

Title: **Humanizing the Giants**

Author: Swinal Samant, Senior Lecturer, National University of Singapore

Subjects: Architectural/Design  
Interior Design

Keywords: Interior Design  
Landscape  
Public Space  
Sky Garden  
Skybridges

Publication Date: 2016

Original Publication: Cities to Megacities: Shaping Dense Vertical Urbanism

Paper Type: 

1. Book chapter/Part chapter
2. Journal paper
3. **Conference proceeding**
4. Unpublished conference paper
5. Magazine article
6. Unpublished

# Humanizing the Giants

## 摩天大楼的人性化



**Swinal Samant**  
Senior Lecturer | 高级讲师

National University of Singapore  
新加坡国立大学

Singapore | 新加坡

Dr. Swinal Samant is a Senior Lecturer at the Department of Architecture, National University of Singapore (NUS). Prior to this, Swinal was an Associate Professor of Architecture at the Department of Architecture and Built Environment at the University of Nottingham. She has over 24 years' built environment experience within the education, research and consultancy sectors with her research and teaching focused on sustainability in the context of global architectural and urban dimensions. She is a member of CTBUH's expert peer review committee and INTACH, an editorial reference for a number of international journals and conference, and has published widely.

斯维娜·萨马特博士是新加坡国立大学建筑学院的高级讲师，在这之前任诺丁汉大学建筑与环境学院的副教授。她在环境设计方面的教学、研究和咨询顾问工作上已实践超过24年，教学和专注于全球化背景下的建筑与城市可持续性。同时，她也是世界高层都市建筑学会以及印度国家艺术文化遗产信托基金会的专家成员，也是国际期刊会议论文的编辑成员之一。

### Abstract | 摘要

*The rise in sustainable skyscrapers and large-scale mixed-use buildings has seen the proliferation of atria and sky-courts worldwide due to their ability to simultaneously contribute to aesthetic, socio-cultural, economic and environmental functions. This paper seeks to examine the various dimensions of atria and sky-courts with a view to understanding how such spaces can become the “breathing lungs” of rapidly urbanizing cities that are experiencing loss of civic and green spaces; and how they could contribute to low energy buildings in urban settings. Furthermore, the paper explores the mediating role of these spaces in creating vital bridges, most notably between the masses and the voids of a city, the public and the private spaces of a city, the inside and the outside, the built and the un-built, the soaring vertical and the horizontal, the old and the new, and the buildings and their infrastructure.*

**Keywords: Atria and Sky Courts, Environment, High Density Urban Environments, Infrastructure, Mixed-Use, Social Spaces**

随着可持续发展的摩天大楼和大型多功能建筑在世界各地数目的增加，我们已看到中庭和空中绿化空间的数量也随之激增。这归因于这些空间在美学、社会文化、经济和环境等功能上对建筑的突出贡献。在城市公共空间和绿色空间正不断缺失的迅速城市化背景下，本文探讨了中庭和空中绿化空间在不同维度下去如何能成为城市“呼吸的绿肺”，以及它们如何协助建筑降低能耗。而且本文也探讨了中庭和空中绿化空间的“中介”和“桥梁”作用，如何去调和城市的虚实空间、城市的公众和私密空间和室内和室外空间，以及垂直和水平之间、新老建筑之间、建筑和基础设施之间的关系。

**关键词：中庭与空中庭院、环境、高密度城市环境、基础设施、混合用途、社交空间**

### Introduction

World population is expected to rise 33% by the year 2050 (United Nations, 2013), and the fact that 50–75% of this population will live in urban centers/cities puts unprecedented pressure on urban land, making densification inevitable. In this context, the need for sustainable, mixed-use skyscrapers where people live, work and play is recognized with many cities' infrastructures and key structures, nature and ecology now extending upwards. Consequently, 21st century skyscrapers and large scale mixed-use projects seek to address concerns of environmental, social, and economic sustainability; high density urban living; ecology through innovative forms and organization; technical innovations in glazing, façades, materials and structures; incorporation of renewable energy technologies; and greening of the vertical environment.

The domination of such massive buildings and infrastructures combined with, as Carmona et al. (2010) identifies, a decline in the availability and significance of public spaces and public realm has consequently led to a loss of public life in cities. It is suggested

### 前言

到2050年，世界人口预计上升百分之三十三（联合国，2013），而其中的百分之五十至七十五的人口将会居住在城市区域，这将会空前地对城市用地施加压力，也将不可避免地促使城市高密度化。由此而论，对于提供居民居住工作娱乐的包含可持续性和综合性的摩天大楼其需求也被很多城市考虑和融入到基础建设和关键构思中去，其中自然与生态正在往高度上发展。因此，通过运用在施釉、立面、材料和结构方面的技术创新，形式和组织的创新和可再生能源技术的整合以及垂直绿化的改善等方法，二十一世纪的摩天大楼和大型混合发展项目正在解决环境、社会和经济的可持续发展问题，高密度的城市生活情况问题和生态友好等备受关注的问題。

正如卡尔莫纳（Carmona）（2010）所言，如此大量的摩天建筑和基础设施在城市上的支配，再加上公共空间与公共区域在可用性和重要性方面的逐渐衰弱，都会导致公共生活在城市中的缺失。城市复兴公共生活可能需要新公共空间形式，而中庭因其同时包含美学，社会文化和城市环境等功能呈现出了创新性、可行性和选择性。目前，由于中庭能够创造吸引人的以人为本的环境，并在高密度之下能够提供庇护

that to revive public life, new forms of public spaces may be required, and atria present innovative viable options due to their ability to simultaneously contribute to aesthetic, socio-cultural, urban and environmental functions. Indeed, atria have proliferated worldwide due to their potential to create attractive, people-centered environments; provide sheltered public spaces and visual relief in dense settings; assimilate contextual influences of geometry, street pattern, and building mass; integrate old and new buildings; facilitate historic preservation; and enrich the urban pedestrian experience (Saxon, 1983; Bednar, 1986). The atrium concept has seen many skilful manifestations in response to various climatic, environmental, economic and cultural contexts. In an era of globalization and its related homogenization, atria in the form of focal squares and streets, green and buffer spaces, double-skin façades, and sky-courts/gardens have opened up buildings internally, transformed their interiors dramatically, and lent them distinctiveness and identity.

