DESIGN

Health by Design

RAMBOLL

EDITION NO. 9
OCTOBER 2024

Prologue

Today, approximately 87% of the population in industrialized countries live urban lives, spending 90% of their time within the built environment. This environment, which shelters us from harsh natural conditions and supports comfort, safety, and productivity, significantly impacts our health and wellbeing.

Given the substantial time we spend in such settings, it's crucial to identify and rectify environmental deficiencies to enhance our quality of life through design.

The built environment should not be hermetically sealed but must closely resemble our natural surroundings to promote homeostasis, the balanced interaction between our internal physiological state and external environmental stimuli.

Copenhill Power Plant, Copenhagen, Denmark (Bjarke Ingles Group)
A revolutionary waste-to-energy plant, that powers 150,000 homes with clean energy. Its rooftop also offers a ski slope, hiking trails, and a climbing wall, encouraging active lifestyles in the heart of the city.

Biophilic Environments

At its inception in 1984, the “Biophilia Hypothesis” by Stephen R. Keller and Edward O. Wilson posited that humans possess an “innate emotional affinity” for nature and living organisms, rooted in evolution.

This concept, explored from psychological, sociological, and physiological perspectives, how this affinity impacts health, productivity, and well-being, influencing architectural and urban design.

The biophilic design approach can be **summarized in five major principles:**

Direct Experience of Nature:
Incorporating natural elements like light, water, plants, natural materials, and views of nature.

Indirect Experience of Nature:
Evoking nature through design elements such as lighting, color, texture, organic forms, and images of nature.

Spatial Conditions:
Creating environments with natural spatial hierarchies, providing vistas, safety, engagement, and a sense of controlled risk.

Evolved Human-Nature Relationships:
Designing with climatic, diurnal, and seasonal conditions, using natural elements and local materials, native vegetation, and cultural artifacts.

Health and Wellness Integration:
Designing environments that simulate natural rhythms, light and temperature changes, and air movement, contributing to health and wellbeing.

These principles, scientifically tested to improve health and performance. Research shows exposure to natural environment reduces blood pressure, heart rate, and stress hormone levels. Neuroimaging indicates nature scenes increase brain activity associated with emotional stability and stress reduction.

Children with regular access to nature show reduced attention deficit symptoms, better social interactions, and improved academic performance. Interwoven green spaces with ample daylight are linked to reduced stress, better cognitive performance, and mental health. Spaces designed for physical and social activity enhance fitness, mood, and wellbeing.

Building materials impact indoor air quality, aesthetics, lighting, and occupant health. Natural materials like wood promote calm and wellbeing, fostering a healthier built environment.

The Complexity of
Health and Space

An unintended consequence of urbanisation, noise pollution can lead to stress, sleep disruptions, and cognitive impairments.

A noisy environment can trigger the release of stress hormones, which in the long term can contribute to chronic health issues such as hypertension and cardiovascular diseases. Controlled noise environments, however, can promote mental tranquility, enhance focus, and support cognitive performance.

