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Successful Sky Life



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Currently, Paul is leading several high-profile projects including 40 Leadenhall Street in London's insurance district; Wynyard Place, an office, station concourse and retail development in Sydney; and two striking residential towers in Mumbai.

Paul is championing the role tall buildings play in supporting population growth while mitigating their impact on global warming to create more integrated and sustainable spaces. He is external examiner for the University of Nottingham's course in Sustainable Tall Buildings.

Abstract

There is no doubt more tall buildings are required to accommodate global population growth. However, the taller a building, the greater the disconnect between occupants and nature leading to a potential detrimental impact on wellbeing.

Integrating effective external space is key to successful future skyscrapers and consideration of design and financial viability is required to convert additional cost to value for owners ensuring commercial and social sustainability.

It is time to define our relationship with nature and consider design strategies to sustain successful sky life.

Wilson and Kellert developed the concept of biophilia, the innate affinity of humans with nature. Simply put, Wilson and Kellert defined that we originated in natural rather than built environments meaning people feel better in places which connect to nature.

Referring to biophilia, the paper explores how Resurgent Skyscraper Cities may successfully engage with nature to improve our quality of life, health and wellbeing.

Keywords: Biophilia; Health; Mixed-Use; Nature; Social Interaction; Sustainable

The Human Condition

Cities are natural, self-perpetuating places characterized by the ebb and flow of their population and exposure to different cultures and economic, political or geographical conditions. In 1915, 10% of the world's population lived in urban areas. A century later it is over 50% and predicted to reach 80% by 2050. This increase reflects rapid global population growth combined with economic urban migration, greater life expectancy and people living in cities for longer. The consequence is the requirement for more buildings - including skyscrapers - to satisfy demand which will change the physical make-up of cities.

The title of the 2015 CTBUH conference is 'Global interchanges: Resurgence of the Skyscraper City'. In this context, what will life in the sky be like and is there a risk of creating a largely artificial environment that only occasionally meets the natural world?

For many human beings, it is unnatural to spend much of the time inside and at such heights - the appreciation of these factors is required by skyscraper developers and designers to ensure their commercial success and social sustainability. As skyscrapers become the majority building typology, their longevity will depend on their ability to enhance the quality of life of their inhabitants. In particular, the taller a building gets, the more disconnected its occupants are with outdoor space. With less opportunity to interact with the natural world, it is likely this will have a detrimental impact on wellbeing.

The benefit of nature on people was recognized by biologist Edward (E O) Wilson in his book 'Biophilia'. He developed the concept with social ecologist Stephen Kellert in 'The Biophilia Hypothesis', a collection of essays curated by Wilson and Kellert. Biophilia as a term was first proposed in 1973 by the psychoanalyst Erich Fromm in 'The Anatomy of Human Destructiveness' and defined as 'the passionate love of life and all that is alive'. Wilson and Kellert individually expanded this concept in their essays for 'The Biophilia Hypothesis' that formed 'Part One: Clarifying the Concept' and may be summarized as the innate affinity of human beings with the natural world.

In terms of architecture, biophilia identifies that human beings evolved in natural rather than built environments. People simply feel better in buildings that connect their occupants in a truly sensory way to the natural world. Therefore, a biophilic design response is the clear intention to harness this understanding at all scales. There are many examples of architecture from before the term biophilia was coined that relate to nature. These include the proportional systems developed during the Italian Renaissance that Le Corbusier found relevant to the ancient concepts of Chinese Feng Shui

and Indian Vaastu. These seek to harmonize the relationship of people and their environments.

A great opportunity for the Resurgent Skyscraper City is to draw on this legacy of connecting tall building occupants with the natural world and positively impact wellbeing with successful sky life that is engaging at every level. In many respects, it is easy to design a tall building with a great relationship with nature for the benefit of its occupants, but successful delivery requires tangible financial benefits for both owners and customers.