### Aesthetic Dimension

Atrium spaces are increasingly introduced at height in tall buildings to improve visual links internally and externally, to create smaller discernible neighborhoods with personalities, and to build thriving mixed-use vertical communities. Where large-scale multi-tenanted office and mixed-use buildings can be plagued by anonymity, they help break down the scale and lend structure, spatial and visual coherence, character, identity, and present opportunities for self-sufficiency and localized management.

Atria, through their inherent nature, aid organization, legibility, movement and continuous use as they often encompass circulation spines that link to secondary circulation routes within buildings and aid connectivity between different components of a large scale and/or mixed-use building, and with other buildings and the external environment. The London Bridge Tower (2012), famously known as the “Shard of Glass,” is a mixed-use (offices, hotel and apartments, exhibition spaces, shops) development by Renzo Piano (Figure 1). This 72-story slender tower entails a social system of atria and sky gardens at different heights of the building to support the vertical village/community of 7,000 residents. Half way up the tower, a central triple-height atrium is a hub of social activity with circulation, naturally ventilated social/breakout spaces, sky gardens and



Figure 1. The Shard at London Bridge by Renzo Piano (Source: Terri Boake, The Skyscraper Center)  
图1. 伦佐·皮亚诺设计的碎片大厦 (来源: Terri Boake, 摩天大楼中心)

场所和视觉享受，其也能融合城市几何结构、街道模式和建筑组团的上下文脉，以及整合新老建筑促进历史保护和丰富城市步行体验 (Saxon, 1983; Bednar, 1986)，中庭已在全世界范围内数量激增。在各种不同气候、环境、经济和文化背景之下，中庭的概念运用在实际例子里已经看到了许多证明和尝试。在全球化和同质化的时代背景之下，中庭以中心广场、街道、绿化缓冲空间、双层幕墙和空中花园的形式内在地展露着建筑的特色，并显著地改造建筑的内在和赋予建筑的独特性和同一性。

### 美学维度

中庭空间正越来越多地在高层建筑中被高度引进，它们在改善室内外的视觉联系，创造富有特色的街道和建造繁荣的多功能垂直社区都发挥着不小作用。其中，大型

的多租户办公室和混合多功能建筑可以被代理所困扰，其分化了建筑的规模和出借了建筑的结构、空间和视觉的连贯性和同一性，提出了自足性和本地化管理。

由于其自身性质，有助于其自身的组织、辨别、运转和持续利用，它往往被各条建筑内部动线所包围，也有助于加强大型或/和混合多功能建筑与其它建筑和外部环境等不同部分之间的连通性。以“玻璃碎片大厦”著名的伦敦桥塔 (The London Bridge Tower) (2012) 是由伦佐·皮亚诺 (Renzo Piano) 设计的一个包含办公、酒店、公寓、展览空间和商店的混合多功能建筑 (图1)。这个七十二层的细长塔楼在建筑的不同高度蕴涵有着中庭和空中花园的去支持那七千个居民的垂直社区。其中，在桥塔中间位置有一个三倍高度的多功能中庭就包含着社交活动空间、自然通风空间、空中花园、冬季花园、餐厅、咖啡吧和公共观景廊。





Figure 2. The Skygarden at Pinnacle @ Duxton in Singapore (Source: Heng Cheng Sin, NUS Department of Architecture Year 5 Student)

图2 新加坡达士岭空中花园（来源：新加坡国立大学建筑学院5年级学生 Heng Cheng Sin）

corner winter gardens, restaurants, coffee bars, and public viewing galleries.

Openness created through panoramas are one of the most delightful aspects of atria that, in addition to the temporal references, add historical content to a building, enriching the architectural experience. They vitally provide the space and time that a retina needs to adjust to extremely different lighting conditions/levels (from bright to dark interior spaces or vice-versa). In this sense, atria form part of the essential hierarchies of spaces and mediate between the light and the dark, the public and the private, the formal and informal spaces, and the inside and the outside. Connectivity with nature and natural elements afforded by atria enables symbiotic relationships between buildings, people, and nature (landscape, daylight and natural ventilation) that will be of increasing importance to dense urban living. As an extension of the outdoors, they essentially form pockets of contrasting spaces to those found in the rest of the building that soften the hardness of architecture otherwise around, if they incorporate greenery. Steven Holl's Linked Hybrid in Beijing and ARC Studio's Pinnacle @ Duxton (Figure 2) in Singapore are noteworthy examples of high density, high-rise residential projects defined and characterized by varied and delightful elevated public green spaces in the form of sky-bridges and skygardens for social encounter. WOHA's high-rise residential blocks, The MET in Bangkok and Newton Suites in Singapore (Figure 3) and Stefan Boeri's Bosco Verticale in Milan (Figure 4) also incorporate vertical landscaping and shaded balconies, adopting climate sensitive environmental design approaches. However, the next generation of tall towers needs to push the boundaries further, whereby the towers essentially form the backdrop to what would be elevated and accessible common public green spaces for the benefit of all rather than a few. They could be reimagined as sheltered meadows that

form part of the network of public spaces of a city and offer the much sought after respite from the severities of weather, urban life and concrete jungles.

