

OASIS OF EQUALS

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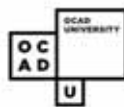
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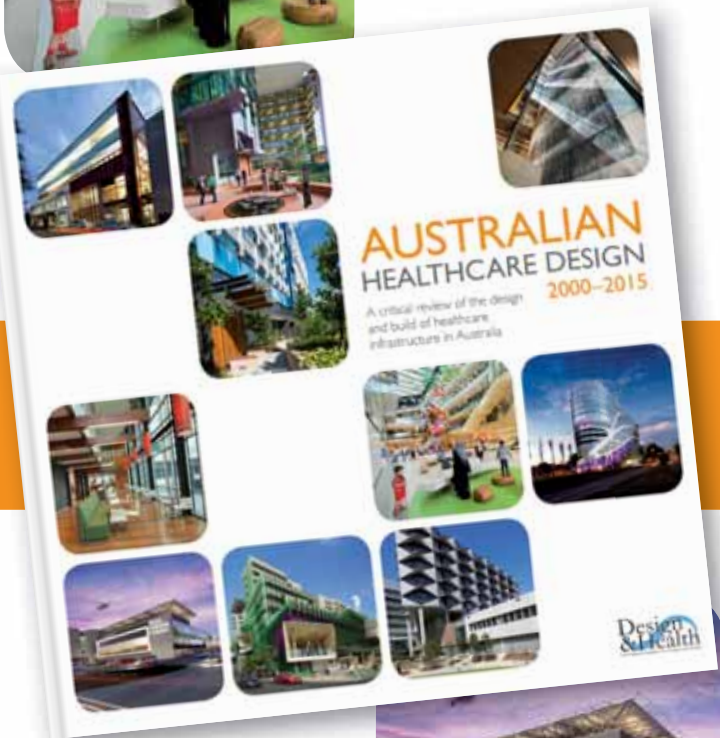




AUSTRALIAN HEALTHCARE DESIGN 2000–2015

A CRITICAL REVIEW OF THE DESIGN
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Australian Healthcare Design 2000–2015 is a review of past, current and future projects and trends in healthcare design in Australia. It is a unique reference publication for researchers and practitioners working in the field of healthcare design, both within the region and internationally. Fronted by a collection of essays from prominent Australian academics and practitioners, it also contains a comprehensive catalogue of projects delivered during the most remarkable period of capital investment in health infrastructure ever seen in the region.

Published by the International Academy
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Copeland with Marc Sansom, Kathleen
Armstrong and Emily Brooks



Contributors

Ray Pentecost
Understanding your environment, being able to attract and manage your resources and having a sense of purpose is the essence of the salutogenic organisation



Eve Edelstein
Emerging technologies can reveal the response of the mind and the body to specific features, changes and interventions in the design of the physical environment



Chloe Hamman
How do we measure the restorative potential of the living components of nature and its influence on mood and wellbeing versus artificial substitutes?



Rana Sagha Zadeh
What are the perspectives of the nurses themselves on the key characteristics of their work environments in respect of improving their health and their performance



Cliff Harvey
A review of a new book, *Design for Care*, that assesses the evolution and potential impact of a new design movement focused on healthcare experiences



Cover Image
The Beijing office of Roberts Interiors and Architecture. See pp 14-15



Voyage of discovery

The departure point for scientific research must by its very nature be a celebration of our own ignorance. Only by recognising how little we know can our scientists and researchers be intellectually prepared to embark on a true voyage of discovery. Science can be ruthless in exposing our ignorance, incompetence or confusion, but progress is dependent on accepting our weaknesses in order that we can become stronger. The criteria for a healthy organisation with a strong sense of coherence (salutogenic), as described by Dr Ray Pentecost (p13) is that it must be able to comprehend its environment; successfully manage and attract the resources it needs to fulfill its tasks; and have a meaningful vision for the positive impact it can have on society. Knowledge is an intangible resource, but it is the foundation for human comprehension, without which our coping strategies would flounder. Scientific research forms a vital component of this search for knowledge. Join us in the Middle East where there is a great thirst for knowledge which will be enriched by the Design & Health Middle East International Symposium in Doha, Qatar, from 13-14 November (see pp22-23). And make your contribution to the next Design & Health World Congress in Toronto (9-13 July, 2014) by submitting an abstract by 15 November (see pp 2,3,10,11), and if selected sharing your knowledge, experiences and expertise on a world stage.

Marc Sansom
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Winning at WAF in Singapore

Innovative designs for healthcare in Kuwait and the USA win at the World Architecture Festival Awards in Singapore

Innovative approaches to the design of health facilities in the USA and in Kuwait to support the reprogramming of health services were rewarded at the sixth World Architecture Festival (WAF), held at the iconic Marina Bay Sands in Singapore in October.

Designed by Perkins + Will, the Rush University Medical Center New Hospital Tower won the WAF Complete Buildings – Health category. A part of a major campus-wide transformation, the 800,000 sq ft hospital consists of 386 patient beds along with diagnostic and treatment facilities such as surgery, radiology and emergency departments.

The organisational concept consists of a rectangular six-storey base containing new diagnostic and treatment facilities topped by a five-storey curvilinear bed tower. The base connects to existing diagnostic treatment facilities to create a new continuous interventional platform. The geometry of the bed tower maximises views and natural light for patient rooms while also creating an environment for efficient and safe healthcare. The project also includes an orthopaedic building and a parking structure and new loading and delivery system. The judges said this was, “a sensitive approach to context, an innovative solution to a highly complex programme, combined in a compelling result that challenges stereotypes of institutionalised healthcare”.

In the WAF Future Projects – Health category, the winning submission brought recognition to the pioneering New Sulabhikahat Medical Centre, designed by Spanish practice AGI Architects. Addressing challenging issues such as privacy and security, the project applies a new model, where courtyards attached to the façade are the driving element behind an innovative typology.

The judges praised the reprogramming of existing health services that draws on the specific needs of the local community. “It overcame the limitations of the normal existing typology,” they said.

Over 2,100 architects and designers from 68 countries attended this year’s WAF in Singapore for three days of speeches, presentations and exhibitions.

The most prestigious category, ‘World Building of the Year’ was won by the Auckland Art Gallery Toi o Tamaki, New Zealand, designed by Francis-Jones Morehen Thorp and Archimedia.

This extensive public project includes the restoration and adaption of heritage buildings; a new building extension which more than doubles the public exhibition areas; extensive basement storage and support areas; and the redesign of adjacent areas of Albert Park. The design of the art gallery creates an openness and transparency to allow views through, into and out of the gallery circulation and display spaces into the green landscape of Albert Park.

Projects entered in this year’s festival awards, against a challenging global economic climate, reflected the festival’s theme of ‘Value and Values’ demonstrating the core factors that inform the relationship between perceptions of financial value and the values that architects typically hold regarding their work.

This year’s super-jury was chaired by Ken Tadashi Oshima of The University of Washington. The highly esteemed international judging panel also includes Ken Yeang, Llewelyn Davies Ken Yeang; Patrick Bellew, Atelier Ten; Jeanne Gang, Studio Gang Architects; and Dietmar Eberle, Baumschlager Eberle.

The World Architecture Festival will return to the Marina Bay Sands in Singapore between 1-3 October 2014. Entries for the WAF Awards 2014 will open in February 2014.

For more information visit: www.worldarchitecturefestival.com



The Rush University Medical Center New Hospital Tower, USA



The New Sulabhikahat Medical Centre, Kuwait



The Auckland Art Gallery Toi o Tamaki, New Zealand

New board embarks on new era

Inaugurated in Brisbane during the 9th Design & Health World Congress & Exhibition in July at its annual general meeting, the International Academy for Design & Health (IADH) has a new board of directors.

In combination with a new organisational and governance structure, developed under the guidance of Dr Ray Pentecost, the current president of the IADH, the new board will enable the non profit organisation to continue on its upward curve of influence in advocating to governments, industry, and building owners and commissioners the importance of designing environments that promote health, wellbeing and quality of life.

Previously constituting three executive directors, the new board has grown to 11 members, and will eventually number 13, as the presidential role evolves with the development of president-elect and past-president positions.

Supporting the work of the three executive officers, the new board is shaped around both geographic representation, with four new positions covering the Americas; Asia Pacific; Europe; and Africa and the Middle East; and four new positions covering market sectors and stakeholder groups, including government; design and build industry; research; and health providers and professions.

Dr Alan Dilani, founder and ceo, commented: "Since establishing the International Academy for Design & Health in 1997 with the 1st Design & Health World Congress in Trondheim, our community has grown into the leading forum in the world supporting the sharing of knowledge and research in the creation of healthy built environments."

"As we have grown and our influence has extended through the developed and developing world, it has become clear that a new structure is needed to further enhance our capability to support governments, universities and industry in recognising and embedding salutogenic and health-promoting design at the heart of our societies and infrastructure," adds Dr Ray Pentecost. "I am confident that the new board can deliver us into a new and exciting era as we execute our mission further and embed our principles and values with the support of our global knowledge community."

A new board of directors and organisational structure is set to deliver a new era of influence on the world stage for the International Academy for Design & Health

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Towards a Salutogenic Society

The Scientific Programme for the 10th Design & Health World Congress & Exhibition in Toronto will explore the global application of salutogenic perspectives on improving human health and wellbeing by design, writes *Alan Dilani*

The International Academy for Design and Health (IADH) will be organising the 10th Design & Health World Congress & Exhibition (WCDH 2014) in partnership with the Ontario Ministry of Research and Innovation, and supported by world-renowned academic institutions and healthcare industries worldwide.

The WCDH 2014 will be held from 9-13 July 2014 at the Fairmont Royal York Hotel in Toronto, one of the most multicultural population centres in North America, and a city with ambitious plans to place the health, wellbeing and quality of life of its citizenship at the heart of its plans for regenerating its urban and health infrastructure.

The health status of people living in Canada is one of the highest in the world, with rising life expectancies and falling mortality and morbidity rates. But the region's healthcare system faces similar challenges to the rest of the developed world, characterised by increasing cost pressures and a rise in the level of chronic diseases linked to unhealthy lifestyles, such as diabetes, obesity and cardiovascular diseases.

According to the World Health Organization (WHO), lifestyle is a key determinant of an individual's health status. Enhancing the quality of the environment, however, is also one of the most cost-effective and enduring approaches to improving public health.

Growing awareness of the importance of health promotion and the need to invest in healthy and sustainable public, social, domestic and urban infrastructure through the application of ecological and salutogenic design are at the leading edge of change in our society. Embracing these perspectives to shape our built environment and infrastructure investment, while embedding it at the core of a preventative care strategy changes the focus from risk factors and the treatment of disease to a more holistic understanding of the factors that determine a healthier society.

