

Sky Garden Design in High-density High-rise Residential Development

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SB13HK 2013.9.13



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

Can sky gardens be an option of bridging nature with urban living?



Objectives

- Investigate the characteristics of existing sky gardens
- Analyse environmental, social & economic performance
- Evaluate residents' experiences in sky gardens
- Discuss design of effective sky gardens in high-density high-rise residential developments



Gardens in Urban Living

- Green spaces have direct and indirect benefits on environmental, social, and economic aspects in urban living (Givoni, 1991; Goddard et al., 2009)
- Urban dwellers have a strong desire and even pay more for pleasant green spaces (Chien & Wang, 1999; Huang, 2006; Chen & Jim, 2010; Jim & Lo, 2010)
- Children in the city may develop nature-deficiency disorders with physical inactivity (Lee & Min, 2006; Kuo et al., 2002; McCurdy et al., 2010)
- Elderly residents' social integration and healthy development (Delvin & Zaff, 1998; Kweon et al., 1998)
- Lack of research on sky gardens in urban contexts

roof garden

sky garden

podium garden



Design Guidelines of Sky Gardens in HK (HKSAR, 2001)

- Wind tunnel testing or CFD modelling but not compulsory
- Max. no. of sky gardens \leq no. of storeys / 15
- Split into multi-levels but not less than 1/3 of floor plate
- 1st sky garden at not more than 10 storeys
- 4.5m min. headroom & open-sided for cross ventilation
- Sky garden can be coupled with refuge floor
- Not less than 25% floor plate area to be vegetated



Characteristics of Sky Gardens in High-rise Residential Developments in HK

Case Studies on 20 Sky Gardens in Different Typologies

Development	Solely a sky garden	Refuge floor	Adjacent to podium clubhouse	Adjacent to sky clubhouse	At roof level	Specific location for air ventilation
The Orchards (2003)		SG1, SG2				
The Arch (2005)		SG1		SG1		
Centre Place (2006)	SG1			SG1		
Grand Promenade (2006)	SG2	SG1				
Indi Home (2006)		SG1				
31 Robinson Road (2007)	SG1		SG1			
Manhattan Hill (2007)		SG1				
The Apex (2007)	SG1				SG1	
SOHO38 (2008)	SG1					
The Forest Hills (2008)		SG1				
The Sparkle (2008)	SG1			SG1		
i-home (2009)		SG1				
Shining Heights (2009)		SG1, SG2		SG2		
The Masterpiece (2009)	SG1	SG2	SG1			
Aria (2010)	SG1			SG1		
Forfar (2010)		SG1	SG1			
Island Crest (2010)		SG1				
Larvotto (2011)		SG1				SG1
Lime Stardom (2011)		SG1				
Harbour One (2012)		SG1, SG2	SG1			



Characteristics of Existing Sky Gardens in HK

- Height concession is the main driver
- 2/3 of SG at mid- & high-levels about 80-150m from the street
- SG at mid-levels act as refuge floors
- SG at low- & high-levels act as an extension of clubhouse areas or main circulation to clubhouses
- Total openness in proportion to the overall building height is merely 2-3%
- 15-20% of the NET floor areas are vegetated
- Sitting areas, viewing platform, strolling path & foot massage trails