### The Socio-Cultural Dimension

Atria are essentially intermediate, interpersonal (familiar/communal) spaces that form part of our neighborhoods,

全景的开放性，是中庭其中一个最让人愉悦的方面，除了增加历史内容到建筑中之外，也增进了建筑体验的价值。中庭刚好地提供了人视网膜所需要适应的不同光照条件下的时间和空间过渡，例如从明亮的室外空间到暗淡的室内空间的适应，或相反路径的适应。从此层面上说，中庭成为了空间基本层次结构的其中一个要素，能够在明亮和黑暗空间、公共和私密空间、正式和非正式空间以及室内和室外空间之间的调解。中庭所赋予的与自然的连通性和环境性使得建筑、人和自然(景观，采光和自然通风)三者之间形成了共生的关系，这一方面在高密度的城市生活中将会变得越来越重要。其中，以天桥和空中花园的形式创造了社交用途的多样化和愉悦的公共绿化空间的高密度高层住宅项目，北京当代万国城（Steven Holl's Linked Hybrid）和新加坡达士岭（Pinnacle@Duxton）（图2）都是代表的例子。新加坡WOHA建筑事务所设计的曼谷“THE MET”高层公寓和新加坡纽顿轩公寓（图3）和斯丹法诺·博埃里（Stefano Boeri）设计的意大利米兰“垂直森林”（图4）都采用竖向绿化景观以及阳台气候环境适应性设计方法。然而，新一代的高层塔楼的需要进一步突破界限，它需要本质上构成一个有所提高的背景环境以

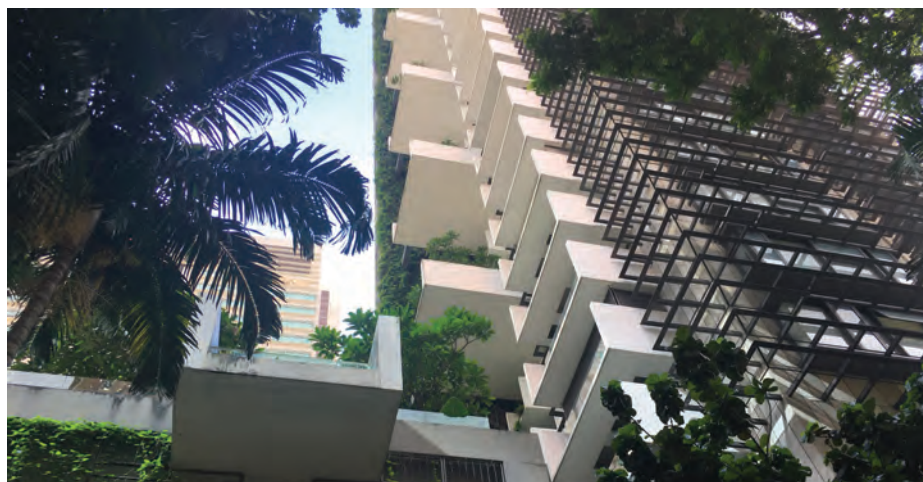


Figure 3. The vertical greenery at Newton Suites in Singapore (Source: Swinal Samant, NUS Department of Architecture)

图3 新加坡纽顿轩垂直绿化（来源：新加坡国立大学建筑学院 Swinal Samant）



Figure 4. Vertical landscaping of Bosco Verticale in Milan (Source: Eleonora Lucchese, The Skyscraper Center)

图4 意大利米兰“垂直森林”的景观园林（来源：Eleonora Lucchese, 摩天大楼中心）





Figure 5. Green Spaces of the Skyville @ Dawson in Singapore (Source: Heng CHeng Sin, NUS Department of Architecture Year 5 Student)

图5. 女皇镇杜生阁组屋的绿化空间 (来源: 新加坡国立大学建筑学院5年级学生 Heng Cheng Sin)

communities, institutions, workplaces and public buildings. Oldenburg (1999) refers to them as the “third place,” which he defines as, “...great variety of public places that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work.” An atrium has the potential to form bridges between the private and the anonymous public, strengthening social relationships and sociability within the building and with the immediate and wider environment. It frequently projects a façade/face/ image to the street, the neighborhood, and the city at large whilst providing a buffer to the inner core of the building. In the hierarchy of a city to its constituent parts, such spaces may form part of the network of collective center points or social foci that characterize a city and the movements within it.

However, they can also be viewed as ones that separate the public and private spheres and control movement between them, and whilst this may be necessary for safety and privacy, they can pose a real threat to the “publicness” and use of these spaces. Mediating between the two realms is essential to create desirable and inclusive people places achieved by a continuum of program, establishing appropriate levels of permeability and delicate handling of the more tangible and intangible barriers, thresholds and enclosures. Reconciliation between public and private is important, particularly in large-scale mixed-use communities where housing can be mediated through appropriate people presence, activities and, consequently, natural surveillance whilst exercising certain control.

In many spectacular retail environments, internal atria with shops bordering on to them are central promenading spaces and destinations (with cafes, retail kiosks,

landscape/fountains, public art, street furniture, etc.) in their own right. However, with most activities often stimulating the internalized atria, there is a real danger of engulfing street life within these domains and leaving the city outside bereft of movement or life, as evidenced in many contemporary urban settings. The mixed use Lotte Tower by Kohn Pedersen Fox Associates in Seoul integrates itself with its urban fabric externally and affords spatial continuity internally through a series of sculptural peripheral atria in the form of hotel lobbies, sky lobbies for the residences, and observation decks ensuring legibility and animation of the internal environment whilst enabling connectivity externally. Furthermore, it is important to recognize that “human scale” stacked communities characterized by strategically located transitional breathing lungs / green spaces encompassing various functions may alleviate the pressures of living in dense vertical environments and offer opportunities for new experiences and interactions, as attempted at the Skyville @ Dawson in Singapore (Figure 5). Such engagement can be further reinforced if complemented by programs involving wider sections of the society, which may include recreational, sports, retail, educational and cultural functions. Indeed such spaces have the potential to recognize the needs of the collective and, rather than polarizing people into private and public spheres, could facilitate collaboration and coexistence.