The salutogenic perspective embraces health promotion by exposing us to wellness factors in the built environment that support behavioural change towards healthier lifestyles. By improving our understanding of health as a process that engages social, mental, spiritual and physical wellbeing, the salutogenic approach acts on the knowledge that health is a key resource to the individual, the community and society, and it must be implemented in all environments where we are living, working and playing.

One of the most pressing needs is the regeneration of our existing infrastructure into more livable eco-cities, providing the foundation for the creation of a healthier society. Supported by world governments, a new generation of designers, architects and engineers is therefore needed to learn how to apply ecological and salutogenic design principles in their work.

Increasingly, healthcare providers must adopt a leadership role in health promotion as well as the treatment of disease. How we design our health infrastructure to better connect communities and urban life will support these efforts. The role of public-private partnership as the primary procurement model for infrastructure projects, including healthcare, poses challenges to apply the salutogenic approach that supports the delivery of healthy and sustainable environments.



From left: Prof Alan Dilani, Queensland Health Minister Lawrence Springborg MP and Dr Ray Pentecost speaking during the 9th Design & Health World Congress in Brisbane



Sharing ideas and exploring opportunities with colleagues during the exhibition at the 9th World Congress in Brisbane

Call for Papers

The IADH is committed to developing knowledge among the design and health professions in an effort to reduce the prevalence of lifestyle diseases and improve quality of life, and invites you to submit scientific abstracts for the 10th Design & Health World Congress & Exhibition in Toronto, Canada, from 9-13th July, 2014 by submitting abstracts on the following themes:

- The salutogenic hospital: leadership in health promotion;
- Innovation in procurement, delivery and operation: new models of public private partnership (P3/PPP);
- Case studies of successful healthy built environments;
- City life, culture and health: Stimulating built environments;
- Salutogenic design for healthy communities and urban and city planning;
- Developing international benchmarks in design and health;
- Innovation in the creation of healthy workplace environments; and
- Promoting active living and healthy lifestyles to prevent non-communicable diseases (NCDs)

Authors are invited to submit abstracts of 400 words in English. The abstract should clearly state the objectives, methods used, results and conclusions. The paper will be presented to an audience with diverse interests and disciplines. Consequently, we are seeking presentations that focus on the practical importance of environmental design qualities that promote health and wellbeing. Papers addressing more than one of the congress themes will be given preference.

All abstracts will be subject to a blind and rigorous peer-review process by the WCDH 2014 Scientific Committee. A select number will be chosen for oral presentation with a wider number presented as posters in a gallery within the exhibition area. Abstracts and enquiries should be submitted by e-mail to the WCDH 2014 Secretariat at info@designandhealth.com by no later than 15 November, 2013.

Proposals must include a title, author(s), organisational affiliation, and three keywords. Papers chosen for presentation will be published in the Final Programme and Book of Abstracts, with selected papers published in full in World Health Design in 2014-15.

The author(s) or co-author(s) should register and pay the registration fee in order to present the paper at the conference. The official language of the WCDH 2014 is English. Further information on the conference venue, hotel accommodation and registration fee will be provided in the Preliminary Programme in February 2014.



Timetable

15 September 2013

First announcement and call for papers

15 November 2013

Deadline for abstracts of papers

15 January 2014

Authors notified of decision of paper acceptance

1 February 2014

Preliminary programme and registration opens

15 May 2014

Deadline for speaker early-bird registration

Completed manuscript is due to the conference secretariat

1 July 2014

Book of abstract and final programme published

July 2014-2015

Selected papers will be published in World Health Design

Congress dates and schedule

The WCDH 2014 is a five-day event, which will be held from 9-13 July, 2014 at the Fairmont Royal York Hotel, Toronto, Canada.

Wednesday 9 July

Registration from 14.00-18.00

Pre-congress symposium

Opening Ceremony and Welcome Dinner from 19.30

Thursday 10 July Congress & Exhibition

Late registration from 08.00-09.00

Congress and exhibition from 09.00-18.00

Social programme to be advised

Friday 11 July Congress & Exhibition

Congress and exhibition from 09.00-18.00

Advisory Board Meeting of the International Academy for Design & Health from 19.30

Saturday 12 July Congress, Exhibition

& Academy Awards Gala Dinner

Congress and exhibition from 09.00-18.00

Academy Awards Gala Dinner from 19.30

Sunday 13 July Architectural Study Tours

Site tours and visits to local landmarks and health facilities



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In ancient times, great architectural feats of human achievement such as the Egyptian pyramids, the Colosseum in Rome, the Taj Mahal in India and the Great Wall of China all bear testimony to skilled organisation and management.

In modern society, we have all worked for, been served by or been affiliated with an organisation of some type or form, whether it is a commercial business, a government agency, an educational institution, a charitable or voluntary body, a social or health provider, a professional or trade group, or indeed a local sports team or club.

Since the so-called rise of the contemporary organisation as it rolled out across the now developed world following the industrial revolution, many theories have inspired or reflected the evolution of the organisation, from 'entrepreneurial' capitalism and scientific management theory in the late 19th and early 20th centuries to human relations modeling in the middle of the 20th century, the ideas of the learning organisation during the 1990s, and the concepts of today's remote organisation.

But the study of organisations is not a single theory. By its nature, it is a complex process and an interdisciplinary field of study. At the International Academy for Design & Health (IADH), our greatest feat in recent years has been to gain recognition within the design and health industries for the salutogenic perspective in the design of the physical environment and the potential improvement it can bring to human health.

It is a model that can be equally applied to the future evolution of the organisation.

The hypothesis is that the stronger an organisation's *sense of coherence* in respect of the application of its three dimensions of *comprehensibility*, *manageability* and *meaningfulness*, the more competitive and successful it will be. Firstly, to what extent does the organisation *comprehend* the world in which it exists, the political, social, economic, technical and competitive environment. Secondly, to what degree does it have the resources it needs to *manage* its tasks and develop its activities. And what is its sense of purpose and *meaning*, and how does this shape and filter through its culture. In essence, what is required to create a healthy organisation? Is it defined by its level of profit? Or by the wellbeing of its staff? Does its capacity to innovate and have an impact on societal needs define its success? How transparent is the organisation? How effective is its governance structure? Only once we have defined what we mean by a healthy organisation can we understand what interventions are required to transform, evolve and embed health-orientated changes.

Driven by its vision for a healthy, salutogenic society, the IADH has a very clear sense of purpose and meaning that has defined its success to date. To develop our capacity to influence change, notably at levels of government health policy and international development, we need however to improve our comprehension of the rapidly changing global environment around us, and at the same time, attract and develop the level and management of our resources. Just as we advocate the value and impact of salutogenic design on the physical environment, at the IADH we are also striving to set the standard for a salutogenic organisation and the next phase in the evolution of the firm.

Last year, I was tasked with providing the IADH with new bylaws, job descriptions, and policies and procedures for the purposes of both positioning the organisation to this end, as well as providing for an orderly transition of leadership in the future.

These tasks were completed in the spring of 2013.

The vision included an expanded board of directors, growing from three to thirteen, including five officers. The new board convened for the first time in July, 2013 at the 9th Design & Health World Congress in Brisbane (see p9).

The new leadership team will bring a stronger, more developed sense of coherence to the IADH, strengthening its comprehension of the different regions of the world, and the communities it serves; attracting more resources to enhance the quality and reach of the services it provide; and of course bring ever greater purpose to the influence the organisation exerts on how design can help to improve human health, wellbeing and quality of life.

Dr Ray Pentecost III is the president of the International Academy for Design & Health



The Salutogenic organisation

As we voyage further into the knowledge age, the nature of the organisation is changing. *Ray Pentecost* calls for the evolution of the salutogenic organisation

How do we define a healthy organization?



Oasis of equals



One may not expect to find too many salutogenic offices in one of the world's most polluted cities, so the Beijing offices of Robarts Interiors & Architecture present a welcome surprise. The impressions conveyed by the design are more akin to a chic, boutique hotel than a typical office. The elements are distinctive: an expansive six-metre-high space gives gracefulness and focus to the public areas, which include a lounge for reading, working and informal meetings; a water wall and reflecting pool that integrate with one of the two stairs to the mezzanine level; and an east-west bridge that acts as a metaphor for connectivity. Full-height windows allow for the space to be bathed in generous daylight, while south-facing views reach out to the large roof garden, where staff and visitors can enjoy nature right in the heart of the capital's central business district.

It is not unusual for many companies to pay high attention to their front-of-house client spaces, often investing more in these areas than in their working spaces. At Robarts, however, there is no such separation between the client areas and working spaces, with the latter treated with equal care and thoughtful, exquisite detailing. For a company that has "culture" and "courage" as its core values, it is inspiring to see that these working spaces include several areas that help bring about collaborative working, as well as a meditation/prayer room and a spa, where staff can sign up for seated back-and-shoulder massage from a resident massage therapist.



A rooftop play area at Deptford Lounge and Tidemills School, London

Municipal missions

Can urban design impact on obesity levels, community cohesion and long-term wellbeing? Yes, but only if certain key ingredients are present, says *Veronica Simpson*

As urban regeneration projects around the world gain momentum, driven by the need to accommodate burgeoning city-based populations, those involved – be they architects, planners, local authorities or a new breed of enlightened private developer – are seeking to identify the factors that can transform a blueprint design concept into a thriving and healthy neighbourhood.

At the Fit Cities Conference in London earlier this year, it was glaringly apparent that planning alone cannot ensure a city's inhabitants will actively explore and embrace their immediate urban environment in ways that promote both community and individual health and wellbeing. How you programme urban space is every bit as important as the look and feel of the space itself, as New York-based landscape designer James Corner revealed.

Corner's consultancy Field Operations has been challenged with creating an enormous public park in what was London's Olympic Village – now the Queen Elizabeth Olympic Park. It is widely hoped that his Queen Elizabeth South Park Plaza can galvanise and animate this soon-to-be-transformed residential neighbourhood, in much the same way as his landscape designs have helped unite the disaffected denizens of Manhattan around New York's high line park.

"Every great city needs a great park," stated Corner, who pointed out that the connections into any park – strong links to residential neighbourhoods, leisure attractions and transport networks, as well as the activities available within it – are vital ingredients. "A sense of connection is fundamental to the idea of a fit city," he concluded.

Sited close to several subway stations and many historic buildings, the high line park – a one-mile

Kalasadama region, Helsinki, Finland

Finland's capital city has been undergoing a slow but steady city-centre regeneration, with several areas earmarked for development, mainly around the former cargo ports along the central seafront. One of the most dynamic of these is Kalasadama.

To ensure the most appropriate developments emerge for the local population, Helsinki's City Authority has actively encouraged temporary uses in this area, giving out permits for events, such as farmers' markets, open-air cinemas, exhibitions and urban food farms. Last year, a 1930s-built abattoir, which had previously been used as a wholesale market, was turned into the thriving Kellohall restaurant serving locally sourced seasonal food, as well as a 'flavour studio' – a cooking and cocktail school offering workshops, seminars and presentations). 'Spontaneous urban culture' is planned for the area around this building, from the 'solar kitchen' in the abattoir yard immediately outside the Kellohall (where solar-powered grills serve lunch through the summer, weather permitting), to a free community barbecue. Also on the cards are year-round organic farmers' markets, a skating rink in winter, and a free programme for urban gardeners offering personalised grow bags, shared fruit trees and herb bushes.