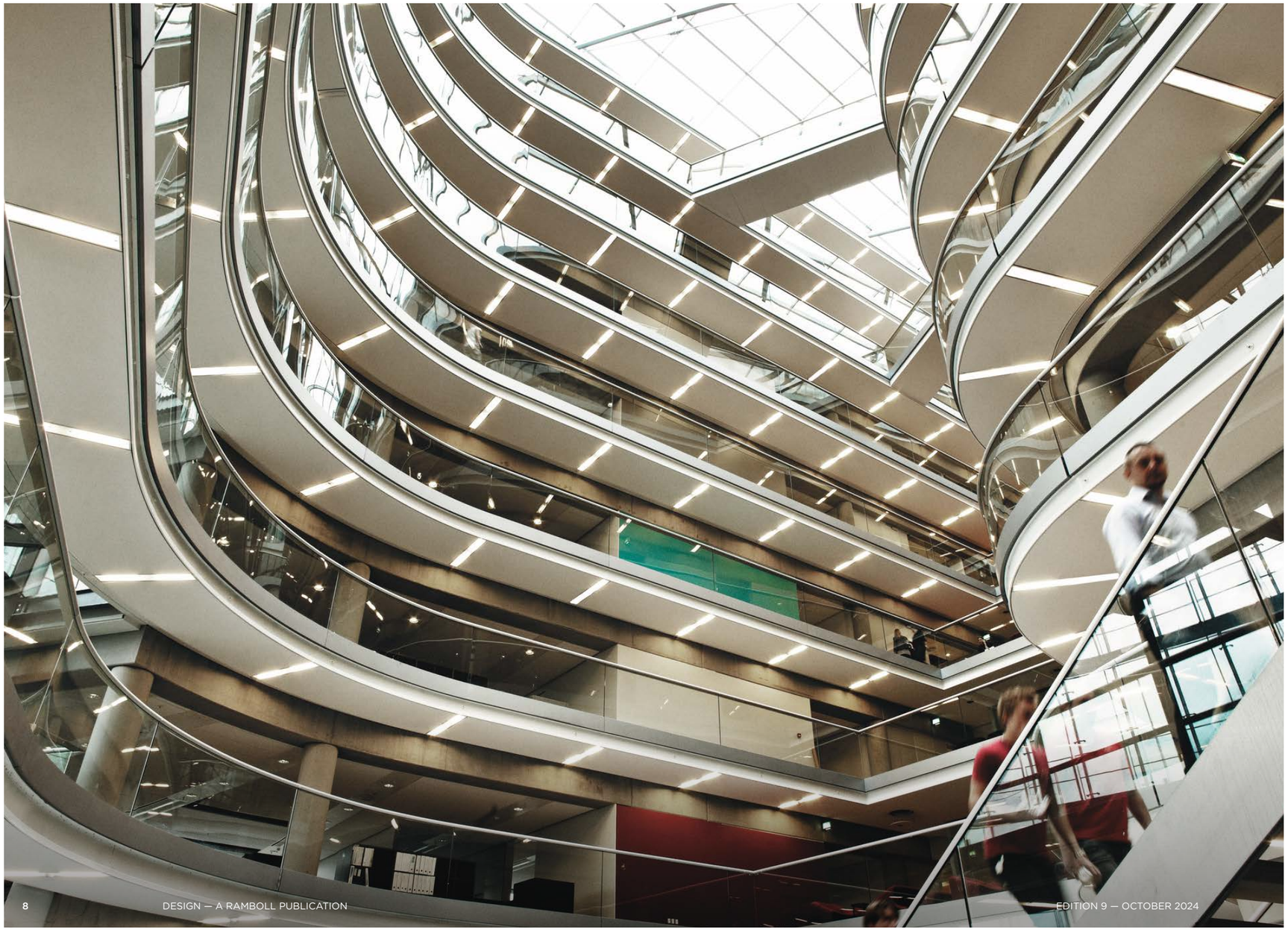
Poor indoor air quality can lead to a range of health issues, including allergies and respiratory disorders.

Research shows CO_2 buildup and reduction in oxygen affect the cognitive domain by, reducing the ability to make decision-making tasks, concentration, and focus, and impairing both short-term and long-term memory. Even a few degrees of temperature difference can affect our cognitive performance and mental acuity.

Bridging the gap between cognitive and environmental psychology, neuroscience, design, and engineering of the built environment can produce places, optimized for human health, happiness, better performance, and wellbeing.

We can design buildings that promote health, schools that enhance children's learning abilities, homes and offices that foster positive moods, productivity, and relaxation as needed, hospitals that expedite healing processes, and care and work facilities that reduce accident rates and promote overall health.

We can design healthier environments by closely mimicking the daily conditions of our natural environment.



Then there is light

Among the various aspects of the built environment, the impact of light on our health, physical and mental performance is exceptionally significant. More than a mere source of illumination for vision and visual task performance, light is the main environmental cue, regulating our circadian rhythms, sleep cycles, mood fluctuations, sustained vigilance, and cognitive performance.

Our biological rhythms are finely tuned to the daily cycle of natural light, disruption of which can lead to sleep disorders and a whole host of acute adverse effects and chronic diseases.