To define our future relationship with nature and consider design strategies that sustain successful life in skyscrapers, developers and designers need to consider that:

- Wilson and Kellert identify that humans respond positively to nature and this disposition is an inborn effect we have from birth
- We live in an ecological age with more people aware of their natural environment, which design strategies should embrace (Wood, 2014)
- The built environment, and skyscrapers in particular, should not be considered an efficient 'high-piling of the species' with the loss of the felt experience (Self, 2015), but an opportunity to sustain, nurture and progress human development in an increasingly congested world

Considering the human condition, Kellert and others from a wide range of fields have identified that:

- Communities have greater social cohesion in places with access to open space
- Healing and recovery are enhanced in environments that engage with their natural surroundings
- Successful workplaces are often characterized by good external awareness, natural daylight, ventilation and proximity to vegetation and/or outside space
- Cognitive development and functioning for children and adults is improved in places with access to high-quality natural spaces
- We fear some aspects of nature (predators and natural catastrophic events) and as a consequence, humans intuitively maintain a close relationship with their environment to ensure survival

- Environmental conservation is a human instinct to maintain life
- The human desire to nurture animals and plants is a simple reflection of the wish to surround ourselves with nature

Within the built environment, the role of nature in the growth of cities and buildings is apparent in development plans such as the City of New York's plaNYC, launched in 2007 and updated in 2011 (City of New York, 2011). The plan brings together over 25 city agencies to work toward the vision of a 'greener, greater New York' by 2030. This initiative is underpinned by two common themes: human engagement with nature at every opportunity and an improvement in the quality of the environment (water, light and air) to achieve a direct positive impact on the lives of New Yorkers. For a city as established and successful as New York to consider its future in such a fundamental way demonstrates the necessity to embrace progressive environmental design.

Establishing appropriate design parameters for skyscrapers as part of a city development plan such as plaNYC is the next step in the delivery of tall buildings that successfully engage with nature to improve our quality of life. Skyscrapers will have different characteristics depending on their location and predominant use, so to uphold the concept of biophilia, their design should take a common approach to:

- Be of their place, connecting occupants with the culture and geography of their location
- Differentiate between the needs of living, working and socialising
- Incorporate external space to ensure people do not become reliant on artificial environments

Kellert's chapter 'The Dimensions, Elements and Attributes of Biophilic Design' in the book 'Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life' (Kellert, Heerwagen and Mador, 2008) defines a biophilic design hierarchy as follows:

1. Two basic dimensions –
 - 'Organic or naturalistic' – use direct, indirect or symbolic forms that reflect the human affinity with nature
 - 'Place-based or vernacular' – connection to the culture and ecology of a locality or geographic area
2. Six design elements -
 - Environmental features
 - Natural shapes and forms
 - Natural patterns and processes
 - Light and space
 - Place-based relationships
 - Evolved human-nature relationships

Environmental features	Natural shapes and forms	Natural patterns and processes
Color	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal (mainly vertebrate) motifs	Age, change, and the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterned wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces
Views and vistas	Simulation of natural features	Transitional spaces
Facade greening	Biomorphy	Linked series and chains
Geology and landscape	Geomorphology	Integration of parts to wholes
Habitats and ecosystems	Biomimicry	Complementary contrasts
Fire		Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales
Light and space	Place-based relationships	Evolved human-nature relationships
Natural light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape orientation	Mastery and control
Light as shape and form	Landscape features that define building form	Affection and attachment
Spaciousness	Landscape ecology	Attraction and beauty
Spatial variability	Integration of culture and ecology	Exploration and discovery
Space as shape and form	Spirit of place	Information and cognition
Spatial harmony	Avoiding placelessness	Fear and awe
Inside-outside spaces		Reverence and spirituality

Figure 1: Kellert's table of elements and attributes of biophilic design from the 2008 book "Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life" (Source: Stephen Kellert John Wiley & Sons)

3. 72 design attributes -

- The six biophilic design elements are subsequently broken down in a table of detail design attributes which were considered work-in-progress at Kellert's time of writing in 2008 (see Figure 1)

Kellert's effort to describe design content is useful, but translation requires great skill and care if biophilia is to be developed as a fundamental component of the design. As with good sustainable design, biophilic design should adopt a holistic approach that is taken seriously from the outset, rather than a decorative motif.

Fundamentally, the architectural application of biophilia is about connecting with, rather than imitating, nature. Arguably, biophilia is a return to simple person-centred design principles which root the building to its place and make the best of views and prevailing winds, while controlling temperature and light. For skyscrapers, the inherent disconnect between people and nature due to height means we must also consider greater sensory engagement, allowing occupants to see the rain, be warmed by the sun, smell plants and feel the breeze to promote positive emotional experiences. For longevity, it is essential that biophilic skyscrapers allow people to inhabit and adapt buildings in an ever-changing way, just like the natural environment itself.