Feeding into this community hub, some 20,000 new homes are being built, and many of them will be affordable. Meanwhile, the port's industrial buildings are slowly being refurbished as studios and office space for start-ups. Food-related wholesale and manufacturing businesses will be particularly encouraged. In this way, residential, leisure and commercial businesses will cohere around the city's burgeoning food-culture scene, generating a mutually supportive spirit of engagement and creating a vibrant destination for visitors.



Anni Bäckman

"A sense of connection is fundamental to the idea of a fit city"

section of a historic freight line elevated 30 feet above western Manhattan – offers regular and weekly-changing activities: food and music festivals and markets; a vast selection of independent, non-chain eateries; classes for yoga and Tai chi; and even night-time astronomy sessions. It has also become a popular route for running and walking groups, and it has an ongoing programme of public art. These have all played a vital role in turning the high line into the massive attraction it is today, together with Corner's thoughtful planting, which

offers a variety of seasonally-shifting vistas, plus diverse sensory experiences and textures (eg water features in which children can paddle and grasses that whisper in the breeze).

Good programming comes from good consultation and a genuine understanding of – and desire to include – the local population. The ongoing relevance of the high line park's activities to the local population are more or less guaranteed thanks to the community group that first raised funds for, and now operates, the park. Without that kind of continual, on-the-ground insight and input, even the best-intentioned schemes will falter. Thankfully, many local authorities appear to have wised up to the value of genuine consultation and inclusion.

Food festivals and Facebook

Helsinki is a metropolis that is in the early stages of a massive regeneration scheme, in which local citizens have been handed a generous role. With Finland one of the few European Union states to be enjoying relative economic buoyancy, Helsinki City Authority is in the process of creating 25,000 new homes in a 175ha area of waterfront



Deptford Lounge and Tidemills School, Lewisham, London, UK

A school that combines housing with community resources, and which sits at the heart of one of the most deprived parts of southeast London, is triggering a new sense of community for the people of Deptford. The Tidemills School, designed by Pollard Thomas Edwards Architects (PTEa), combines a bright, airy and colourful primary school with a state-of-the-art community library and learning resource, the Deptford Lounge, which also provides council and community office space, artists' studios and a gallery. The school's sports, music and entertainment facilities are shared with the local community for out-of-hours activities, while additional funds for the building were raised by adding a block of high-quality, rented housing-association flats to the rear.

Lewisham Council has seized the opportunity this landmark facility offers to improve substantially the surrounding public realm. The building exterior presents an uplifting civic presence within a new community square; its main public-facing elevation a glowing origami-screen of golden mesh panels, offering both shading and transparency. PTEa director and project architect Dominique Oliver says: "The idea was to create a kind of oasis within an urban environment for the children and the wider community."

Alongside this key community asset, Lewisham Borough Council has upgraded and linked the previously fragmented parks and public spaces around the school and square and their immediate neighbourhoods, improving landscaping, lighting, children's play spaces, sports facilities and seating. Now highly-connective cycle and pedestrian routes link to all local amenities, as well as the improved transport networks at the newly upgraded and relocated Deptford Railway Station. These and other schemes have won the borough major public-realm improvement awards.



previously dominated by industrial docklands, having moved the docks out of the city centre in 2008. But it is doing so carefully, and in stages that stretch over the next three decades. In the meantime, it has opened up many of these new parts of the future city to temporary uses, which has led to the flourishing of pop-up festivals and events, often centred around the city's blossoming food-culture scene (see case study).

Much of this activity is facilitated online and through social media; the city authorities actively encourage e-participation, with all services listed in a comprehensive online database, along with multiple opportunities for feedback. Even Facebook has played its part: two years ago, a 'restaurant day' was launched allowing citizens to circumvent the city's normally tortuous food-permit procedures and open their own food outlet for the day – whether it was serving Korean food from a kiosk on the pavement or lowering sandwiches down in a basket from a third-floor flat. Head of arts and culture at The Finnish Institute Paula Karlsson says of the event: "Through Facebook, it has grown to four times a year. People really own that event now and it's made Helsinki a better place in which to live. We saw a lot of food from different cultures like Korea, giving a presence to nationalities that are not normally so visible in the city. Finnish people usually obey rules quite well; it's been good for them to experience that kind of activism."

Across the Atlantic, the New York Center for Active Design has been encouraging a different kind of activism, with the support of New York mayor David Bloomberg. Three years ago, the Center drew up a list of guidelines – some design-based, others policy-based – which are slowly being implemented in new-build commercial and housing schemes. These range from making the staircase, as opposed to lifts, the most visible and accessible means of circulation in new buildings, through installing a hydroponic farm on the rooftop of a new housing project so that people can grow around 40% of their food on site, to encouraging more mixed use of land so that people's homes are within easy walking distance of work and leisure facilities. The UK Design Council is following suit with its own 'Active by Design' programme, working closely with New York and other cities to promote best practice.



Tero Pajukallio

A temporary urban kitchen-garden in Helsinki



Oxford Terrace, Christchurch, New Zealand

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Avon River Precinct, Christchurch, New Zealand

Following the earthquakes of 2010 and 2011, BDP was asked to come up with a concept design for New Zealand's Te Papa Otakaro/Avon River Precinct in Christchurch, as part of the Christchurch Central Recovery Plan. The project seeks to restore the health of the river and encourage the return of native birds and aquatic life to the centre of the city, while transforming the 3.2km stretch of water into a dynamic destination for the city's inhabitants to engage in sports and leisure pursuits, as well as healthy commuting.

The Precinct embraces both urban and natural landscapes, with easy access to and from Victoria Square, the Terrace and Margaret Mahy's 'Amazing Place' Memorial Playground – a new family play area named after the country's most famous children's author and designed by local schoolchildren.

The rejuvenated landscape will represent a blend of exotic and native planting, reflecting the weaving together of the city's different cultures.

A pedestrian promenade and separate cycleway extend the full length of the Precinct. Boardwalks and terracing will allow easy access to the river and feature lighting should improve safety in the evenings. Construction work on Watermark, the first element of the project to be implemented, is now complete and a 'txt an answer' campaign will soon be launched to gauge public opinion on the project; this feedback will have an influence on how the remaining areas evolve. The main construction work is due to start in February 2014.

"We don't want islands; we want interconnections with the wider communities."

Balancing priorities

There is still, however, a very long way to go before the competing pressures of civic wellbeing and developer profiteering can be brought into equilibrium. At a regeneration conference in July, organised by the NLA (New London Architecture) – London's key networking organisation for built-environment professionals – several schemes showed great ingenuity in trying to address the needs of impoverished and resource-starved residents, while attracting the much-needed prosperity that better housing, offices and leisure facilities can bring to the city.

John Comber, deputy chief executive and director of regeneration, enterprise and skills in the Royal Borough of Greenwich, admitted a "lack of honesty" was impacting on the growth of healthy communities. "Private developers aren't always as honest as they should be; local authorities aren't always as helpful as we can be," he lamented. "We don't want islands; we want interconnections with the wider communities. We want benefits and legacy and [those] in the private sector want that, too." He concluded that the real issue regeneration needs to tackle is "not about buildings, [but] about people." In terms of future engagement and empowerment with healthy living schemes, a dialogue between residents and politicians, planners, developers and construction companies is crucial.

Veronica Simpson is an architectural writer



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Frontiers in the fast lane

With populations living in increasingly large, multicultural urban habitats, the global world we live in today is one with few boundaries.

Qatar, like many emerging nations, has witnessed rapid changes in many aspects of life, not least in the size of its economy. These changes have had a huge impact on urbanisation and the lifestyle of the Qatari people. The country has seen lifestyle-related diseases or non-communicable diseases (NCDs), such as cardiovascular diseases (CVDs), diabetes

and obesity, become the leading causes of morbidity and mortality over the past two decades. Hypertension, which is a major risk factor in the development of CVDs, has become the main public-health problem.

In an interdependent world, improvements in the quality of life and wellbeing of all Qatari and Middle East citizens will be founded on the recognition that a healthy population is the means to social development and economic growth. Design objectives for enhancing human health must encourage an active lifestyle, enable effective management of physical, psychological and emotional stress, and support cognitive processing of information via stimuli in a variety of designed environments.

Well-designed healthcare facilities make a vital contribution to healing and rehabilitation. However, a broader perspective demonstrates that health processes are continuously operating in all types of built and physical environments where individuals spend their daily lives.

Organised by the International Academy for Design & Health in partnership with Hamad Medical Corporation, delegates to Design and Health Middle East 2013 International Symposium & Exhibition in Doha, Qatar will enjoy the opportunity to participate in a leading-edge symposium and exhibition that will help set the Gulf and Middle East region on a path to a healthier future. Delegates are also invited to attend the Gala Dinner, which will take place on Wednesday 13 November at the Hilton Doha.

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Edward Hillhouse
Chief of science, academic and faculty affairs, Hamad Medical Corporation



John Lambert Smith
Executive director, health-facility planning and design, Hamad Medical Corporation



Awn Sharif
Manager of health-care facility planning, Supreme Council of Health, Qatar

Next level

With robust primary healthcare in place, the Gulf States are now tackling a weak spot – the relative lack of specialist, high-spec facilities that can deal with the complexities of 21st-century clinical care. *Emily Brooks* reports

The rise of lifestyle-related diseases is a healthcare challenge faced by most of the world, but for those countries of the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates and Yemen), the changes are bearing down more swiftly than for most. In the wake of the rapid economic development that has also brought unhealthier diets, low levels of physical activity and an increase in obesity, diabetes has become an exceptional concern: according to the International Diabetes Federation's latest intelligence, Gulf countries occupy five of the top 10 spots for the highest prevalence of diabetes in the world.¹ In the UAE alone, the treatment of diabetes in 2011 cost the Government \$6.6bn, or 1.8% of GDP.² In Kuwait, 80% of women and 70% of men are obese.