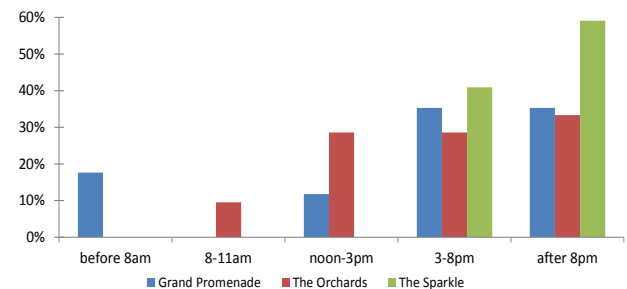
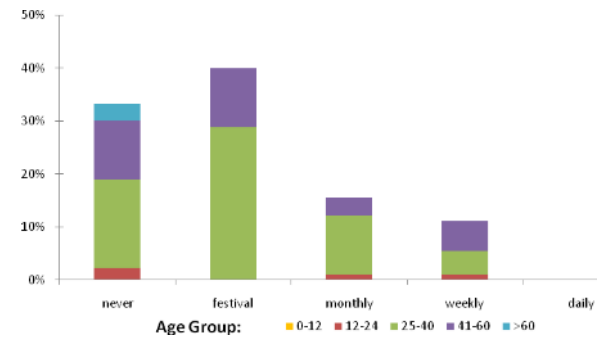
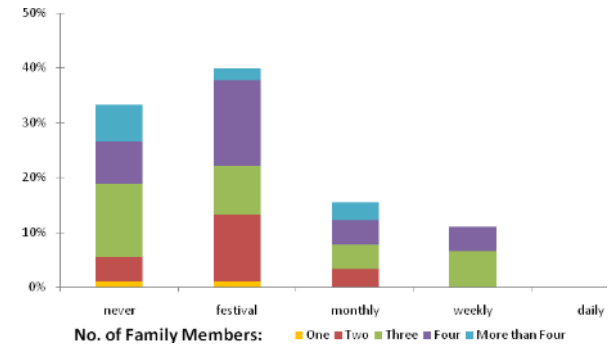
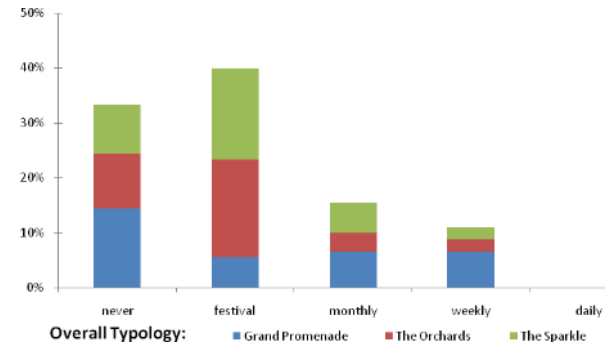
Residents' Experiences in Sky Gardens in HK