### The Urban Dimension

Abel (2010) proposes that, “the idea of a genuine three-dimensional urban typology, that might create elevated spaces of equivalent character and variety to those

及让所有人都能受益于公共绿化空间而不是那一小部分人。中庭空间可以被重新视为构成城市公共空间网络中的一部分，在天气，城市生活和水泥丛林的烦躁喘息之后其能为城市居民提供充分和受庇护的绿地。

### 社会文化维度

本质上，中庭是中间过渡的人际交往空间，也是组成邻里、社区、机构、工作场所和公共建筑的一部分。奥尔登堡

(Oldenburg) (1999)把此空间指为“第三空间”——“各式各样的公共场所承载的定期的、自愿的、非正式的和期待的个体集会已超出了家庭和工作领域所承载的。”中庭空间能够建立私密与公众之间的桥梁，而在建筑内能加强社交关系和社交能力，它不断地投射一个立面/印象到街道上，并成为社区和城市通往建筑内部核心的缓冲区域。从城市层次结构到它的各个组成部分，这样的中庭空间会成为层次的聚焦点，或成为表现城市特征的社交焦点的一部分。

然而，中庭空间可以被看作是在分离公众空间和私人领域，并在考虑到安全和私隐的时候掌控着私密与公众领域之间的动态移动，它们也可以对“公共性”和使用这些空间时构成威胁。两个领域之间的调解对创造满意而有人气的空间、有适当渗透性的空间和能细腻处理有形和无形壁垒、门槛和围墙的空间是不可或缺的。公共空间和私密空间的调和十分重要，特别需要在大尺度的混合用途社区中依照城市居民、活动和自然监控来实行一定的控制和调节。

在许多华丽的零售环境中，贴近内部中庭空间的会是中心步行空间、咖啡店、零售亭、景观、喷泉、公共艺术和公共设施等等。但是，随着大多数活动往往都在刺激内部中庭空间，许多当代城市的前例证明，其有着吞噬此领域内街道生活和剥夺城市动态生活的危险。在韩国首尔由KPF建筑事务所设计的乐天超级大厦 (Lotte super tower) 通过设置一连串适合于居住区和观景台的酒店大堂和空中大堂，使其在外部上与城市肌理相结合，而在内部给予其空间连续性，从而确保了内部环境的特色和活力，同时在外围能够具备一定的连通性。此外，认识到这一点很重要：被各种功能所包围的处于过渡绿色空间的“人性化”社区能够减轻居住在高密度竖向环境下压力，以及能提供新的体验和相互作用的机会，例如新加坡公屋 SkyTerrace@Dawson的尝试 (图5)。这种过渡空间和参与，如果能再考虑社会更多层面和在允许下增添休闲、体育、零售、教育和文化等功能，将可以进一步地加强。的确，这样的空间能够认识到集体的需求，没有太偏向私密或公众领域的某一边，促进了两个领域之间的合作和共存。





Figure 6. The tapering and twisted Shanghai Tower by Gensler (Source: The Skyscraper Center)  
图6. 尖细和扭曲的上海中心大厦 美国Gensler建筑设计事务所 (来源: 摩天大楼中心)

found in any great city at street levels, remains a compelling but elusive prospect.” Moreover, Pomeroy (2007) advocates complementing the traditional streets and squares at ground-level with recreational and civic spaces at height in the form of sky courts and sky gardens. Such habitable spaces increasingly link people at height with those on the ground, and in doing so, they vitally enhance the pedestrian spaces thus emulating the finer grain and intricacies of a city higher up and becoming part of the hierarchy of participatory spaces within the city. Moreover, large scale exhilarating voids at the top of the building used as observation decks, bars and restaurants have also become important destinations offering unrivalled city views, contributing to tourism and generating revenue opportunities. Importantly, such spaces aid the wider public use of so-called exclusive spaces that previously only served

the elite or corporate clients. A web of such innovative void spaces within the vertical environment and improved transitions from the horizontal to the vertical plane characterized by greater porosity, legibility, choice, activity and natural surveillance would lead to integration of the high-rise with its urban fabric and strengthen the commercial viability and livability of such spaces.

Architects are increasingly using the atrium concept for multiple purposes in mixed-use and high-rise projects to simultaneously impact upon building aesthetics, environmental performance, and urban and social integration as evidenced by the 128-story, mixed-use (comprising offices, retail, hotels and restaurants) Shanghai Tower by Gensler (Figure 6).

亚伯(Abel) (2010) 提出, “在任何城市的街道层面上, 那些有可能创造等效性和多样性的高层空间的三维城市类型学理念仍然是一个引人注目的, 但难以实现的前景。” 此外, 波默罗伊(Pomeroy) (2007) 提倡去称赞地面上的传统街道和广场, 在高层上以空中场地和空中花园的形式设置的休闲和公共空间。这样的居住空间渐增地把高层上和地面上的居民联系起来, 在此情况下, 它们极其地提高了步行空间的性质, 从而模拟了一个更高层城市的精细性和复杂性, 使其成为城市参与空间的层次结构中的一部分。而且, 在大型的愉悦的边庭的楼顶上设置观景台、酒吧和餐馆的已成为重要的城市景观点, 以此促进了旅游业和增加创收的机会。重要地是, 这样的空间有助于更广泛地面向公众, 让更多的公众能使用原先只服务于精英或企业客户的空间。此类在竖向环境内的创新孔隙空间, 以更多孔性、辨别性、选择性、活动和自然监督为特征, 从水平面到垂直面进行改进和转换, 将会导致高层建筑与城市结构的整合, 以及加强此类空间的商业可行性和宜居性。