Residential/hotel and office are the two generic types of skyscraper accommodation, either as

single or mixed-use towers. For office buildings, many companies recognize that employees are their greatest asset and for office-based activities this means people spend most of their time inside in artificial environments. Therefore, creating a workplace of the highest quality is key to ensuring employee productivity, satisfaction, retention and wellbeing.

Optimizing the quality of internal space is a priority for many companies as the benefit of natural light and sounds and access to fresh air (which may be provided as an outdoor extension of the workplace) is known to have a direct positive impact on employees. Research has consistently shown that a variety of space and the integration of external areas into the office environment encourages beneficial informal communication. In turn, this enhances work-related activity, and provides n places for passive and active recreation which are essential to ensuring a healthy place to work.

Commitment to this strategy has traditionally been adopted by owner-occupiers as an investment in their employees and real estate (see Figures 2 and 3). Developers of tenanted buildings tended to follow a neutral approach that would appeal to the widest range of tenants. However, the 21st century office building is no longer perceived as just a place to work but as an essential business tool to support inspirational, collaborative and individual working methods (see Figure 4). To achieve this ideal, all offices – either owner occupied or tenanted – need to be versatile and offer a

choice of spaces with a different environmental character inside and out. Furthermore, the building a company inhabits is emblematic of its values and a medium for communication with its community.

The design of office buildings is evolving rapidly in line with the essential concept of biophilia that people simply feel better in buildings that connect their occupants in a truly sensory way to the natural world. The simple investment and return on investment for all involved is as follows:

- Developer/owner occupier invests in higher quality internal environments, spatial variety and integrated external spaces
- Occupiers are increasingly demanding and prepared to pay enhanced rates for great places to work evidenced in the content of many accommodation briefs for large tenants which put great emphasis on the quality of the workplace in terms of availability of natural light, air and external space
- The result is greater staff satisfaction, retention and productivity for the occupier as demonstrated in the World Green Building Council's 'Health, Wellbeing & Productivity in Offices' (2014), which offers greater financial value to the business than the additional costs of building, and a higher residual value asset for the developer/owner

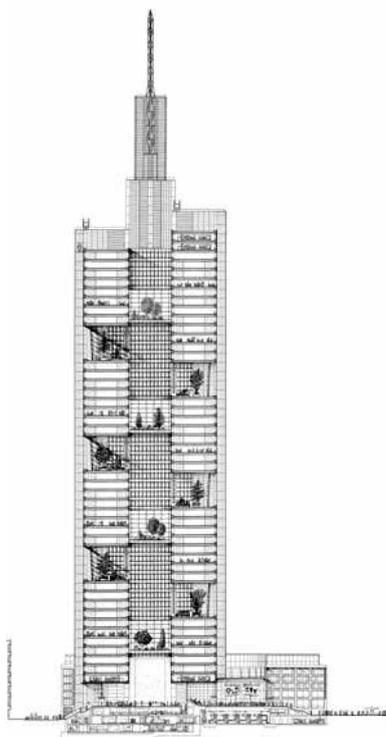


Figure 2: Foster+Partner's 53 story Commerzbank Headquarters in Frankfurt commissioned by the bank as an owner occupied building and completed in 1997 has access to skygardens every 4 storeys providing visual and social amenity space while acting as source the source of natural ventilation to the atrium facing offices (Source: Foster+Partners)



Figure 3: Commerzbank Headquarters' skygardens are protected from the elements by an openable single glazed façade to allow their use throughout the year (Source: Foster+Partners)



Figure 4: COOKFOX's 55 story One Bryant Park, New York and completed in 2010 is a tenanted office building that consciously draws on the concept of biophilia. The lobby typifies the design philosophy to create a variety of high quality spaces with great external awareness, access to high level external amenity space and use of materials such as oak, stone and leather panelling to connect its occupants with the outdoors (Source: Richard Berenholtz/The Durst Organization)

**Office design case study:
Wynyard Place, Sydney**

At the heart of Sydney's dynamic Central Business District (CBD), Wynyard Place enjoys an elevated position where the city is experienced as a series of layers and unexpected vistas formed by the overlay of a regular grid with undulating topography. George Street, one of Sydney's main streets connecting the harbour and CBD is to the east and Carrington Street adjacent to

Wynyard Park created in the 1920s flanked predominantly by heritage buildings is to the west (see Figure 5).