Sky Gardens selected for the Survey on Residents' Experiences

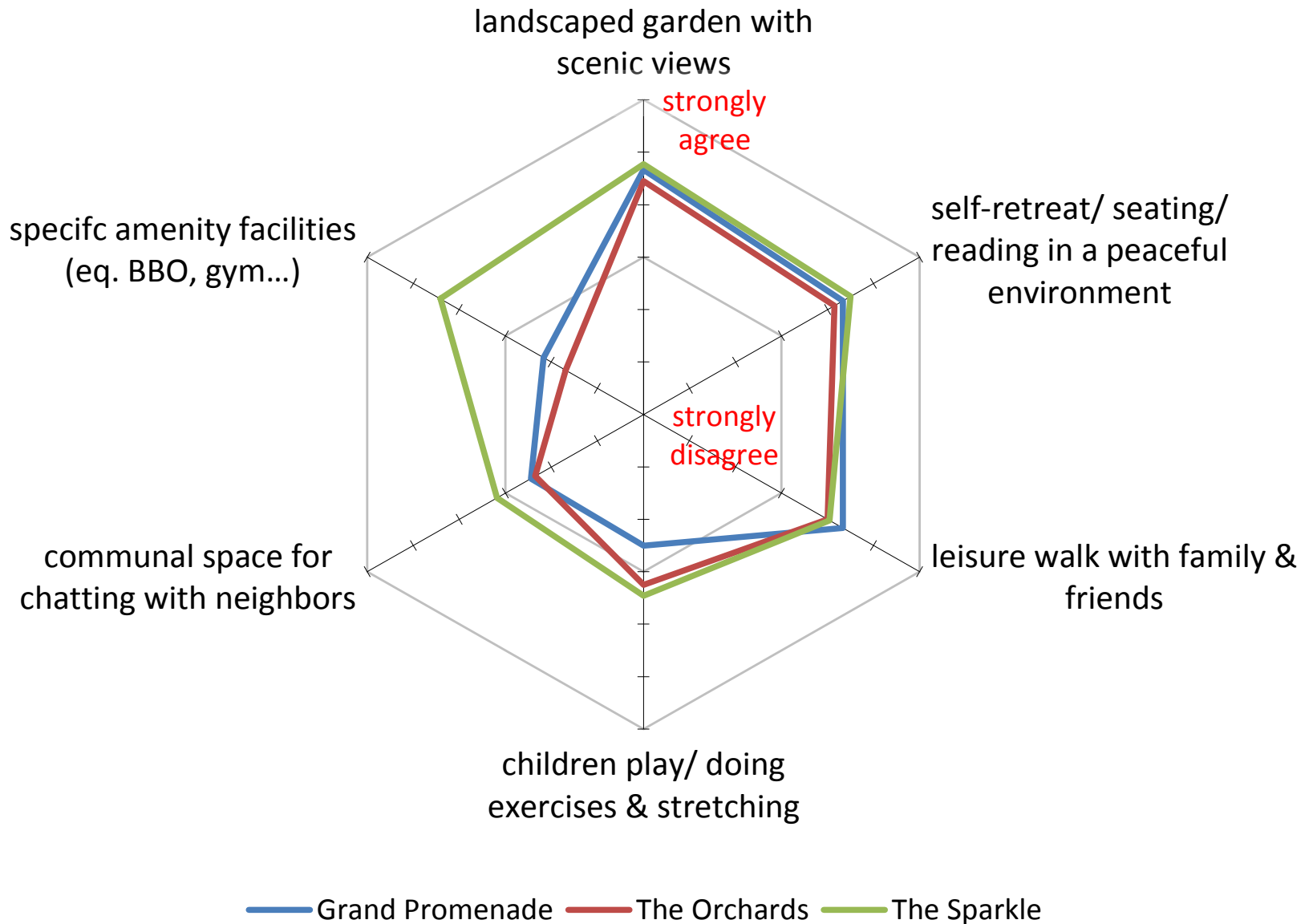
Typology	One mid-level sky garden	One low-level & one mid-level sky garden	One high-level sky garden connecting to sky clubhouse
Property Name	Grand Promenade	The Orchards	The Sparkle
Image			
Location	Sai Wan Ho, HK (Harbour Front)	Quarry Bay, HK (Urban Area)	Cheung Sha Wan, HK (An Old District)
Completion	2006	2003	2008
Property Description	5 blocks, 56-58 storeys, 2020 units (435-3,155 ft ²)	2 blocks, 38 storeys, 442 units (790-1,737 ft ²)	2 blocks, 37 storeys, 400 units (520-2,016 ft ²)
Design Theme	Art Garden (arts/sculpture) Sound Garden (bird /breeze) Tea Garden (tea/chess/bonsai) Scent Garden (flower scent, freshness & mist)	Japanese Garden British Garden Seating, strolling path, sculpture & planting	Soothing Green (music & lush greenery) Dancing Light (floor lights) Seating, audio devices, sculpture & planting