Called photoentrainment, exposure to daylight entrains or synchronizes our circadian rhythms, for improved sleep quality and duration. The disruption of sleep and circadian rhythms influences a wide range of physiological processes, including metabolism, hormone regulation, and immune function.

A well-lit workspace or learning environment can boost alertness, focus, mood, vigilance, cognitive performance, and productivity.

While most interior environments are dimly lit during the day, excessive exposure to bright electric light at night, disrupts our circadian rhythms, leading to sleep disorders and associated health problems.

Exposure to daylight enhances alertness and cognitive function, while insufficient light can lead to fatigue and decreased focus. It is equally important to avoid bright lights at night as they can have a disruptive and delaying effect on sleep and the timing of the circadian rhythm.

Healthy Cities

Noorderplassen in Almere, The Netherlands
A modern suburban area featuring artificial islands nestled on the Flevoland polder, surrounded by the serene beauty of nature and the Nieuwe Land national park

“A healthy city is one that continually creates and improves its physical and social environments and expands the community resources that enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.”

World Health Organization (WHO)

Health and wellness have been an increasing focus for cities around the world as citizens have taken a more active in their personal health in the aftermath of COVID-19 and have started to demand more from policymakers to ensure they can lead healthy lifestyles.

In developed economies, this might include improving provision and access to outdoor space for exercise, reducing air pollution, providing infrastructure to support active travel, or policies which help reduce unhealthy behaviours such as prohibiting smoking in public places or stopping unhealthy food outlets from opening close to schools.

In developing economies, the needs may be more basic such as improved water quality or access to sanitation and health facilities. A focus on health has been brought to the forefront due to the COVID-19 pandemic, but modern lifestyles and consumption have led to other health crises that have been developing over a number of decades such as rises in obesity, diabetes, cardiovascular disease, and mental health problems.

In this sense a healthy city should aim to:

- create a health-supportive environment,
- achieve a good quality of life,
- provide basic sanitation and hygiene needs,
- supply access to health care.

Good progress around the world has been made in providing basic sanitation and hygiene as wellas supplying access to healthcare; attention has now turned to creating health-supportive environments and raising quality of life.

Studies show that approximately 75% of our health depends on the environment in which we develop our lives; that is, the combination of lifestyles, built environment, natural surroundings, and social relationships.

The built environment can encourage or discourage active lifestyles, car dependency, social cohesion, and much more, which affects our health.

Public spaces, buildings, neighbourhoods, and cities themselves have an impact on physical, mental, and environmental health. This means that collective health is largely determined by policies outside the health sector.

Namba Parks, Osaka, Japan
Namba Parks, an urban retail and entertainment complex, features lush gardens, cascading greenery, and open-air terraces that encourage relaxation and outdoor activity. By seamlessly integrating nature into its design, it provides a peaceful escape from the city, demonstrating how well-designed spaces can promote both mental and physical well-being in an urban environment.

Reducing Urban Loneliness

An ‘inclusive city’ is also a ‘healthy city’ as it facilitates social interaction and access to services and amenities. Cities offer lots of opportunities for social interaction due to their density of people and places but they can also lead to isolation and loneliness if they aren’t inclusive of all people, having damaging effects on people’s mental wellbeing. Outside of the home or places of work or study, the supporting social infrastructure of the city provides ‘third places’ for people to meet others and feel part of a community whether it is a local park, sports club, local pub, cafe, or religious institution.

These are our “happy places” where we speak to friends, meet new people, and feel part of something. There is a consensus among practitioners that compact, mixed-use, and amenity -rich neighbourhoods can bring not only economic benefits but also create sustainable, healthy, and resilient places.

The world’s most successful neighbourhoods are all characterised as being vibrant and interesting; places full of vitality that encourage ‘street life’, activity, and most importantly social interaction.

Primrose Hill at sunset, London, UK
As a vital part of London’s urban landscape, Primrose Hill promotes mental and physical well-being by encouraging outdoor activity, mindfulness, and relaxation.

Harnessing the Wisdom of Age:

A Path to Climate Resilience

As we stand at the confluence of two defining global trends—the rise in the number of older persons and the increasing frequency of climate-related natural disasters such as extreme heat or flooding—societies worldwide face a dual challenge of unprecedented magnitude.