Scheduled for completion in 2019, Wynyard Place consists of 10 Carrington, a tenanted tower with 27 office levels; Shell House and 285 George Street, two heritage buildings built in 1923 and 1938 respectively which will be sensitively restored and converted into high-end offices; various retail spaces; and world-class transit hall for subterranean Wynyard Station,

one of the city's busiest transport hubs. The scheme aims to establish Carrington Street as one of Sydney's prime addresses, raising aspirations for this section of the city and leading the way for the area become a prestigious, vibrant commercial precinct. (see Figure 6).

The development is uniquely positioned to become fully integrated with Wynyard Station and its shopping precinct to create a spectacular transport interchange. Below 10 Carrington, a generous multi-level transit hall with grand entrances, open and legible pedestrian concourses and flagship retail stores – all with clear sightlines, street views and generous levels of daylight – will give the station an exciting new identity (see Figure 7).

10 Carrington is designed in response to the complex constraints of the site and the scale, language and rhythm of the surrounding buildings and streetscape. Formed from a composition of interlocking rectangular blocks that become visually lighter as they gain height, the building's layered appearance can be read from many angles and vantage points. Each elevation is different to complement and enhance the city's skyline and sculpted to optimise views to and from the building.

At street level, 10 Carrington is deliberately designed to restate the urban grid and activate the street edge to improve the public domain and establish new connections with the nearby Wynyard Park. The entrances of 10 Carrington



Figure 5: Wynyard Place in context with Sydney's CBD (Source: Brookfield Property Partners/visualization Squint Opera)



Figure 6: Wynyard Place viewed from George Street illustrating the composition of interlocking rectangular blocks and integration of amenity space set against the backdrop of Shell House's clock tower (Source: Brookfield Property Partners /visualization DBOX)

and Shell House are located directly opposite the park offering occupants convenient access and use of this public open space which serves to integrate the development with its immediate urban context and provide a respectful setting for the surrounding heritage structures and streetscapes (see Figure 8).

Designed as a vertical campus, the office space enjoys great external awareness and opportunities for interconnected floors between 10 Carrington and the heritage buildings creating a rich blend of different workplace characters. The composition of interlocking rectangular blocks naturally generates external terraces accessed directly from 10 Carrington's



Figure 8: The new transit hall announcing Wynyard Station on George Street (Source: Brookfield Property Partners/visualization Factory Fifteen)

adjacent office floors which allow engagement with Wynyard Park and the wider city at different levels as follows:

- Mezzanine balcony overlooking the lower open space of Wynyard Park
- Level 4 walled garden at the roof of 285 George Street with street level vistas east down undulating Hunter Street and the eastern CBD
- Level 9 terrace with expansive views over Wynyard Park's tree canopies, surrounding heritage buildings and expanding western CBD including new commercial developments at Barangaroo and Darling Harbour

- Shell House roof gardens and new pavilions adjacent to the building's clock tower offer characterful amenity space with views to the east, north and south over Sydney's roofscape
- Level 27 terrace offer panoramic views of Sydney's towers, waterfront and suburbs

The result is a truly dynamic, people oriented, inclusive, healthy and productive office which truly engages with its setting at every level through transportation interchange, public park, heritage buildings, terraces and ultimately taps into Sydney's heart and soul.

Residential design case study: Aranya, Mumbai

The integration of external amenity space within residential buildings is typical, as the value put on external space as an extension to the home is an established concept delivered through the provision of gardens and balconies. However, connection to the natural world should be more than just access to external space; the use of materials and orientation should holistically connect the individual with the place they live in (see Figure 9 and 10). To demonstrate the application of this philosophy, a case study describing how Make approached the design of a residential scheme in Mumbai to provide an affordable way of living in harmony with nature follows.

Aranya comprises a pair of 300m-tall towers in the central area of Byculla adjacent to the Mumbai's Botanic Garden, one of the city's rare open spaces away from the waterfront. Mumbai is the agglomeration of a number of



Figure 7: The new transit hall announcing Wynyard Station on George Street (Source: Brookfield Property Partners/visualization Factory Fifteen)

rocky islands, one of which is below Aranya, into a peninsula through land reclamation. This has expanded the city, yet constrains its growth and makes open, natural space a precious and valued commodity.

Byculla has a rich history and boasts many important landmarks including the natural harbour around which Mumbai grew as a trading centre. Bombay, Mumbai's original name, is from 'Baum Bei' meaning 'good harbour' in the native language of Portuguese settlers. Aranya is the site of one of several textile mills which formed a key component of Mumbai's industrial heritage, providing wealth and a foundation for the economic development in the city. Advances in textile production and improved infrastructure have allowed the textile industry to successfully relocate, releasing parcels of city centre land for large-scale residential redevelopment projects.