建筑师们在混合用途和高层项目里为了多重目的正越来越多地运用中庭的概念, 与此同时这些都影响着建筑的美感、环境性能、城市和社会融合, 其中一个例子是由美国Gensler建筑设计事务所设计的126层632米高包含办公室、商业、旅馆和餐馆的混合用途的上海中心大厦(Shanghai Tower) (图6)。

该大厦采用两层表皮的内外双幕墙系统, 并以等边三角形的建筑形式上升到632米的巨大高度。内层在平面上是圆形的并且分成九个区域堆叠, 每十二至十五层则分隔为服务设备层。此内层塔楼以逐渐缩小直径的方式在高度上上升, 而外层则形成带圆角的三角形平面并随着高度上升逐渐尖细和扭曲, 在内层筒和外层表皮之间设置公共空间和空中花园并围绕着建筑一路往上。这些位于每个区域中心的外围中庭基本上可视为共享空间, 而且被比作类似于能人聚集起来的和举行不同活动的传统城市广场、购物中心和庭院的市民空间(Xia et al., 2010)。这些中庭或空中花园是地面上公共空间和景观的延伸, 这种方法的采用维持了它们的连续性并在建筑上部分无缝整合, 也同时满足百分之三十三的场地绿化率要求。

把竖向环境和交通整合起来是取得高层建筑乃至城市成功的关键。越来越多中庭的使用把混合用途建筑和城市地面上的公共交通、基础设施和公共领域联系起来, 例如新加坡和香港示范性地展示了此方面对城市形态的影响越来越大: 它们可以与城市形态联系起来, 延伸和转化它去创造独特的关系良好的和谐的街区、街道和人行



Rising to a colossal height of 632 meters, this equilateral triangular form building tapers and twists as it ascends in height. In plan, the tower has two skins, an inner and an outer double-skin curtain wall system. The inner tower is circular in plan and is vertically divided into nine stacked neighborhoods, 12–15 stories high that are separated by service and mechanical floors. This inner tower effectively reduces in diameter as the building soars upwards while the outer skin forms a triangular plan with rounded corners, and it twists and tapers as it rises creating 21 dynamic public atria spaces and sky gardens between the inner cylinder and the outer skin, enveloping the building all the way up. These peripheral atria are essentially dedicated communal spaces at the heart of each of the neighborhoods, and liken to the traditional civic spaces of squares, plazas and courtyards that bring together people and offer diverse activities in a landscaped setting (Xia et. al., 2010). These elevated atria/sky gardens are an extension of the public spaces and landscape at ground level; the adopted approach maintains their continuity and seamless integration into the upper reaches of the building whilst satisfying the requirement of 33% of the site to be reserved as green space (Xia et. al., 2010).

Integrating the vertical environments with transport is key to the success of tall buildings and that of cities. The increasing use of atria to link mixed-use buildings with mass transit, infrastructure and public realm at ground level in cities such as Singapore and Hong Kong demonstrates their growing impact

on urban morphology. They may connect with the urban morphology, extending and transforming it to create distinct, well-connected and sympathetic blocks, streets and pedestrian routes. Three-dimensional organization of public circulation, strong connections with urban transportation (MTR, taxi, bus station), entrances to the various functions, escalators, and gathering spaces can create great commercial opportunities as seen in Festival Walk in Hong Kong and the linear strip of shopping malls along Orchard Road in Singapore.

Referring to the International Commerce Centre (ICC) Hong Kong, Malott (2010) notes: “beyond its picturesque profile, ICC speaks to the promise of the tall building as a sustainable paradigm, in which individual buildings form part of a larger ecosystem of vertical centers linked by horizontal networks of public transportation.” The 108-story, 484-meter ICC is anchored to the city and the wider world via the below-grade transport hub, which connects ICC to the international airport and main land China via a network of high-speed rail, subway, buses, and ferry terminals (Mallot, 2011). The meeting of the tower with the ground and the transport hub is softened and articulated by the atrium and its curved roof (Figure 7). The use of atria in the Elements mall and the office tower was critical to the effective and legible internal circulation of the different users. Commuters arriving from Kowloon station go through the mall to reach the tower atrium where, “A multi-level lobby connecting the various transportation modes filters different user

路线。公共交通动线的三维组织与地铁、的士和公交车站等城市交通紧密联系，在通往不同功能入口、不同自动扶梯和聚集中庭空间的设置都可以创造巨大的商业机遇；例如香港的“又一城”(Festival Walk)和新加坡的乌节路一带的大型购物中心。

关于香港环球贸易广场 (International Commerce Centre)，马洛特 (Malott) (2010)指出“越过其独特生动的外立面，环球贸易广场兑现了高层建筑作为可持续发展范例的承诺，建筑单体成为由公共交通横向网络连接的竖向生态系统的一部分。”108层1588尺高的环球贸易广场已通过交通枢纽屹立在香港这个城市 and 更广阔的世界，世界各地的人通过高速铁路、地铁、公交车和渡轮码头连接环球贸易广场到国际机场和中国大陆 (Mallot, 2011)。其塔楼与地面和交通枢纽的关系被中庭和拱形屋顶所弱化和柔和 (图7)。另外，中庭在圆方购物中心和办公塔楼的运用其至关重要是能有效并清晰地认识到不同用户在内部的交通动线。从九龙站到达的乘客通过商场到达塔楼中庭，其中连接着各种运输模式的多层次大堂会“过滤”不同类型的用户，并引导他们到区间电梯系统或前往空中大堂去到上层办公楼层，观测廊道和酒店 (Mallot, 2011)。