HDR's Cleveland Clinic Abu Dhabi, scheduled for completion in 2014; private providers are starting to make a significant impression in the region

At its annual research meeting last year, the Gulf Research Centre, based in Cambridge in the UK, stated that “no other region in the world faces such rapid growth in demand with the simultaneous need to realign its healthcare systems to be able to treat the disorders of affluence... Although there has been major investment in the healthcare system in the GCC, many residents remain unsatisfied with the availability and quality of care at government-run hospitals and clinics. While the healthcare system is mainly run by the government, government agencies mostly lack strategies and policies as well as the managerial skills needed to run healthcare facilities. Therefore, government-run healthcare centres (hospitals and clinics) are ill-prepared for a rapidly growing and aging population, nor are they prepared for the rise in chronic diseases.”³

While the Gulf must try to stem the tide by redoubling its efforts at preventing disease, it is also seriously gearing up to tackle treatment. According to Richard Sprow, principal at Perkins Eastman, these countries “have met their general population's health needs, and now they want to expand their system to cover secondary and tertiary healthcare facilities”. The firm has just completed Sheikh Khalifa Specialist Hospital in the UAE's Ras Al Khaimah (see case study). Sprow explains how the emirate “is in the same position as most of the other Gulf countries right now – they all have basic hospital services, but they're looking to build new-generation, more specialised facilities, so they can minimise the number of patients they have to send elsewhere.

“Ras Al Khaimah already had some general hospital care, but they conceived the idea that they wanted specialist care for things like cancer, emergency care and some higher-level surgery care.” The brief called for “western-style modern healthcare, delivered at international levels of quality,” and the project blends advanced technology with a patient- and family-centric approach. Because their visits may be frequent, cancer

New facilities are bringing first-class healthcare to populations away from the capital cities



Al Wakra Hospital, Qatar

This 300-bed general hospital sits half an hour south of Doha, on the east coast of Qatar, and is provided by Hamad Medical Corporation, which manages nine hospitals around the country. Capable of handling 500 emergency patients a day and 1000 births a year, it aims to relieve patient flow in the region's other primary hospitals. A large, brightly-lit reception sits at the centre of the building, hugged by two semi-circular buildings either side of it, and linked to a further structure that contains an education department on the ground floor, and theatres and intensive care on the first floor. The central atrium space is big enough to support 'hubs' of waiting/meeting space suitable for large families to gather, and leads to a dramatic circular lift core, naturally lit by a glass dome far above. The bright corridors are wider than one might find in western countries, again to accommodate the movement of larger families. Outside, planted pergolas provide both greenery and shade, with courtyard water features to create cooler spaces in the hot climate.

Client: Hamad Medical Corporation
 Principal consultant: GHD
 Size: 130,000sqm
 Beds: 300
 Completion: 2012

patients have a separate car park and entrance, to make it quicker and easier for them to visit for infusion or radiation treatment; patient units are all on the north side of the complex, so they can take advantage of garden views on the shaded side.

Specialist care, closer to home

Large and challenging building programmes are taking place in many GCC countries, with many facilities filling in the gaps, geographically speaking, bringing first-class healthcare to populations living away from the capital cities. Al Wakra Hospital in Qatar, open at the end of 2012 (see case study) serves those living south of Doha up to the border with Saudi Arabia, while Oman's US\$1bn International Medical City (IMC) is in Salalah, 1000km south of the capital Muscat. Its first phase, a 530-bed tertiary care hospital, is due to open in 2016, with a four-star 'medical hotel' and education complex coming later.

Saudi Arabia is constructing 135 new hospitals in 2012-17, including five integrated medical cities, one of which is the AECOM-designed King Khalid Medical City (see case study). "The Kingdom's healthcare market is going through a tremendous growth and development phase," says KKMC's Mounir Marhaba,



King Khalid Medical City, Saudi Arabia

About to be put out to tender, this is one of five medical cities being built in Saudi Arabia to tackle a healthcare deficit caused by a growing population, greater patient expectation, and an increase in lifestyle-related diseases. The wider 70-acre site has been masterplanned by AECOM, with the intention that the 1500-bed academic medical centre be the anchor for a wider development of housing, hotels and retail, plus a community hospital and hospice. The brief for the phase-one medical centre was composed of four tenets: creating a healing environment; patient-centred care; enabling multidisciplinary healthcare delivery; and a flexible framework with future adaptability. A decentralised plan breaks down the scale of the hospital for patients, with seven 'core competencies' given their own entrance and distinctive wayfinding. KKMC reflects its geographic location, culture and community through the use of locally sourced materials, geometric patterning inspired by traditional mashrabiya screens, and a respect for regional cultural traditions. The Gulf region is seeing high demand for technologically advanced healthcare facilities, and this is no exception – KKMC will be a smart hospital that allows electronic connectivity between professionals, and uses technology to measure results and achieve greater consistency of outcomes.

Masterplanning/architect/landscaping/interiors/engineering/QS: AECOM

Construction: Vanir Construction Management Inc

Client: Kingdom of Saudi Arabia

Cost: US\$1.217bn

Size: 1.5m sqm

Beds: 1,500 (phase 1)

Completion: Late 2017 (phase 1)



program director, contracts, business operations and special projects. "New state-of-the-art facilities are being constructed, small facilities are expanding and established facilities are upgrading their infrastructure, improving quality and revising standards. Regardless of the type and capacity of the healthcare facility, there is a big demand across the market for the latest, cutting-edge, innovative medical equipment, and IT solutions."

Campus-style complexes like KKMC are a favoured model, possibly because they are also a recognised model in the US, which Gulf governments are clearly looking to as a benchmark; the introduction of a medical education component will also help solve the problem of a lack of skilled staff in the region. "They are very much thirsting for the standards we've developed in the US, especially for infection control and a lot of the things we've developed with evidence-based design," says Jeff Frush, principal and project director at AECOM. The practice has not only devised the masterplan for this project but the architecture, landscape, interiors, engineering, cost management and quantity surveying

as well, making it the firm's biggest healthcare project to date. With an all-single-bed hospital at its heart, it will contain seven centres of excellence (including cardiac science, neuroscience and multi-organ transplantation), and will have a multidisciplinary approach that embraces treatment, research and education. The seven centres of excellence will have their own entrances to make the scale of the

campus more manageable for patients, supported by “some very careful wayfinding, with branding for each of the specialties using colour, material and signage,” explains Frush. But while patients will feel like they are on a simple, singular path, behind the scenes the design must also support the multidisciplinary approach, where specialists from many departments might get together to discuss a complex case: for this there are dedicated multidisciplinary meeting areas, connected on a back quarter so that staff can easily make connections from clinic to clinic.

Designing for families

The region's family-centric culture means that extra allowance is made in patient rooms, waiting rooms and elsewhere to accommodate greater numbers of visitors. KKMC's single rooms have been designed with space-saving back-to-back loos to free up space for families, and there are also semi-private spaces outside patient rooms for staff to talk to family members. “It was expressed by the client that each 12-bed wing should be gender separate, and that ended up being a huge driver for the shape of the bed tower, which basically has three arms that come from a central elevator core,” explains Jessica Radecki, project designer and healthcare planner at AECOM. “We made sure that we didn't have any unnecessary traffic passing through these wings, and that there was privacy within each wing, plus it reduces travel distances for patients and families.”

John Lambert-Smith, executive director, health facilities planning and design for Hamad Medical Corporation (HMC), which delivers 85% of secondary care and all tertiary care for Qatar, says designing for families is not just about bigger rooms and wider corridors but “allowing spaces for families to be in the right places

The introduction of a medical education component will help solve the problem of a lack of skilled staff in the region

Sheikh Khalifa Specialist Hospital, Ras Al Khaimah, UAE

This new six-storey hospital in Ras Al Khaimah supplements a new general hospital with some more specialist care that includes oncology and emergency care. A greenfield site allowed the architects to orientate the building in a way that mitigates the effects of the desert heat. “We organised the building in a purposefully asymmetrical way,” says Richard Sprow, principal at Perkins Eastman. “The south side faces parking, and has a large block of diagnostic space, with the emergency department, surgery, imaging and labs, while the patient units, which are occupied 24 hours a day, are on the shaded north side.” These units take the form of a series of L-shaped structures with nursing stations at the junction point. There is capacity to add two more of these units should future need demand it, and flexibility has also been carefully built in to the existing structure – clinical areas have a series of standard, modular layouts, and operating theatres are very similar, for example. Distinctive red sand dunes surround the hospital, the colour of which has informed the palette with a mix of warm cinnamon shades and brighter hues.



Gerry O'Leary

Architect/interior design: Perkins Eastman
Associate architect: Bayaty Architects
General contractor: MCM Group
Cost: US\$164m
Size: 65,000sqm
Beds: 248 (phase 1); 400 (full capacity)
Completion: 2012



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within the clinical environment – the issue of enabling clinical practice to take place without the family getting in the way. We're coming up with fresh ideas as to how we can get the architecture to manage that better, for example by developing a universal patient room that allows for a family space, but that can be separated when there's some sort of clinical action happening. And that idea of universal rooms extends to treatment rooms and clinical spaces, allowing all the flexibility we might need so they can be reconfigured without having to pull out a wall or disrupt the spaces around it."

Australian firm GHD, which has had a presence in Qatar since 2001, designed Al Wakra Hospital for HMC, but Lambert-Smith says the talent pool for this sector could be bigger. "There is a number of good consultants working here, but when you're talking about creating state-of-the-art healthcare facilities, we do lack a certain amount of skill. So we're trying to attract more awareness of what we're doing, and how big the playing field is. Also, we want people to see that we're not in the middle of a war zone – it's very stable politically, and it's a wonderful place to be." He adds that during the global financial crisis "a lot of international firms in the Gulf got burnt badly, mostly by private developers, and since then there's been a lot of fear that they won't get paid properly or fully".

There has been a struggle to regain trust, on both sides: "It's important to understand that we're a government department and there are fiscal regulations that we have to abide by –

Sheikh Khalifa Medical City, Abu Dhabi, UAE

A joint venture between Skidmore Owings & Merrill (SOM), ICME and Tilke, Abu Dhabi's flagship facility will replace an existing hospital of the same name, which will undergo phased demolition as the new buildings come into use. It is actually three facilities in one, fusing a general hospital and trauma centre with tertiary women's and paediatric hospitals; each will have its own identity and separate entrance lobby, all rising from a two-storey plinth containing shared services. It is hoped that the high quality of the public spaces – a 'town centre' of lobbies, cafes, retail and education spaces, all connected by a network of open outdoor areas – will create an uplifting environment with a strong feeling of community. The numerous open spaces, including hanging gardens, tree-lined boulevards, rooftop terraces and a central 'common' with fabric shading, are seen as key to creating a healing, non-institutional hospital. SKMC will also satisfy Abu Dhabi's sustainability rating, Estidama, with integrated photovoltaics, a condensate recovery system that will provide water for irrigation, and integration with the existing and future public transport system.

Architect: Skidmore, Owings & Merrill

Project manager: Allen & Shariff Corporation

Client: Seha, Abu Dhabi Health Services Co

Beds: 850

Size: 210,400sqm

Completion: 2016

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Medicover Hospital, Warsaw, Poland

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Ysbyty Aneurin Bevan, Blaenau Gwent, Wales, UK

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Laguna Honda Hospital, San Francisco, USA

© David Wessely/Photography/Corbis



University College Hospital, Macmillan Cancer Centre, London, UK

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Tseung Kwan O Hospital, Hong Kong, China



Cairns Base Hospital, Queensland, Australia

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and so once [a consultancy] has got a contract, and once they've performed under that contract, there's no reason why they won't get paid. But it goes two ways. A lot of consultants – not necessarily Western companies – employed by government departments, particularly in the early 2000s, didn't perform particularly well; there was massive growth, and certain companies took advantage, trying to make lots of money for doing little work. And because of those performance issues in the past, the government now makes them put a little bit of their money where their mouth is, putting in a performance bond at the beginning of the contract."