Vaastu - an historic set of building design principles which promote spiritual and physical relationships between the built environment and nature to create safe, successful and happy family homes - is valued by many living in India influencing the overall and detailed layout of many residences. In 2015, enabling construction works commenced and sales launched. To reach this point, extensive market research and engagement sessions with a diverse group of potential residents tested Aranya's architectural concept and layouts. The recurring theme which has been welcomed by the majority of those involved is the creation of homes which are connected to the natural world positively set this development apart from others in a competitive residential market in Mumbai.

Therefore, in this context, biophilia has genuine traction as a design philosophy and is inherent within Aranya's design in a predominantly experiential manner where residents are connected through the following key moves:

- Creating rooms with views and optimized terraces, windows and door openings so residents can engage all their senses
- Offering communal environments at the top and base of each tower that have other life forms around and within them
- Considering homes as habitats rather than just accommodation

Active promotion of:

- Natural light and ventilation
- The use of natural materials inside and out
- A dynamic inter-relationship between inside and outside space

Ultimately, Aranya represents the integration of architecture and nature to create invigorating, inspiring and comforting spaces. It is in an idyllic location adjacent to the Botanic Garden, with views of the Arabian Sea, the harbour and the distant hills beyond. All these provide Aranya with enchanting scenes and endless animation that is drawn into the internal spaces at every level.

The two towers are aligned on a north-south axis, so each faces the Botanic Garden and the Arabian Sea to the west with the harbour and



Figure 10: One Central Park biophilic design philosophy is defined by vertical planting across the facades maintained by the building management company as part of the resident's service agreement (Source: Ateliers Jean Nouvel)

hills to the east. One of the principal design decisions is the development of a cruciform floor plan, with four apartments per level for each tower to ensure each has generous views on three sides. The apartments at each end of the tower offer true dual-aspect accommodation and the ability to experience the rising and setting sun within the same space (see Figures 11, 12 and 13).

Tradition and cultural context are as important as connections with nature, infusing the building and its residents with a sense of place and belonging. Aranya's elevations represent an outcrop of the bedrock upon which the site sits, through the defining use of natural stone to express the structural walls and floors inside and out. In contrast, the fenestration and screens display a finer grain, detail and texture that represents the textile threads and fabrics once produced on the site.

The scheme incorporates a 24m-tall podium comprising parking, building entrances, club house and landscaped grounds including tranquil walks and active sporting facilities such as swimming pool, cricket area, tennis courts and running track, all with an intimate relationship to the Botanic Garden's tree canopy. This feeling of immersion is enhanced through the selection of trees and foliage that extends the perceived extent of the Botanic Garden and attracts the biodiversity which marks the area as an oasis within Mumbai.

Creating places where people genuinely feel good is key to the project's aspiration to create the best large-scale residential development in Mumbai's city centre. It benefits all in two ways –

- Aranya will be an exemplar in the city for its commitment to putting the resident first
- Commercial value for developer and customers is enhanced and secure

Aranya allows real communities to be forged as the spaces for social interaction outside



Figure 9: Atelier Jean Nouvel in collaboration with PTW Architects' One Central Park, Sydney, completed in 2014, is an iconic 34 story residential tower with a symbiotic relationship between occupants with the natural world delivered through multiple balconies for each residency oriented to views (Source: Brookfield Property Partners/visualization Factory Fifteen)



Figure 11: Aranya's pair of towers are aligned on a north-south axis with a cruciform floor plan, with four apartments per level for each tower to ensure each has generous views on three sides and the apartments at each end offering dual-aspect accommodation (Source: Make)



Figure 12: West facing apartments overlook the Botanic Garden with views over Mumbai to the Arabian Sea (Source: Piramal Realty Ltd./visualization Uniform)

the home are provided in a hierarchy from personal to communal:

- Blurring the boundaries between inside and out encourages people to live in a visible way which promotes interaction, as people share the experience of being at one with nature
- Allowing homes to extend beyond their front doors generates neighborhoods at each level
- The podium amenity spaces become places where people congregate, leading to engagement with nature and the wider community

The value of financial property increases, benefitting home-owner and developer, as ultimately Aranya sets the standard for large-scale residential to become a local, national and global exemplar which connects residents with their place in the city and the natural world.