This reality prompts two critical questions:

- How can we care for the growing number of older persons in our society?
- And how can we reduce their vulnerability to disasters while empowering them to contribute to resilience-building efforts?

Addressing these issues requires not only intelligent policymaking but also practical, grassroots solutions that involve citizen engagement at every level.

The intersection of global aging and climate change increases the vulnerable population at risk.

By 2050, projections indicate that the elderly population will double globally, imposing an urgent mandate on our society to adopt age- and climate-ready practices. The unique vulnerabilities of older persons to climate-related hazards necessitate targeted attention. Factors such as reduced mobility, diminished cognitive capacities, and altered physiological responses to heat significantly elevate their risk profile. A significant portion of fatalities in recent major natural disasters such as extreme heat, earthquake, or hurricane are reported to be among those over 60 years old.

Furthermore, studies have shown that even minimal temperature increases can significantly elevate mortality rates among the elderly.

The 2023 report of the Lancet Countdown data projects that heat-related deaths of people older than 65 years increased by 85% compared to 1990-2000, far exceeding the 38% increase that would have occurred without temperature changes. These statistics underscore the necessity for tailored interventions for this demographic.

To mitigate these risks and enhance resilience, several **strategies can be recommended:**

1. Developing Age-Inclusive Disaster Preparedness Plans:
This includes modifying hazard maps, evacuation plans, and creating age-appropriate evacuation centers that are easily accessible. Such plans must consider the specific needs and limitations of older persons during emergencies.

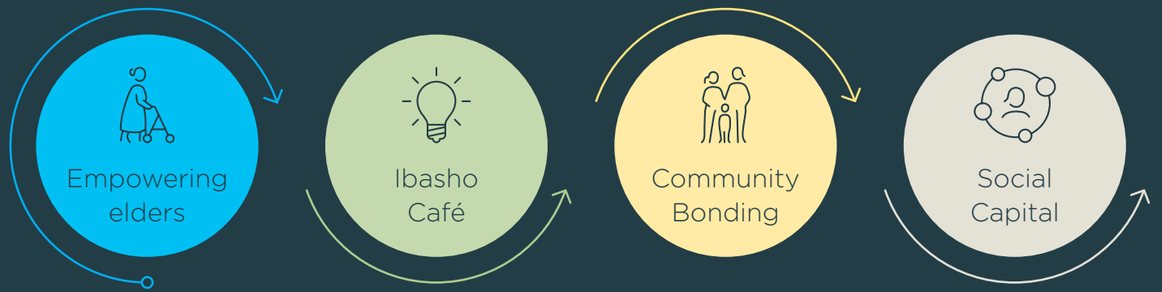
2. Constructing Climate-Resilient and Energy-Efficient Housing:
Housing should be designed to withstand extreme weather conditions and to maintain comfortable indoor environments without excessive energy consumption. This approach not only protects older residents but also contributes to broader sustainability goals.

3. Designing to encourage independent living:
As the number of older persons rises, the availability of caregivers may not keep pace. Urban and residential design should thus incorporate features that support independence and reduce the need for extensive caregiving, such as smart home technologies and accessible infrastructure.

4. Cultivating Age-Friendly Communities with Robust Resilient Hubs:
Communities should foster environments where older persons feel valued and included. Resilient hubs can serve as centers for emergency preparedness training, resource distribution, and community building, ensuring that older residents are not isolated during crises.

Ibasho and Theory of Change

Theory of change for Ibasho Café Project:



- Challenging social perception about aging
- Changing mindset Of care
- Empowering elders

- Elders as a resource
- Reverse role of care
- Community ownership
- Transfer of knowledge

- Multi-generational interactions
- Various levels Of relationships: thin and thick
- Informal support

- Network
- Belonging
- Efficacy
- Trust
- Reciprocity

- Strengthening community resilience to mitigate and prepare for global aging and climate change

Despite the common perception of aging as synonymous with vulnerability, older persons possess invaluable wisdom and experience that can significantly contribute to societal resilience, particularly in times of crisis.