Sustainability moving up the agenda

Desert environments are architecturally demanding, and sustainability is moving up the agenda fast – not just regarding water and energy saving, but the wider understanding that flexible, adaptable buildings will reduce obsolescence. Greenfield sites happily allow for optimum orientation, with layers of screening on the outer face of the building that can allow for large areas of glazing without direct sunlight. Practices are responding with characteristic innovation: for example, KKMC's cooling system is air cooled rather than water cooled (to save on fresh water), with ice-based thermal energy storage (whereby ice crystals are formed and stored during off-peak hours, and released during peak demand, to even out electrical loads). HDR Architecture's 360-bed Cleveland Clinic Abu Dhabi, on the shores of the Persian Gulf, opens this year; it is arranged as a series of horizontal stacked blocks topped by a larger patient tower and has a double glass curtain wall. Air is cooled via a tripartite approach using sea water, heat reclamation, and used cool air exhausted through the five-foot-wide space between the two glass curtains walls.

Aesthetically speaking, architects are being challenged to create landmark buildings that echo the local vernacular, yet speak of forward-thinking modernity. "There's a general push for respecting Islamic culture, but there are some clichéd thoughts around it," says Lambert-Smith. "You start to see Arabic screens or patterns on glass, just repeated over and over again without too much thought. But we're starting to see a couple of consultants go beyond that, coming up with some interesting and unique architectural designs that understand the culture and that aesthetic, but move it into something a lot more contemporary."

Looking ahead, the greatest changes to come in the region will be the increased participation of private providers, as governments recognise that their healthcare spending is unsustainable: Cleveland Clinic Abu Dhabi, for example, is the result of the UAE government's concerted effort to attract international healthcare investment. In Saudi Arabia, the Ministry of Health owns and manages 60% of facilities, and the private sector owns around 10% of healthcare infrastructure. Here, says KKMC's Mounir Marhaba, "healthcare is not evenly distributed across geographic locations and demographics, so in addition to the Ministry investing in mega health-facility projects, they are also encouraging the private sector to take more projects across the country, including rural areas. In order to incentivise, the MoH has issued subsidised rates and offered investment funding options."

Emily Brooks is an architectural writer

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Oman's US\$1bn International Medical City. A 530-bed tertiary-care hospital is due to open in 2016, with a medical hotel and education complex to follow

Architects are being challenged to create landmark buildings that echo the local vernacular

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ICU design is complex, with a diverse set of needs that are not always easy to combine – the integration of advanced equipment and the requirement for strict hygiene must sit alongside patients' and visitors' desire for privacy and a soothing environment. At Kaplan Medical Center in Rehovot, Israel, interior designer Anat Herman has taken nature as a broad starting point to the design of the ICU, introducing a blend of natural materials, curving organic shapes, images of plantlife and bright green accents.

"Combining elements of nature in the design has a soothing effect and creates a serene and calm atmosphere, which is much needed in such an intense medical unit," explains Herman. "Nature plays a role of catalyst in the healing process and has a major part in easing anxiety and calming the patient's state of mind. This atmosphere has a positive effect on both patients and their loved ones, which helps minimise healing time required and maximise medical staff productivity."

Fresh ideas

Israel's Kaplan Medical Center has built an ICU inspired by nature, from its colour scheme to its balconies where even critical patients can enjoy the outdoors



Serene and soothing environment

Curving timber-clad walls are topped with a floral-patterned frieze, with bamboo-like flooring tiles underfoot. A fresh colour scheme extends from the offices, staff rooms, meeting rooms and patient rooms. In waiting areas, the lime-green chairs that line the walls are intended as 'wild flowers', sprouting up along the verges. Nurses' stations are well lit, with Corian worksurfaces to minimise infection, in bands of white and green.

Two balconies were built so that even critically-ill patients can be taken out to enjoy some sun and fresh air. The visitors' waiting room overlooks these balconies, separated by a glass door that allows natural light to filter inside.

All of these elements come together to create as serene and soothing environment as possible – in a part of the hospital where what takes place can often be far from calm.



Eastern promise

Plans have been announced for a vast, integrated, healthcare hub to be designed by Broadway Malyan and built around Tan Tock Seng Hospital in Singapore.

Spearheaded by Tan Tock Seng Hospital, the National Healthcare Group and Singapore Health Ministry, 'Health City Novena' will serve patients in central Singapore. Broadway Malyan's Singapore-based team is delivering the masterplan, and architectural and landscape-design services, with Surbana International Consultants leading on project management and engineering services.

Due to be completed in 2030, the scheme will link existing facilities and the Lee Kong Chian School of Medicine to create the largest healthcare complex in Singapore. It will offer a full range of acute to intermediate and long-term holistic-care services, along with wider research and education, commercial, leisure and public spaces.

Existing low-rise buildings will be replaced with multi-storey blocks to increase the floor space from 250,000 to 600,000sqm, the number of beds will increase by 25% to 2,200, and 10 buildings will be physically connected.



Research tower has lab fab layout

The Hospital for Sick Children (SickKids) has opened the Peter Gilgan Centre for Research and Learning in Toronto, Canada. Spanning 750,000sqft, the 21-storey tower is believed to be the world's largest facility devoted to children's health research. HDR provided laboratory planning and design services, as well as equipment planning, security and interior design services. Interior spaces and, indeed, the tower itself were designed by Diamond Schmitt Architects.

The tower covers 16 floors of laboratory space – and an estimated three-miles-plus of benchtop – with the main research focused on genomics, cancer, stem cells, brain behaviour and organs. The building was designed to enhance collaboration and is divided into six research neighbourhoods connected through staircases and shared spaces.

"In traditional science buildings, departments are often separated into silos, where they each independently conduct research," explained Clare Swanson, principal laboratory planner with HDR. "In this tower, the silos are dissolved, as researchers are encouraged to work together to 'cross pollinate' and generate innovative health solutions."

Plug-in potential

In July, representatives from Gresham, Smith and Partners attended a ceremony in China to mark the Shanghai New Hongqiao International Medical Centre Shared Facility. Aiming to advance healthcare delivery internationally, the five hospitals and additional specialist clinics planned on the medical campus will 'plug into' this new centralised facility, which is set to be completed in 2015.

Gresham, Smith and Partners' principal Kevin Kim AIA, who spoke at the ceremony, remarked how the design concept "will reduce costs for individual hospitals and provide access to cutting-edge technology that those hospitals might not have been able to afford".

Alongside traditional support services, such as food, laundry and IT, the Shared Facility will house diagnostic imaging suites, clinical and pathology laboratories, and pharmacy retail and storage. It will also act as the public centrepiece of the complex, with amenities including food services, retail, medical exhibition space and underground parking. To separate the movements of materials, patients and the public, designers layered circulation patterns vertically, with service-and-supply distribution occurring primarily in lower-level tunnels; public activity limited to the main level; and patient and staff activity concentrated in raised sky bridges.





Grouping gynaecology

Integrated property-services firm Styles&Wood has completed a £1.2 million project at Chesterfield Royal Hospital, to create a specialist women's healthcare facility. The project involved the complete strip-out and remodelling of the hospital's Women's Health Unit (WHU) and Trinity Ward, to bring together its gynaecology services in one high-quality facility.

Styles&Wood's specialist health-service team employed infection-control partitions and technology to help prevent the spread of dust and debris, in addition to enabling work to be carried out around live clinical services.

The project included the identification and removal of asbestos, as well as the installation of new M&E services. It also involved the transformation of the two units with a modern finish, as well as providing new reception, triage and treatment areas, individual five-bed wards and secondary-service rooms.

The WHU has three clinic rooms, a separate area and waiting room for women arriving at the early-pregnancy assessment unit, along with other separate areas for outpatient procedures and day-case surgery, plus private areas for changing.

Hovering expansion

WHR Architects has been selected to design a major expansion for the Robert Wood Johnson University Hospital (RWJUH) in New Brunswick, New Jersey – one of the leading academic medical centres in the US.

According to the practice, it was chosen for its direct and comprehensive approach to addressing complex site and structural issues for the hospital's new South Building Overbuild project.

The expansion will consist of three levels of additional bed units, new surgery units, public spaces and a new southern entry to the hospital. Owing to dense urban constraints, the expansion is proposed as an overbuild project, which can pose challenges in terms of how it connects to the overall fabric of the existing campus and surrounding urban setting.

WHR came up with several ways to deal with a host of construction challenges, as well as creating what it calls "holistic, healing and patient-centred environments". The firm's urban approach to the design enhances the kerb appeal on the facing street, and conceives the project as a new gateway into the campus.



Lord of the Rings

A consortium of BIG + WHR + Arup has made the shortlist for the second phase of the design of the Nyt Hospital Nordsjælland – a 124,000sqm acute-care hospital in Hillerød, north of Copenhagen. The team's proposal would preserve the site's existing natural features, while creating an efficient, healing hospital.

The result of a merger of three existing facilities, the new hospital will be built on a former hunting ground, characterised by rolling hills, small ponds and one of the largest forests in Denmark. The design concept consists of eight interlocking rings, which vary in height, to provide access to the greens, while a flat green roof responds to the natural topography.