Occupancy Rate & Pattern

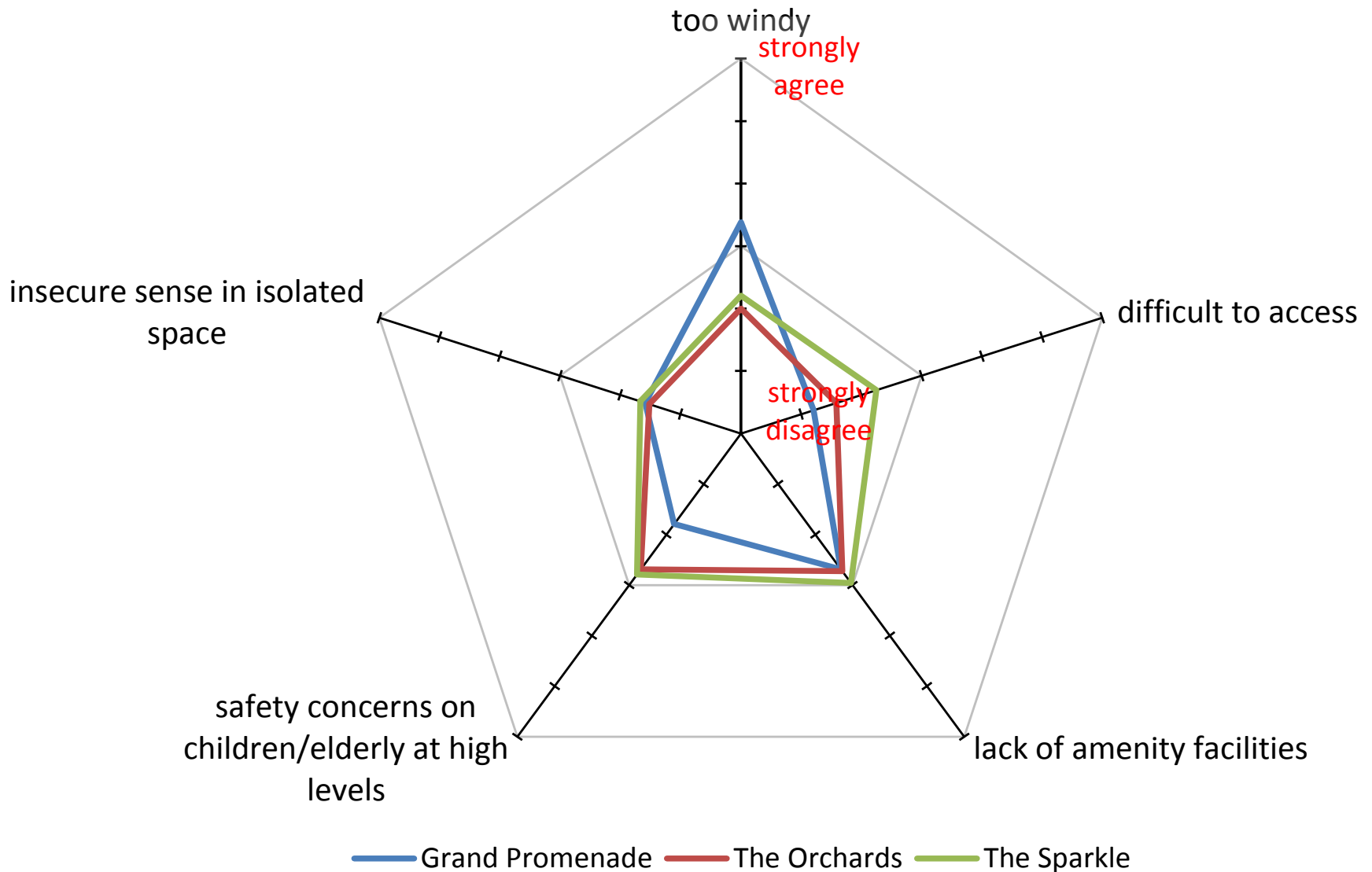
- 33% of residents never visit, 40% visit during festivals or special occasions, and 27% visit regularly on a weekly or monthly basis, but none on a daily basis
- The age of 25-40 are the main users
- Daytime visitors are not the majority: 43% after 8pm, 35% between 3-8pm and 13% between noon-3pm
- Different typologies pose slight variations