作为城市公共艺术或公共空间，在建筑之间的中庭能唤起与过去之间的联系，同时能复兴一些城市生活中被遗忘的元素。那些次要和被忽视的空间根据中庭类型不同，以及根据不同文化特性和内涵、城市之间的联系、气候控制、庇护所和空间组织等角度来看又呈现着不可忽视的可能性。RSHP建筑事务所 (Roger Stirk Harbour + Partners) 在华盛顿新泽西大道采用一个12000平方英尺的中庭空间，利用10层高的办公建筑与两栋现存建筑联系起来，它们在庭院空间之间的相互作用使之前相互独立没什么交流的两个现有建筑重新焕发活力。如今，局部通风的中庭空间成为聚会的场地，它不仅有助于生动建筑之间的人流动线，而且对新建筑的南立面也起到热缓冲器的作用。

中庭有助于建筑在水平和垂直两层面上进行扩充和添加，我们就可以逐步扩大建筑或城市密度却不用涉及与拆迁相关的资源问题。在芝加哥由GP建筑设计有限公司 (Goettsch Partners) 和罗汉协会 (Lohan Associates) 在2010年完成的54层楼高226米的蓝盾保险公司大楼 (Blue Cross-Blue Shield Tower) 其第二阶段的电梯系统的适应性就是第一阶段大中庭空间所促成的 (Goettsch, 2012)。

过渡空间是周围城市与自然环境良好发展的重要催化剂，这样的联系对我们对以人为本的动态及高效的城市街区的追求至关重要。然而，我们去考虑如何仿效高层街道环境可能对地面状况的影响也是非常重要的。高层空间必须对地面空间寻求补充，以避免那些在地面上的空间被淘汰，并导致城市的消逝。



Figure 7. The International Commerce Centre (ICC) in Hong Kong anchored to the city and the transport hub via an articulated atrium (Source: Marshall Gerometta, CTBUH)

图7：香港环球贸易广场通过立体式中庭将城市和交通枢纽连接起来 (来源：Marshall Gerometta, CTBUH)

types and directs them to a system of local elevators and high-speed shuttles to sky lobbies for the upper office floors, observation gallery, and hotel” (Malott, 2010).

Atrium as an urban intervention or public space between buildings can form evocative links with the past whilst lending renewed interest and life to forgotten elements of a city. Leftover and neglected spaces present vital opportunities from multiple perspectives: cultural identity and meaning, urban linkages, climate control and shelter, and spatial organization, all of which can be made possible via the atrium type. Rogers Stirk Harbour + Partners linked two existing office buildings with a new 10-story office building on 300 New Jersey Avenue in Washington DC (2004) by a 12,000 ft<sup>2</sup> central unifying and animated atrium space, such that the three buildings faced inwards, enabling interaction between them where previously the two existing buildings operated as two independent buildings that did not communicate or acknowledge the vital courtyard space between them. The partially ventilated atrium now serves as a meeting place, aids circulation between the buildings, and acts as a thermal buffer to the south façade of the new building.

Atria aid vertical and horizontal additions and extensions to buildings such that we can incrementally expand building/city densities without the resource implications associated with demolitions. The vertical expansion of the 54-story (227-meter) Blue Cross-Blue Shield Tower (completed in 2010) by Goettsch Partners and Lohan Associates in Chicago was made possible by the incorporation of large atrium spaces in phase one that accommodated elevators for phase two of the project (Goettsch, 2012).

Transitional spaces offer vital opportunities for interfacing with the surrounding urban and natural environment. Such dialogues are central to our pursuit of connected and human-centric urban communities that are functional, dynamic and efficient. However, it is important to consider how emulating the street environment higher up may affect conditions on the ground. The elevated spaces must seek to complement those at ground level to avoid allowing the ground level from becoming obsolete and leading to the demise of the city.

## Environmental Dimension

Contemporary atria are being reconsidered, often with the rationale of climate modification and energy-efficiency, achieved

mainly through passive heating, cooling and daylighting. An atrium acts as a sheltered buffer space between the exterior and interior that may not be fully conditioned but brings in daylight while excluding wind, rain and temperature extremes. Atria act as heat sinks/stores and can be used as return air plenums and ventilation chambers. The atrium has developed particularly effectively in cooler climates at higher latitudes where expanses of glass may not succumb to excessive solar gain and overheat, whilst at cooler times provides a thermal buffer.

Many skyscrapers incorporate large central atria and smaller peripheral voids to enable natural ventilation through stack effect and increase daylight, making noteworthy contributions to the building's sustainability (Merrill and Gray, 2012). The prominently and strategically located atria of Shanghai Tower (Figure 6) are passive in nature, in that they are daylighted, they need minimal heating and cooling, and act as a buffer between the external environment and the inner office spaces and the hotel, thus reducing energy use significantly whilst creating public spaces with panoramic views.

The Seoul Lite Digital Media City (DMC) Tower in Seoul, which will be completed in 2017, boasts of a streamlined and tapered form and incorporates along with the two perimeter voids, a tall central atrium in the top half of the building that aids natural ventilation through stack effect and brings in ample daylight without excessive solar gains. Furthermore, “innovative materials and a phytoremedian greenwall within the atrium enhance daylighting and clean the air” (Merrill and Gray, 2012). The atrium façades are lined with glass panels that reflect light, improving daylight levels and reducing the use of artificial lighting at the core of the building. Additionally, the attenuated form of the building and the louvered façades reduce solar radiation while the photovoltaic panels integrated in strategic parts of the façade and the wind turbines at the top of the tower produce energy. This building showcases the important role of atria combined with other strategies in enabling stack ventilation, daylighting and solar gain reduction in tall buildings.