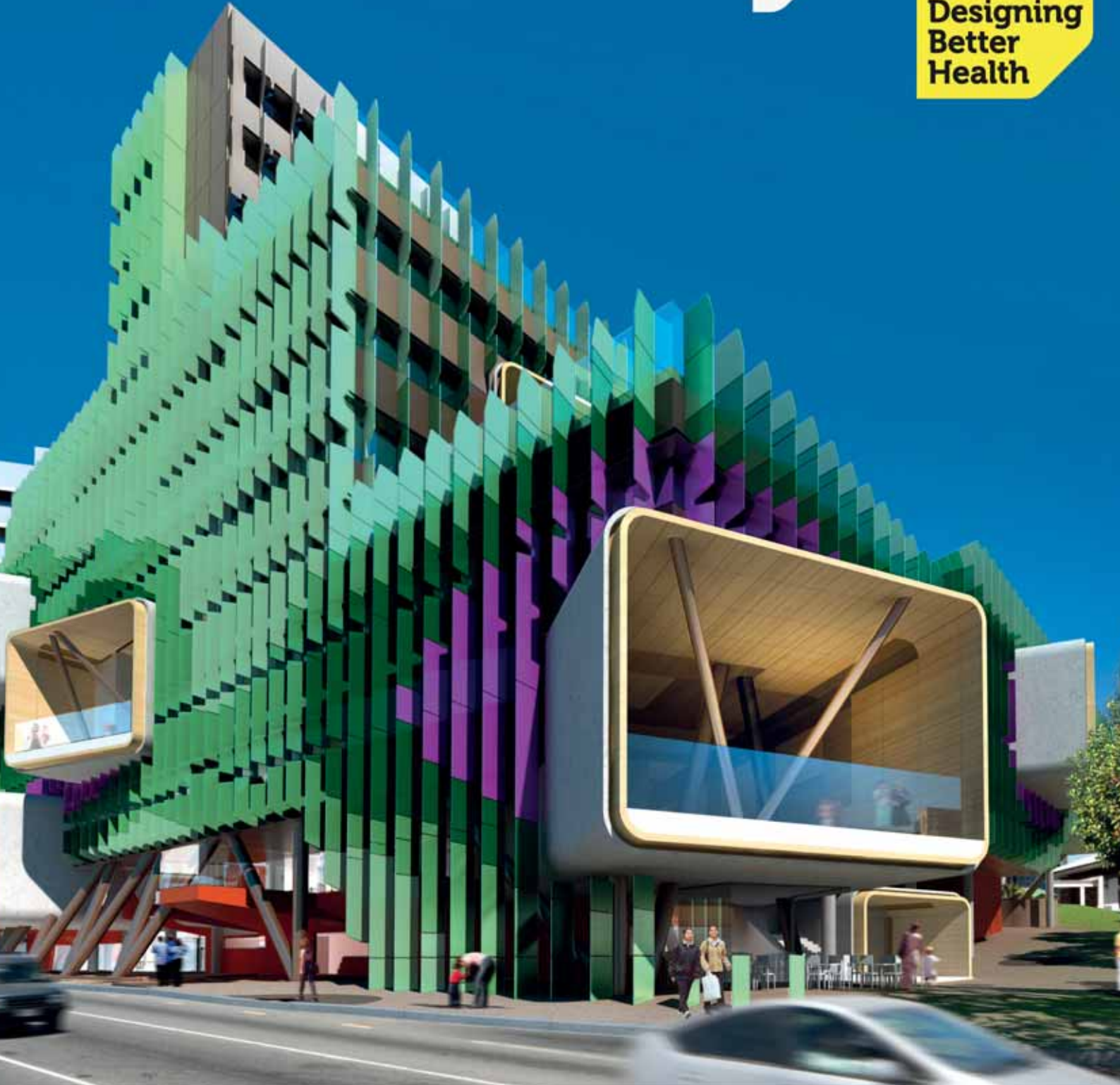
BIG's Bjarke Ingles said: "One of our guiding principles has been to further build on the area's historic landscape features and create a smooth transition between inside and outside. The façade is designed with integrated planters to bring nature right up to the patient's bedroom window. The landscape is always present."

The shortlisting jury commented: "BIG's ideas, together with the large green spaces and green surfaces, mean that we really can talk about a healing interpretation of the concept."

A winner from the shortlist will be announced in March 2014, and the hospital is set to be finished in 2020.

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Image courtesy Conrad Gergett Lyons

Heart of the community

Facilities designed to improve access and integrate with the local community dominated this year's Design & Health International Academy Awards

Integrated care models and facilities designed to improve access to care within the community dominated the Design & Health Academy Awards 2013, announced at the Brisbane City Hall on 13th July during the 9th Design & Health World Congress & Exhibition.

Walking away with four category awards, the Stantec-designed South West Acute Hospital, a 300-bed acute hospital in Northern Ireland, provides a full range of clinical services, but it impressed the judges through its focus on community integration, with spaces in its main atrium and hospital street dedicated for use by community groups, local artists, schools, museums and exhibitions.

In Canada, the CAMH Village Family Health Team, commissioned by the Centre for Addiction and Mental Health, Toronto, Canada and designed by ARK, won two awards in the mental-health and interior design categories for its successful integration of mental-health services and a primary healthcare programme at the heart of a mixed-use neighbourhood of Toronto.

Winning the inaugural award for salutogenic design, the Potter Street Redevelopment in Australia, designed by Allen Kong Architect, also demonstrated its community impact to the judges. An innovative co-development between disability-support organisation Wallara Australia and aged-care specialist Wintringham, the facility blends aged care for disadvantaged people with a variety of complex behaviours, with specialist high-support services for adults with a disability; ageing parents of disabled children are thus given an opportunity to live under one roof.

Other notable winners included the innovative Children's Hospital Tony Molleapaza Rojas, Peru, commissioned by PAZ Holandesa, The Netherlands and designed by EGM architects; the new Queensland Children's Hospital, commissioned by Queensland Health and designed by Conrad Gargett Lyons; the Arts in Hospital programme at the University of Kentucky, Albert B. Chandler, commissioned by University of Kentucky Healthcare and created

by AECOM; and the "High Care" Mental Health Unit, commissioned by Stichting Rivierduinen, designed by de Jong Gortemaker Algra architects and engineers.



The Brisbane City Hall



Left: Murray Coleman, managing director of award sponsors, Lend Lease delivers a keynote speech. Right: Dr Ray Pentecost, president of the International Academy for Design & Health, presenting the award winners

Standards and benchmarks

Supported by lead sponsor, Lend Lease, and presented by Dr Ray Pentecost, president of the International Academy for Design & Health, the successful recipients travelled from far and wide to receive 30 awards made across ten categories, including: Lifetime Leadership Award; Health Project (over 40,000 sqm); Health Project (under 40,000 sqm); Sustainable Design; Mental Health Design; Future Health Project; Salutogenic Design; Interior Design; Use of Art in the Patient Environment; and Product Design for Healthcare Application.

By setting standards and benchmarks, the Design & Health international awards programme has a significant influence on the global design and development of physical environments that support health, wellbeing and quality of life. The recipients of this year's awards are those who, through outstanding efforts, have contributed to the progress of knowledge, and demonstrated vision

and leadership in exemplary initiatives and projects.

Chaired by Prof Alan Dilani, founder of the International Academy for Design & Health, and judged by independent specialists in their fields, the awards are open to international organisations and individuals in both the private and public sectors participating in either research or practice, including the planning, procurement, design, construction and management of healthy built environments.

Turn to the following pages to view the criteria, finalists and winners for each award.



'Designing for well-being'

Kinghorn Cancer Centre
Sydney

www.bvn.com.au



Lifetime Leadership Award

Chair of Lifetime Leadership Award

Prof Alan Dilani, founder and CEO, International Academy for Design & Health



Criteria

Awarded to a healthcare leader and visionary who has shown an ongoing, lifelong commitment to enhancing the health, wellbeing and quality of people's lives through their dedication to healthcare design. The award recognises the human and personal qualities needed to push back the boundaries of progress and inspire future generations.



Winner

Prof Ian Forbes,
University of Technology, Sydney, Australia



(L-R) Prof Alan Dilani presents the award to Prof Ian Forbes with Murray Coleman AM of sponsors Lend Lease and Dr Ray Pentecost, president of the IADH

Born in 1944 in Perth, Australia, Ian Forbes is the youngest son of architect HT "Bill" Forbes, of Forbes & Fitzhardinge Architects. After graduating in 1969 from the architecture school at Melbourne University, he undertook a degree in business administration and decided on a career in health facility design.

In 1972 he joined the Johannesburg Hospital Associated Architects international consortium in South Africa. Over a two-year period, he planned all the departments for the replacement 2,000-bed Johannesburg General Hospital – the largest new building in the southern hemisphere at the time.

In 1974, he joined Thompson Berwick Pratt and Partners (TBP&P) in Vancouver, Canada and became a partner in 1977. During his time in Canada he became chair of the Committee on Architects for Health, at the Institute of Architects of British Columbia. In 1982, he completed a part-time Masters in Science (Health Services Planning and Administration) from the Department of Health Care and Epidemiology at the University of British Columbia. He used the knowledge gained from this degree to launch TBP&P's Health Services Planning group, and he inspired rational planning of resources for health services in the province.

On his return to Australia in 1987, he joined the Faculty of Professional Studies at the University of South Wales' School of Health Services Management, where he was responsible for teaching physical-facilities development and health-services planning. In 1994, he became the head of school – a post in which he remained until 2001 – and oversaw its move to the Faculty of Medicine. He created the Group for Health Architecture & Planning (GHAAP) research unit, which, in addition to undertaking commissioned studies, provided regular seminars, allowing multi-disciplinary practitioners to share experiences and gain further research knowledge.

During his time as an academic he conducted education projects, via the World Health Organization, for Ministries of Health in Fiji, Tonga, Papua & New Guinea, Laos, China and East Timor. He was also awarded a major AusAID research grant, working with the Shandong Medical University in China to help develop research methods and train healthcare academics. Between 1990 and 1993, he was seconded to the Asian Development Bank in Kuala Lumpur, Malaysia, where he implemented the US\$280m loan programme, involving 13 hospital masterplanning projects throughout the country.

On returning to private architectural practice in 2002, he became a director and the head of Woodhead's health division, until 2008, when he left to work with the architectural division of GHD, in a joint venture with Ellerbe Beckett Architects, on a new \$2bn hospital in Dubai. With the cancellation of this project in February 2009, owing to the global financial crisis, Ian joined DesignInc Sydney as director for health projects; he returned to his own company in mid-2011.

While in private practice he moved GHAAP from the UNSW to the Faculty of Design, Architecture and Building (DAB) at the University of Technology, Sydney (UTS) in 2004. He was appointed as an adjunct professor to conduct environment-behaviour research jointly with the UTS Faculty of Nursing, Midwifery and Health (now the Faculty of Health). This collaboration has benefited from major grants from the Australian Research Council and the National Health & Medical Research Council, and he continues to deliver physical-facilities research on birthing-unit design, aged care and, more recently, mental health.

Health Project (Over 40,000 sqm)

Sponsored by
BVN Architecture



Lead judge

Warren Kerr, national director, health portfolio, Hames Sharley, Australia

Panel

John McGuire, director of global health (building systems), AECOM, Australia

Craig Dixon, director, health practice, Capita Consulting, UK

Criteria

An award for an outstanding acute or non-acute healthcare building where patient-centred considerations are as evident as clinical and managerial priorities. The project must demonstrate an understanding of the therapeutic effect of a 'healing' environment, and show how innovative design permits ongoing flexibility of use, addresses issues of sustainability and which recognises the broader civic context.

