that advocate active and healthy lifestyles, would seem to be ideal.

Additionally, direct visual connectivity between residential units and the sky gardens should be avoided to maintain occupants' privacy. The degree of regulation of the gardens also needs to be managed to avoid unreasonable limitation of the activities available to residents. Generally, while striving to imbue sky gardens with engaging activities that reduce the necessity to descend to street level, it is important that designers don't seek to precisely replicate the street conditions, but rather aim to complement them, to avoid the possible demise of street activities and life on the ground.

This study of the sky gardens was limited to two public housing schemes and a small sample size. A wider, comprehensive study covering larger cases and different building typologies within Singapore and beyond would offer deeper understanding of the role and impact of sky gardens within high-density urban environments. ■

Unless otherwise noted, all image credits in this paper are to the authors.

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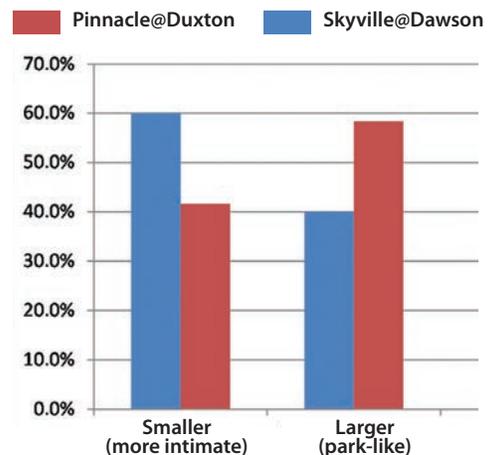


Figure 11. Responses to survey question: "What scale/size of sky gardens do residents prefer?"

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