At every scale, Aranya seeks to enhance connections between people and the natural environment. To engender an inclusive community, spacious elevator lobbies with views create a common room at every level, providing opportunities for interaction between residents to help them feel connected with each other and their environment.

Aranya also promotes the use of natural over mechanical ventilation, to allow residents to enjoy good quality fresh air at height. Through an iterative design process involving wind tunnel testing of the façade and Computational Fluid Dynamic (CFD) modelling of the interiors, the placement and configuration of windows and doors was optimised by locating opening vents in sheltered zones of the façade where wind pressures are less. High-performance double-glazed units are used throughout, which is unusual for Mumbai, providing optimal thermal and acoustic performance. Furthermore, the glazing specification educs glare in an inherently bright location allowing residents to keep curtains and blinds open and maintain the indoor-outdoor connection for long periods of the day.

Care has been taken to make spaces accessible, comforting and amenable to all. Whether they are families with small children, elderly relations or the infirm, the external and internal spaces are designed to promote good health and long life and nurture a sense of wellbeing and delight.

A key decision in blurring the line between inside and outside has been to afford the same relative generosity of scale in both the internal and landscaped environments. This is true of the terraces of the private living and communal

spaces, circulation lobbies or grand reception foyers leading to the landscaped grounds complemented by a material palette chosen to further enhance the inside/outside experience, with a variety of finishes and textures chosen to stimulate the senses. The use of natural products is maximised to create a holistic, biophilic experience representing honesty and visual integrity in the building's aesthetic. Natural stone, expresses the structure with foundations on the bedrock below, is used to connect occupants with the place and blur the visual boundary between inside and out.

The fenestration and screens are designed to reflect the site's textile-making history, with sinuous threads culminating in the shading device of a communal roof terrace for all residents to enjoy. The generous space at the top of each tower is a marvellous place to be at one with nature, and becomes Aranya's distinctive emblem on the skyline as a biophilic people-centred place (see Figure 14).

design strategies that will sustain successful sky life at every level. As skyscrapers become the majority building typology, the key question to be addressed is can the next generation of tall buildings in the Resurgent Skyscraper City afford not to embrace the natural world? The answer demands further research into the tangible benefits offered by biophilia, in order to quantify commercial value for the developers and owners who commission skyscrapers.

Without doubt, placing people and their innate affinity with the natural world as a key design principle will positively improve our quality of life, health and wellbeing and create varied, sensational and socially sustainable Resurgent Skyscraper Cities.

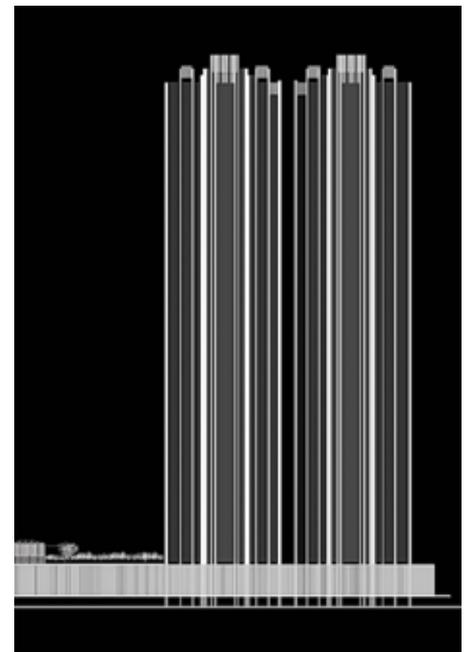


Figure 13: Concept diagram for Aranya's pair of residential towers with the structure expressed as vertical stone elements with finer grain screens at the top and fenestration between (Source: Make)

People matter

In the Resurgent Skyscraper City, designers and developers must seize the opportunity to connect skyscrapers with the natural world and positively impact the occupants' wellbeing.

Ultimately, the challenge is to ensure the value of biophilia is recognized, upheld and engrained as a fundamental design principle, rather than a skin-deep aesthetic. In the same way, the most successful sustainably designed buildings are those which truly embrace its fundamental ethos. Adopting a biophilic philosophy is much more than imitating nature in built form as demonstrated by Wynyard Place and Aranya.

Now is the time to define the significance of our relationship with the natural world and consider



Figure 14: The panoramic views at the communal roof terrace put residents at one with nature as though they are at the top of a mountain whilst distinctively defining Aranya on Mumbai's skyline (Source: Piramal Realty Ltd./visualization Uniform)

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