Finalists

Tata Medical Centre, Cancer Hospital, India, designed by Cannon Design

Hospital Bernhoven, the Netherlands, designed by de Jong Gortemaker Algra architects and engineers

Erasmus Medical Centre, the Netherlands, designed by EGM architects

Al Wakra Hospital, Qatar, commissioned by Hamad Medical Corporation

Isala Klinieken, the Netherlands, designed by Architecten Maatschap Isala



Highly Commended

New Public Collado Villalba Hospital,
Spain, commissioned by Capio Sanidad
SLU, designed by F Forward slp



Highly Commended

Queen Elizabeth Hospital
Birmingham, UK, commissioned by
University Hospitals Birmingham
NHS Foundation Trust,
designed by BDP

Highly Commended
Baylor Charles A Sammons Cancer
Center, USA, commissioned
by Baylor Health Care System,
designed by Perkins + Will





Winner

South West Acute Hospital, UK, commissioned by Western Health & Social Care Trust, designed by Stantec



Bill Rostenberg of Stantec (centre) receiving the award from judge Warren Kerr (right) and sponsors BVN Donovan Hill (left)



Health Project (Under 40,000 sqm)

Sponsored by
Ngonyama Okpanum & Associates



Lead judge

Ian Forbes, University of Technology Sydney, Australia

Panel

Jean Mah, principal, Perkins + Will, USA

Mike Nightingale, founder, IBI Nightingale, UK and South Africa

Criteria

An award for an outstanding acute or non-acute healthcare building where patient-centred considerations are as evident as clinical and managerial priorities. The project must demonstrate an understanding of the therapeutic effect of a 'healing' environment, and show how innovative design permits ongoing flexibility of use, addresses issues of sustainability and recognises the broader civic context.

Finalists

Ichi Go Iche E, commissioned by University of Washington Global Fund

Ronald McDonald House, Canada, designed by Montgomery Sisam

Flinders Centre for Innovation in Cancer, Australia, designed by Woodhead

Translational Research Institute, Australia, designed by Wilson Architects (+ Donovan Hill in association)

The Kinghorn Cancer Centre, Australia, designed by BVN Donovan Hill

Ballarat Regional Integrated Cancer Centre, Australia, designed by Billard Leece Partnership

Gold Coast University Hospital Mental Health Unit, Australia, designed by Hassell, PDT and STH in Joint Venture

Western Australia Comprehensive Cancer Centre, Australia, designed by Hassell

PET-CT Center for Diagnosis and Research, Qatar, commissioned by Hamad Medical Corporation

Warrnambool Hospital redevelopment, Australia, designed by Health Science Planning Consultants

The Montefiore Hospital, UK, designed by IBI Nightingale

Kaiser Permanente Gaithersburg Medical Center, US, designed by AECOM

Highly Commended

St John's Rehab Hospital: the John C and Sally Horsfall

Eaton Centre for Ambulatory Care, Canada, commissioned by St John's Rehab Hospital, designed by Farrow Partnership Architects and Montgomery Sisam



Highly Commended

Akerman Health Centre, UK, commissioned by Building Better Health and Lambeth Primary Care Trust, designed by Henley Halebrown Rorrison



Winner

Children's Hospital Tony Molleapaza Rojas, Peru, commissioned by PAZ Holandesa, designed by EGM architects



Bas Molenaar (centre) of EGM architects receiving the award from judge Ian Forbes (left) and sponsors Ngonyama Okpanum & Associates (right)



Sustainable Design Project

Sponsored by
Arup

ARUP



Lead judge

Steve Trevenar, head of business strategy, health and scientific research, Lend Lease, Australia

Panel

Phil Nedin, global healthcare business leader, Arup, UK

Ihab M K Elzeyadi, University of Oregon, USA

Criteria

Awarded for a completed healthcare project where issues of sustainability are achieved at a level conspicuously above the present mandatory norm and which set a new standard of attainment to satisfy legislative, technical, financial and moral imperatives. The award will only be made for exceptional solutions, which must have been in full operation for a minimum of one year.

Finalists

Potter Street Redevelopment, Australia, designed by Allen Kong Architect

PET-CT Center for Diagnosis and Research, Qatar, commissioned by Hamad Medical Corporation



Highly Commended

Flinders Medical Centre New South Wing,
Australia, commissioned by SA Health,
designed by Woodhead



Winner

South West Acute Hospital, UK, commissioned by Western Health & Social Care Trust, designed by Stantec



Bill Rostenberg of Stantec (centre) receiving the award from judge Steve Trevenar (left) and sponsors Arup (right)



Mental Health Design Project

Sponsored by
HLM Architects



Lead judge

Chris Liddle, chairman, HLM Architects, UK

Panel

Ron Billard, director, Billard Leece Partnership, Australia

Cliff Harvey, Ontario Ministry of Health, Canada

Criteria

Awarded for a mental-health facility where an effective reconciliation between issues of security and perceived 'openness' are evident and where the operational need for supervision does not overwhelm the imperative to provide a civilising and humane setting to support therapeutic intervention. The project should appear community-friendly. Evidence of safe landscaping is important, as are levels of construction specification to meet informed standards of sustainability.

Finalists

Linn Dara Child & Adolescent Facility, Republic of Ireland, designed by Reddy Architecture

Potter Street Redevelopment, Australia, designed by Allen Kong Architect

Worcester Recovery Center and Hospital, USA, designed by Architecture+

Lutherwood Children's Mental Health Centre, Canada, designed by Stantec



Highly Commended

Gold Coast University
Hospital Mental Health Unit,
Australia, commissioned by
Queensland Health, designed
by Hassell, PDT and STH in
Joint Venture

Highly Commended
CAMH Village Family Health
Team, Canada, commissioned by
the Centre for Addiction and
Mental Health, designed by ARK





Winner

"High Care" Mental Health Unit, the Netherlands, commissioned by Stichting Rivierduinen, designed by de Jong Gortemaker Algra architects and engineers



Tycho Saariste of de Jong Gortemaker Algra (centre) receiving the award from judges Cliff Harvey (left) and Ron Billard (right)



Future Health (Unbuilt) Project

Sponsored by
World Health Design

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Lead judge

Mungo Smith, director; Medical Architecture Asia Pacific (MAAP), Australia

Panel

Tarek El-Khatib, senior partner, Zeidler Partnership Architects, Canada

Lim Lip Chuan, CPG Consultants, Singapore

Criteria

An award for the design of an unbuilt acute or non-acute healthcare building that recognises the changing role of the hospital within the wider healthcare system. The project must demonstrate a 'salutogenic' vision for healthy environments that addresses anticipated socio-economic challenges of the future.

Finalists

Healthcare Clinic for the Homeless, USA, designed by HKS

Small Hospital, Big Idea, designed by de Jong Gortemaker Algra architects and engineers

Lions International Eye Centre, Ghana, designed by Broadway Malyan

King Fahad Medical City, Saudi Arabia, designed by Devereux Architects

Bridgepoint Hospital revitalisation project, Canada, designed by HDR

Espoo Hospital and Senior Centre, Finland, designed by K2S Architects

Sijsele Care Campus, Belgium, designed by VK Architects and Engineers

King Khalid Medical City, Saudi Arabia, designed by AECOM

Urban Daycare Complex for Adults with Developmental Disabilities for Semi-Arid Climates, designed by SynThesis Architects



Highly Commended

Vienna North Hospital, Austria, commissioned by Vienna Hospital Association, designed by Health Team KHN – Albert Wimmer ZT



Highly Commended

Sheikh Khalifa Medical City, UAE, commissioned by SEHA, Abu Dhabi Health Services Company, designed by Skidmore Owings & Merrill LLP in Joint Venture with ICME and Tilke



Winner

New Queensland Children's Hospital,
Australia, commissioned by Queensland
Health, designed by Conrad Gargett Lyons



Corbett Lyon (centre) and Bruce Wolfe (right) of Conrad Gargett Lyons receiving the award from judge Mungo Smith of MAAP (left)



Salutogenic Design Project

Sponsored by
Farrow Partnership Architects



Lead judge

Jan Golembiewski, University of Sydney, Australia

Panel

Eve Edelstein, University of Arizona, USA

Tye Farrow, senior partner, Farrow Partnership Architects, Canada

Criteria

Awarded for the design of a completed project of any typology, which is comprehensible, manageable and meaningful, thereby fostering a strong sense of coherence amongst its users that promotes their health and wellbeing. Submissions must show how environmental, social and economic sustainability is improved.

Finalists

The Braggs, University of Adelaide, Australia, designed by BVN Donovan Hill

Indiana University Health, Neuroscience Center of Excellence, USA, designed by Cannon Design

The Kinghorn Cancer Centre, Australia, designed by BVN Donovan Hill

South West Acute Hospital, UK, designed by Stantec

Charles Sturt University National Life Sciences Hub, Australia, designed by BVN Donovan Hill

Flinders Centre for Innovation in Cancer, Australia, designed by Woodhead

Ichi Go Iche E, commissioned by the University of Washington

Global Fund MDR TB Hospital, South Africa, designed by Hospital Design Group



Highly Commended

RFBI Basin View Masonic Village Aquaponic Garden, Australia, commissioned by Royal Freemasons' Benevolent Institution, designed by Earthan Group



Highly Commended

Lebovic Campus Community Complex, Sherman Health and Wellness Centre, Canada, commissioned by UJA Federation of Greater Toronto, Mount Sinai Hospital, designed by ARK



Winner

Potter Street Redevelopment, Australia,
commissioned jointly by Wintringham and
Wallara, designed by Allen Kong Architect



(L-R) Judges Jan Golembiewski and Eve Edelstein presenting the award to Phil Igoe of Wallara, Allen Kong of Allen Kong Architect and Phillip Goulding of Wintringham, with sponsors Farrow Partnership Architects



Interior Design Project

Sponsored by
Montgomery Sisam Architects

MontgomerySisam



Lead judge

Alice Liang, principal, Montgomery Sisam, Canada

Panel

Susan Francis, programme director, Architects for Health, UK

Nicola Bertrand, associate, Hassell, Australia

Criteria

An award to recognise a therapeutic space that enhances the health, wellbeing and quality of life of the patients, staff and visitors. Preference will be shown to projects that respect the privacy and dignity of patients, and which illustrate originality in the design approach and environmental sustainability.

Finalists

Entrance Hall, Ikazia Hospital, the Netherlands, designed by EGM architects

Isala Klinieken, the Netherlands, designed by Architecten Maatschap Isala

Patient Care Environment Phase 1, Hamad Bin Khalifa Medical City, Qatar,

commissioned by Hamad Medical Corporation



Highly Commended

South West Acute Hospital, UK,
commissioned by Western Health &
Social Care Trust, designed by Stantec

Highly Commended
Gates Vascular Institute and UB
Clinical Translational Research
Center, USA, commissioned by
Kaleida Health and SUNY,
designed by Cannon Design





Winner

CAMH Village Family Health Team, Canada, commissioned by the Centre for Addiction and Mental Health, designed by ARK



Judges Alice Liang (right) and Nicola Bertrand (left) present the award to Nancy Wilson and Christophe Gauthier of ARK (centre)

Use of Art in the Patient Environment

Sponsored by
Destravis Group



Lead judge

Marily Cintra, Health and Arts Research Centre, Australia

Panel

Nadia Tobia, Farrow Partnership Architects, Canada
Annette Ridenour, Aesthetics Inc, USA

Criteria

An award that recognises the effective application of creative endeavour (of any type or in any medium) that further advances knowledge of the potential of the arts to assist significantly in the therapeutic process. Preference will be given to conspicuous success in new approaches, stretching still further the boundaries of possibility in the wide creative field.