By marginalizing older populations, societies miss out on the positive roles elders can play in disaster response and community cohesion.

Models like “Ibasho” illustrate how empowering older persons in planning processes not only enriches the societal fabric but also enhances preparedness for unforeseen disruptions. In communities heavily affected by natural disasters in Japan, Nepal,and the Philippines, older members have created community hubs where they contribute to community members of all ages instead of being merely served.

They have improved existing evacuation maps and plans to fit the needs of older persons, making the community hub an evacuation/resource center to prepare for future risks. Older persons are taking a leadership role in increasing community resilience through strengthening their social capital.

As our society navigates the complexities of climate change and aging populations, empowering older persons emerges as not only a necessity but a strategic imperative. This requires a concerted effort among policymakers, planners, architects, community leaders, and older persons to create environments that are both age-friendly and climate-resilient.

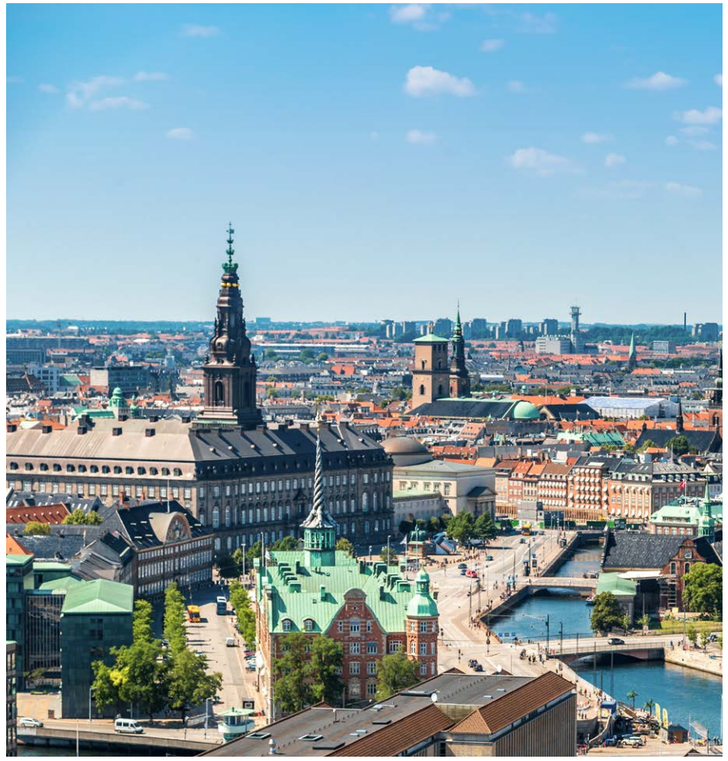
Such collaboration is essential to foster inclusive, adaptable urban landscapes for all.

Healthy City Inspirations from around the world

Copenhagen

has long been an advocate of putting health at the forefront of planning policy which has resulted in it continually performing well in liveability and healthy city indices. Some of it's success can be attributed to national policies which are recognised as some of the most progressive in the world.

Denmark provides a strong social security support to it's citizens which reduces inequality and helps with mental well-being. However, spatial planning plays a big role also. In Copenhagen promoting health in everyday life is central to it's success with high levels of cycling and outdoor living despite the weather being challenging at certain times of the year. Copenhagen has invested in making cycling and walking the default and easy choice for many and has also worked hard to maximise its natural assets, with high-levels of greenspace per capita and providing opportunities for recreation in it's rivers and waterways. It also a city working hard towards becoming carbon neutral with initiatives that require all flat roofs to be planted with vegetation.