The award winning Parkview Green in Beijing (Figure 8) by Integrated Design Associates is a mixed-use building that combines a six-star hotel, retail facilities and a grade-A office space. These functions housed in the four buildings are pulled together by a glazed ETFE envelope and a giant atrium. ETFE offers the benefits of improved light penetration and solar heat gains. This efficient envelope and

## 环境维度

现代中庭正在被重新思考，其思考方向往往与气候调节的基本原理和能源利用率这些领域有关。为了达到这个目的的手段则主要是基于被动加热、制冷和采光系统。中庭作为一个内部与外部遮挡的/缓冲的空间，可能不是完全复合各种条件，但可以起到采光、遮风挡雨和隔绝极端温度的作用。中庭也拥有散热/储热功能并且可以被用作回风室和室内通风井。中庭空间在高纬度寒冷气候下尤为有效，在这种地区大面积的玻璃并不会由于吸收大量太阳能而过热，同时又在天冷的时候起到热缓冲器的作用

许多摩天大楼把大型中庭和边庭结合在一起设计，通过他们所形成的烟囱效应来获得自然通风并改善室内采光效果，为摩天大楼的可持续性做出了突出贡献(Merrill and Gray, 2012)。上海中心大厦(图6)策略性地设计了大型中庭的位置，使其仅需少量加热或冷却就可以作为内部办公室和宾馆与外部环境的缓冲区域，这样可以在有效减少能源使用的同时创造全景式的公共空间。

在韩国首尔的DMC大厦(The Seoul Lite Digital Media City Tower)即将于2017年竣工，其拥有流线型与锥形形态，位于建筑上半部分的大型中庭帮助建筑通过烟囱效应获得了自然通风并且在不吸收过多太阳能的情况下能获得大量的室内采光(Merrill and Gray, 2012)。中庭内部立面排列着用于反射光的玻璃板，以此来提升建筑中心的采光等级并且降低了人工照明的浪费。另外，逐渐收细的建筑体形和装有百叶的立面减少了太阳辐射，同时安装的光伏面板立面以及在塔顶的风力涡轮能够产生能量。这栋建筑展示出了中庭扮演着与其他节能技术策略相结合的重要角色，使其可以帮助建筑起到自然通风、采光以及减少太阳辐射的效果。

在北京由IDA建筑事务所(Integrated Design Associates)设计并获得了大奖的芳草地(Parkview Green)(图8)是一个集六星酒店、购物与A级别办公空间于一体的混合多功能建筑。不同功能的四栋建筑被透明“外膜”和大型中庭包裹起来，透明“外膜”在改善阳光参透与太阳能采集发挥着作用。这种高效能的膜材料与缓冲空间创造了许多“微气候”区域并且它们可以相对统一并易于进行调节。这个缓冲空间在寒冷的冬季起到防护罩作用，而夏季能够利用通风百叶和膜材料进行自然通风热空气时通过顶部及侧边的百叶与中庭空间产生的烟囱效应上方溢出，同时形成一股上升气流，形成空气流动和自然通风。(http://projectgroup.asia/pgasustain/experience/park-view-green/)。也许，这种采取被动式策略与中庭概念相结合的方法最终会“催化”出与环境友好的零消耗或生产能量的摩天大楼。



buffer creates several zones of microclimate that are relatively uniform and well controlled. The buffer zone offers insulation in the harsh winters while the ventilation louvers within the envelope aid natural ventilation in the hot summers. Warm air escapes through stack effect from the louvers at the top and side and from the atrium space while cool air is drawn from the bottom of the building. This is aided by a supplementary earth and radiant cooling system in summers. The incorporation of passive strategies aided through the atrium concept along with integrated renewables may eventually lead to net zero or energy producing towers that contribute positively to the environment.

## Conclusion

The success of atria relies on the delivery of functional, aesthetic, environmental, urban and social objectives simultaneously. The environmental potential of atria has long been recognized as it enables natural ventilation, daylight and thermal buffering. The rich visual and spatial characteristics of an atrium and its often prominent location and links with the outside mediated by its predominantly transparent enclosure contributes to its aesthetic experience. Consequently, atria are increasingly used in a range of building types both on the ground and at height, creating distinctive buildings and memorable social spaces with personalities. They are of particular relevance in the context of large-scale, mixed-use tall buildings and the increasing homogenization of urban centers worldwide.

Atrium spaces support complex transitions and social interactions of various capacities in cities. The movement and activities aided by atria, when successfully extended from outside in and from the ground plane up, have the potential to create continuous city experiences. However, their internalized disposition may result in exclusivity and segregation and therefore calls for caution in both their planning and execution and a balance between access and control.

Atria can play an instrumental role in setting up a constructive dialogue with the past, giving forgotten public spaces a new lease of life such that their physical fabric is preserved, value and meaning is enhanced, and resource efficiency is ensured. Indeed, atria can add to the urban morphology and street patterns due to their ability to integrate with infrastructure, landscape and public facilities. Atria at ground level or at height can become important anchors of activity, integrating tall building with the urban habitats more



Figure 8. Four buildings of the Parkview Green in Beijing, held together by a giant atrium (Source: Terri Boake, The Skyscraper Center)

图8：北京芳草地四座建筑通过巨大中庭联系在一起（来源：Terri Boake，摩天大楼中心）

## 结论

综上所述，中庭空间的成功取决于功能、美学、环境、城市与社会各方面目标的同时实现。一直以来，中庭在自然通风，自然采光与热隔离方面的环境潜力被公众所认可。中庭在视觉与空间上的特征，在建筑中常常显著的位置以及在自身透明性影响下与外界的联系都塑造了中庭的美学体验。因此，中庭不断的出现在各种类型建筑中，创造出个性化的建筑与人性化有纪念意义的社交空间。而在全球化和同质化的时代背景之下，在大型多功能建筑或高层建筑里的这些空间显得更有意义。

中庭空间为城市中复杂多变的社会交流提供了可能性。将室外的流线与活动成功的引入建筑内部并扩散到上层空间，中庭也因此创造了连续的城市体验。然而他们向心化的特质可能导致空间的隔离，需要我们对中庭的设计与实施，以及空间连接与控制的平衡方面更加注意。