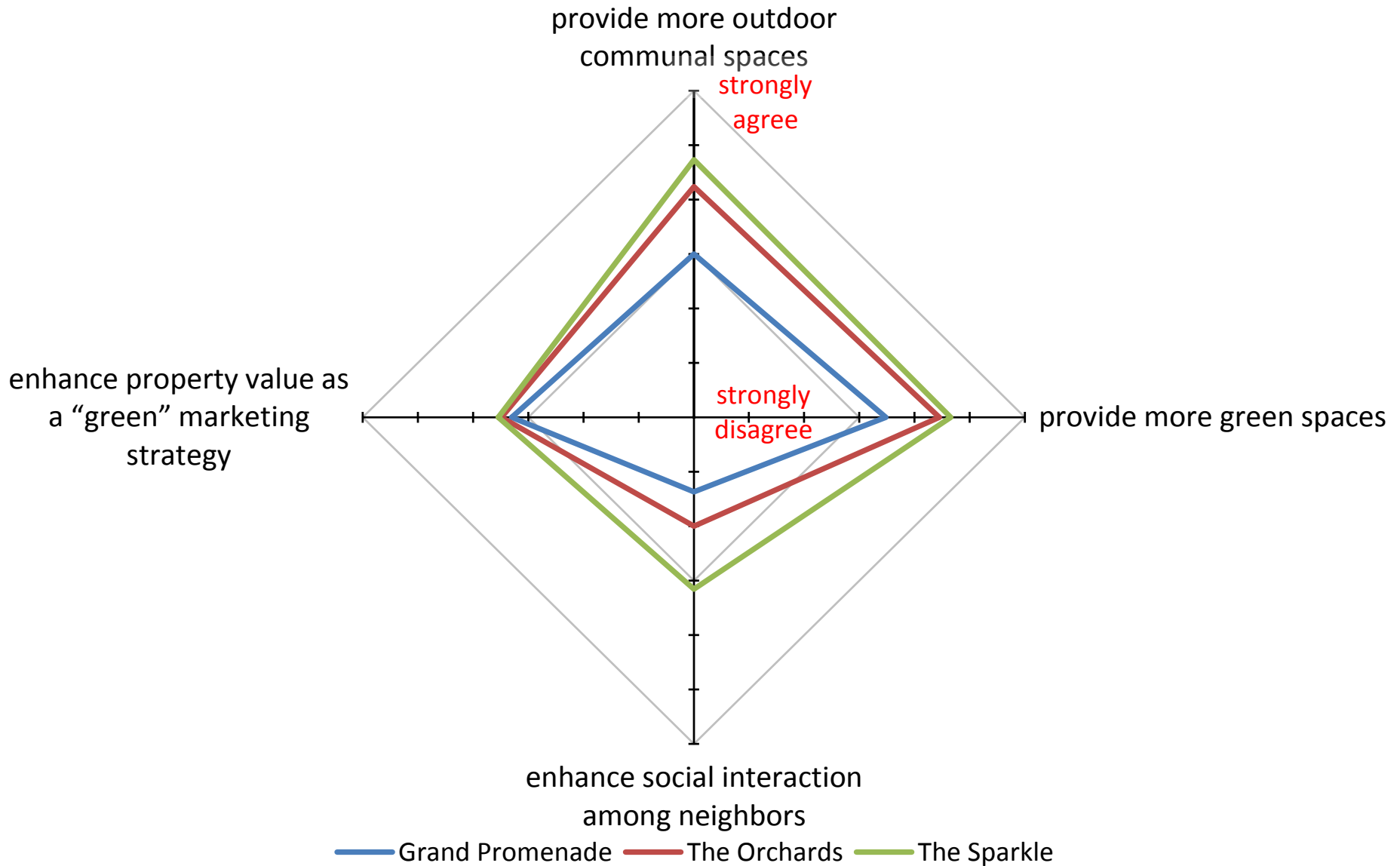
Reasons for Visiting Sky Gardens



Reasons for Not / Seldom Visiting Sky Gardens



Values of Sky Gardens



Can the existing sky gardens improve the quality of urban living?



Environmental

- Not obvious increase of building permeability and greenery ratio

Social

- Agree for self-retreat & leisure walk with family but not enhancing social interaction among neighbors
- Elderly & children are not frequent users

Economic

- Value of more pleasant communal spaces & greenery

Implementation of Current Guidelines

- No wind tunnel testing/CFD; No multi-levels; nominal provision for height concession

How can sky gardens maximize benefits for urban living?



How can sky gardens maximize benefits for urban living?



Building Permeability & Greenery

- Over 13m high SG at low-levels to alleviate urban ventilation; 4.5-6m high SG at mid- or high-levels
- Greenery is a perquisite not a by-product; greenery ratio in relation to population, enhancing chances of physical contact with greenery

Amenity & Spatial Quality

- SG act as a naturally-ventilated sky clubhouse
- Attractive elderly friendly facilities & children's play amenities
- Spacious event spaces with high headroom
- Scattered SG at multi-levels offer more chances of social interactions amongst neighbors & facilitate impromptu extension of living spaces

Conclusion

- Design of sky gardens needs to consider SPECIFIC environmental and social functions
- Qualitative & quantitative design of sky gardens are equally important
- Sky gardens at relatively low-levels emphasize building permeability with sufficient headroom
- Sky gardens at high-levels serve the purposes of recreation, social gathering and ambient cooling
- Scattered sky gardens with extensive planting integrate well with circulation spaces at multi-levels



Thank you