Singapore

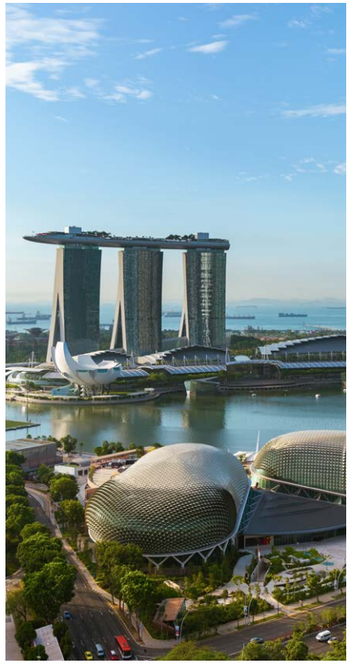
is a city which is recognised a world leader in resilience. Urban planning in this city state is centred on vision of a contemporary 'garden city' which manifests itself through a network of parks, green spaces and waterways. Vegetation starts out on the ground and reaches the very top of buildings, it grows on terraces and also inside houses and offices. But this has not always been the case the city has been transforming the green infrastructure over the previous 50 years to become a garden city.

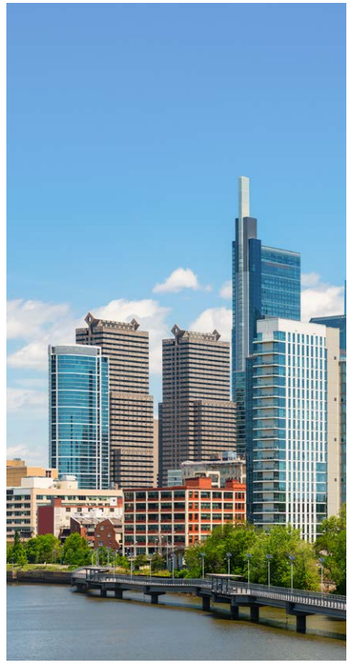
The UK, and London

in particular, are encouraging healthy urban environments using policies for increasing urban greenery through initiatives such as the introduction of an Urban Greening Factor (UGF) as well as the promotion of a 'National Park City' concept which aims to make the capital 'greener, healthier and wilder'. The UK Government has also recently introduced a requirement for all sites over a certain threshold to deliver a minimum of 10% Biodiversity Net Gain (BNG) as part of the planning process.

In Philadelphia, USA

the Green City, Clean Waters program has implemented a citywide mosaic of green stormwater infrastructure. Through hundreds of projects forged through numerous public/private partnerships, the city has created over one thousand "greened" acres to restore the natural precipitation cycles and systems of the area.





Epilogue

Collectively architects and engineers have a larger impact on human health than medical practitioner. As designers, architects, and engineers we are shaping the built environment which has become the dominant living environment for majority of people around the globe with great health consequences. We are, in a way, shaping peoples' health and wellbeing. We have, therefore, a responsibility to bridge the pertinent scientific advances with the built environment to heal, inspire action and emotions, and foster wellbeing.

Eden Project, Cornwall, UK (Grimshaw Architects)
Iconic biomes housing diverse plant collections, fostering well-being and environmental awareness through nature-inspired design and immersive educational experiences

Ramboll is a global engineering, architecture and consultancy company founded in Denmark in 1945. Across the world, our 18,000 experts create sustainable solutions.

We combine local experience with a global knowledge base to create sustainable cities and societies, driving positive change for our clients, stakeholders and society. We enable our stakeholders to realise their goals and navigate the transition to a more sustainable future.

Bright ideas. Sustainable change.

DESIGN is a periodical publication by the Design Excellence Board (DEB) within the Buildings Market in Ramboll.

The publication promotes and articulates latest ideas on matters relating to design, technology, environment and ethos within the design industry and the built environment, at large. It aims to address key issues facing contemporary design professionals, including our evolving relationship with the natural environment; as well as pressing political and social agendas for the built environment.

Editor in Chief
Hossein Rezai-Jorabi

Contributing Editor
Lai Wan Sing

Contributing Writers
Ali Heshmati (Henning Larsen) – Page 2 to 9, 22 to 23
Shira de Bourbon Parme, Sean Cleary, and Kosh Kar – Page 10 to 15, 20 to 21
Emi Kiyota (National University of Singapore) – Page 16 to 19
Jean You (Future Cities Lab Singapore–ETH Centre) - Page 16 to 19

Creative Editor
Tadavarthy Mani Chandana

Design and layout by
Ramboll Global Design Centre

MIX
Paper from responsible sources
FSC® C008474