中庭空间能在与过去的进行建设性对话中扮演重要角色。它可以给予被遗忘的公共空间新的生命，诸如保留它们的肌理，提升它们的价值与意义，促使资源

的有效利用。同时中庭能够与基建，地貌和公共设施结合，因此它也有利于城市形态与街道形式。不论是在地平层或是建筑上层，中庭空间都能吸引活动，将高层建筑与城市环境紧密的联系在一起。这些扩展到建筑上层的公共领域，被联系起来的塔楼垂直空间，以及建筑的竖向交通，在中庭地作用下都能更好的与城市发展结合在一起。为了将城市各自迥异的地区联系起来，中庭提供了一个崭新而又令人振奋的机会。

与绿化结合的中庭，能够成为高层建筑的中心，将自然地貌带入这一垂直社区的中心，并成为一个城市水平与垂直公共绿地的代表性特征。从这个角度来说，我们才真有可能从现有的以零星的绿化或是单一的绿墙为主的绿化设计进化到更加多元、立体、可达性高的绿色公共空间。这也将是围绕城市垂直社区发展的枢纽。

高密度，大尺度，混合多功能的城市发展将是未来可持续城市的特色，它们结合交通，景观，为中庭的设计提供了不仅多样，而且令人振奋而又富有意义的可能性。中庭正逐渐成为以垂直城市公园为形式的城市开发的中心。这些开发

seamlessly. The extension of public realm above ground, linking vertical towers and with transport infrastructure realized through such spaces, could lead to more integrated city developments. This points to the important opportunity for such spaces to connect disparate components of a city in exhilarating, novel and eloquent ways.

Atria incorporating greenery have the potential to become centerpieces of tall buildings that bring in natural landscape to the heart of the vertical communities and become defining features of a city's ground and elevated common greens. In this sense, there is real potential for a departure from the current approach of incorporating piecemeal green spaces or green façades to one where dynamic, elevated and accessible green

public spaces become nodes of a city around which vertical communities may evolve.

Future sustainable cities characterized by tall, dense, mega-scale and mixed-use developments that integrate transport, landscape and more offer the atrium concept to proliferate in diverse, exciting and meaningful ways. Atria may increasingly manifest as centerpieces of developments in the form of elevated urban parks that are inclusive, incorporate transport and other public uses, and seek to overcome the energy efficiency and resource use challenges, as well as the psychological barriers associated with high-rise living. They may have an important role to play in creating people-centric sustainable towers of the future and humanizing the so called "giant" urban habitats.

也结合了交通与其他公共用途，去努力克服能源效用与资源使用的挑战和高层生活面临的心理障碍。中庭空间在创造未来以人为本的可持续发展的高层建筑，以及人性化所谓的“摩天”城市生活的过程中也将扮演着重要的角色。

---

## References:

**300 New Jersey Avenue.** Available at: <http://www.richardrogers.co.uk/render.aspx?siteID=1&navIDs=1,4,25,1271> (Accessed 25 April 2014).

Abel, C. (2010). **"The Vertical Garden City: Towards a New Urban Topology"**, CTBUH Journal. 2, p20-30.

Anderson, R. (2005). **The Great Court At The British Museum.** London, The British Museum Press.

Bednar, M. (1986). **The New Atrium.** McGraw Hill.

**Blue Cross-Blue Shield Tower, Chicago.** Available at: <http://www.ctbuh.org/TallBuildings/FeaturedTallBuildings/Archive2010/BlueCrossBlueShieldTowerChicago/tabid/3472/language/en-US/Default.aspx> Posted August 2012 (Accessed 25 April 2014).

Burdett, R and Rode, Philipp (2007). **"The Urban Age Project"**, in Burdett, R and Sudjic, D (Eds) The Endless City. London: Phaidon Press Limited.

Carmona, M., Tiesdell S, Heath, T, Oc T (2010). **"Public Places – Urban Spaces The Dimensions of Urban Design"**, (2nd Edition), Elsevier.

Goettsch, J. (2012). **"How Tall Buildings Meet the Ground is as Important as How They Meet the Sky"**, CTBUH 9th World Congress Shanghai 2012 Proceedings, 19-21 September.

Malott, D. (2010). **Case Study: Hong Kong International Commerce Centre.** CTBUH Technical Paper. Available at: <http://www.ctbuh.org/LinkClick.aspx?fileticket=xOITlt%2f4ljc%3d&tabid=1090&language=en-GB> (Accessed 4 June 2014).

Merrill, E. and Gray, L. (2012). **A Paradigm Shift in the 21st Century Skyscraper.** CTBUH 9th World Congress Shanghai 2012 Proceedings. Available at: <http://www.ctbuh.org/LinkClick.aspx?fileticket=QoC12R9iWaQ%3D&tabid=90&language=en-GB/> (Accessed 4 June 2014)

Oldenburg, R. (1999). **The Great Good Place: Cafes, Coffee Shops, Bookstores, Bars, Hain Salons and the Other Hangouts at the Heart of a Community.** (third edition) Marlowe & Company: New York.

**Parkview Green in Beijing, China by Integrated Design Associates-2012.** Available at: <http://projectgroup.asia/pgs-sustain/experience/park-view-green/>

Pomeroy, J. (2007). **"The Sky Court - A viable alternative civic space for the 21st century?"**, CTBUH 1ST ANNUAL SPECIAL EDITION, Fall.

Saxon, R. (1986). **Atrium Buildings Development And Design.** Architectural Press: London.

Saxon, R. (1994) **The Atrium Comes Of Age.** Longman: London.

**"World population projected to reach 9.6 billion by 2050 – UN report"**. UN News Centre. June 13, 2013. Available at: <http://www.un.org/apps/news/story.asp?NewsID=45165> (Accessed 4 June 2014)

Xia, J., Poon, D. and Mass, D.C. (2010). **"Case Study: Shanghai Tower"**, CTBUH Journal, Issue II.