Finalists

The Kinghorn Cancer Centre, Australia, created by BVN Donovan Hill
The Montefiore Hospital, UK, created by IBI Nightingale
CAMH Village Family Health Team, Canada, created by ARK
South West Acute Hospital, UK, created by Stantec
SafeVent Fencing, designed by Britplas (Safevent Systems Group)



Highly Commended
Royal Brompton Centre for Sleep, UK,
commissioned by Royal Brompton & Harefield
Hospitals Charity and Royal Brompton
& Harefield NHS Foundation Trust, created
by Steven Appleby with rb&hArts

Highly Commended
Global Fund MDR TB
Hospital, South Africa,
commissioned by
The Global Fund, the
National Department
of Health South Africa,
Limpopo Department of
Health South Africa, the
Council for Scientific and
Industrial Research, and
Sakhiwo Health Solutions,
created by Hospital
Design Group





Kentucky is my land.

*It is a place beneath the wind and sun
Is the very heart of America.
If these United States can be called a body,
Kentucky can be called its heart.*

Winner

University of Kentucky, Albert B Chandler Hospital Arts in Healthcare programme, USA, commissioned by University of Kentucky Healthcare, created by AECOM



Richard W Lay of AECOM (centre) receives the award from judge Marily Cintra (left) and sponsors Destravis Group



Product Design for Healthcare Application

Sponsored by
VK Architects and Engineers



Lead judge

Gunther De Graeve, managing director, Destravis Group, Australia

Panel

Bill Rostenberg, Stantec, USA

Criteria

Awarded for a manufactured product or item of equipment that adheres to human-factor principles and which is integrally installed in a healthcare environment, advances levels of technical performance and integrates satisfactorily with the setting designed to accommodate it.

The finalists

UUBEE Integrated Toilet, designed by UUBEE

UUBED Hospital Bed, designed by UUBEE

Highly Commended

Artis Q.zen Interventional Imaging System,
designed by Siemens Healthcare – AX Division



Siemens receiving the award from judge Gunther De Graeve (left) and sponsors VK (right)

Winner

SafeSee Door, designed by Britplas



Britplas receives its award from judge Gunther De Graeve (far left) and sponsors VK Architects & Engineers (far right)



Highly Commended

Whiterock Wall Cladding Systems, designed by Altro



Glen Stratton of Altro receives the award from judge Gunther Dr Graeve (left) and sponsors VK Architects & Engineers



Ngonyama Okpanum & Associates

ARCHITECTS | PROJECT MANAGERS | URBAN DESIGNERS | INTERIOR DESIGNERS | TOWN PLANNERS

Ngonyama Okpanum and Associates is dedicated to providing knowledge-based solutions to health care design.

Architecture has a strong behavioral influence on the community and society at large. Our approach to design is characterised by a focus on the interpretation of factors which impact on the built environment i.e. the social, architectural, spatial, philosophical, political and technological aspects of design; and their interpretation in the site-specific context.

Ngonyama Okpanum and Associates provides developmental, managerial and technical services in this respect, and within the context of human upliftment and the development of the built environment. Our architecture seeks to promote quality buildings with a strong recognition of the positive influence of architecture through the creation of pleasant therapeutic environments and well-designed spaces.

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CANCER RESEARCH FACILITY

PROJECT: MOTHER AND CHILD CANCER RESEARCH INSTITUTE
BAYELSA, NIGERIA



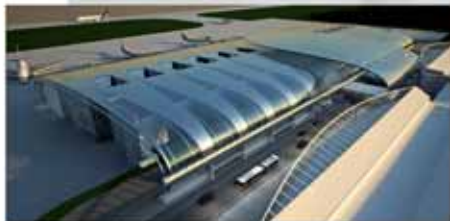
PRIVATE HEALTH CARE

PROJECT: BELLVILLE HOSPITAL
CAPE TOWN, SOUTH AFRICA



INTERNATIONAL AIRPORT

PROJECT: ABUJA INTERNATIONAL AIRPORT
ABUJA, NIGERIA



REGIONAL AIRPORT

PROJECT: ENUGU REGIONAL AIRPORT
ENUGU, NIGERIA



COMMUNITY LIBRARY AND CLINIC

PROJECT: ALBOW GARDENS
CAPE TOWN, SOUTH AFRICA
COMPLETED 2000



PRIMARY HEALTH CARE FACILITIES

PROJECT: OPOLLO HOSPITAL
BAYELSA, NIGERIA
COMPLETED 2009



TERTIARY HEALTH CARE FACILITIES

PROJECT: CHRIS HANI BARAGWANATH HOSPITAL
JOHANNESBURG, SOUTH AFRICA
COMPLETED 2009

Informed Healthcare Design



www.medicalarchitecture.com

Rosberry Park, Mental Health Campus
RIBA Client of the Year 2012
RIBA Northern Network Gold Award 2011
RIBA Northern Network Hadrian Award
2011 (North East Project of the Year)
Design & Health International Academy
Award Highly Commended - Mental Health
Design 2010



Design & Health Scientific Review

Brain matters



Dr John Zeisel is chair of the international advisory board of the International Academy for Design & Health and president of Hearthstone Alzheimer Care

Ten years ago at the American Institute of Architects (AIA) annual conference in San Diego, California, a group of architects, organised by architectural researcher John Eberhard and local architect Alison Whitelaw announced the next major vector they predicted for evidence-based design – neuroscience and architecture. They had been meeting and planning for many months with local neuroscientists, including some from the Salk Institute, a magnificent campus overlooking the

Pacific Ocean designed by architect Louis Kahn. The Salk Institute houses many accomplished neuroscientists, among whom are two who remain involved with this effort – Fred “Rusty” Gage who is one of the discoverers of neuro-genesis (the fact that parts of our brains keep producing neurons even as we age) and Tom Albright, whose work on visual perception is groundbreaking. Out of this collaboration, the Academy of Neuroscience for Architecture (ANFA) was born. Mind-body relations, the function of nature in productivity and health, and environmental supports for health and performance – the subject matter of the three articles in this issue – have in common that they all relate to neuro-architecture themes, concepts, and data. The most direct is Eve Edelstein’s article which describes the link between environmental design lighting and acoustic decisions and memory, word perception and discrimination, and circadian rhythms. Edelstein points out the barriers to perception presented by too much light and too much noise in our environment, and presents virtual reality methods linked to brain monitors that can fine-tune understanding between our brains, bodies and the environment – the Cave Automatic Virtual Environment (CAVE). Hamman and Jones’s discussion of biophilic design is equally linked to neuroscience through their reference to EO Wilson’s assertion of human’s genetic (read “hard-wired”) “ubiquitous fondness for nature” leading to nature becoming “a basic human need.” They found that live plants and animals (two live goldfish) reduce office workers’ stress more than digitised on screen fish and silk plants. Zadeh and colleagues in their environmental design preference survey of nurses found that nature and animals – in the form of fish tanks, natural light, and flowers – all were mentioned as possible health-promoting environmental attributes. Underlying these research discussions – based on a survey of 80 nurses, an experiment with six high school employees, and a new virtual reality technology – is a simple acknowledgement that our brains process the sensory inputs we receive from the environment we live, work, and play in, in turn influencing in various subtle and not so subtle ways our perceptions, behaviours, feelings, and attitudes. Neuro-architecture is here to stay.

- For full disclosure, John Zeisel is a board member of the Academy of Neuroscience for Architecture and head of its research committee.



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New approaches to the creation of healthy environments

Dr Eve Edelstein MArch, PhD (Neuro), EDAC, Associate AIA, F-AAA



70-79

The effect on mood of a ‘living’ work environment

Chloe Hamman MA Science (Hons), BCA; Dr Linda Jones



80-85

Design characteristics of healthcare environments

Rana Sagha Zadeh MArch, PhD, Associate AIA, EDAC; Mardelle McCuskey Shepley DArch, FAIA, FACHA, EDAC, LEED, AP

Research-based design: New approaches to the creation of healthy environments

Technologies are emerging that can reveal the reactions of mind and body to specific features of the designed environment. This paper reviews a selection of these innovations, which can provide the means to conduct pre-design evaluations

Eve A Edelstein MArch PhD (Neuro) EDAC Assoc AIA F-AAA

The impact of building-design strategies on non-communicable disorders, unhealthy behaviour and global ecological conditions has recently been recognised in studies by the United Nations, the World Health Organization and the Institute of Medicine.

Such research acknowledges a compelling need to improve our cities and buildings for the benefit of human health and wellbeing. Revelations surrounding the frequency at which unhealthy and adverse events occur in healthcare environments have motivated architects to create design strategies that improve human and sustainable outcomes. These strategies, however, are not always as informed as they could be, because “too often, the form and function of architectural environments neglect to take into account the influence of the built setting on human responses and, indeed, on human health itself”.¹

In response to these needs, a new generation of designers, architects and engineers is embracing an interdisciplinary approach and employing novel technologies to inform salutogenic design. The incorporation of findings from neuroscience, physiology and psychology, along with architectural research models based on philosophical constructs and sociological and ethnographic methods, offer the means to relate human responses to design in a more powerful fashion.

A ‘neuro-architectural’ approach

The neuro-architectural process informs design by correlating specific measures of the built environment (input) with quantified measures of the brain’s and body’s responses (neural, physiological and psychological responses), as well as

sociological, behavioural and economic outcomes (output). This process gives weight to scientific methods of research, linking input, response and output, and allowing for statistical and critical evaluation of design outcomes.

With the advent of recently developed neuroscientific instrumentation, a higher degree of objectivity enables measurement of both conscious and sub-conscious responses without relying on the subjects’ understanding or ability to articulate their cognitive, sensory or emotional response to design. In this way, resulting findings therefore offer greater potential to reveal the needs and preferences of the growing number of individuals with developmental or physical conditions, or those with dementia or cognitive impairment.

The goals of this integrated approach are to understand better how the brain’s and body’s responses to the environment influence health and wellbeing; and to define and quantify the human, environmental and financial returns on investment in design. The complexity of architectural environments

suggests it may be impossible to reduce human interaction with built settings to measurable elements. But the combination of scientific studies with rigorous social and cultural observations can yield greater analytic confidence in the applicability of findings based on physical, physiological, psychological and social (PPPS) measures. These objectives are consistent with the creation of private and social spaces, with natural and innovative features that improve the quality of a place and how users function within it, as well as including salutogenic factors to enhance wellbeing.

Translating the hierarchy of design

A ‘hierarchy of design principles’ is proposed, translating Maslow’s ‘hierarchy of needs’² into a design process that includes iterative feedback loops to each component of the body, brain and mind that interacts with design features, and consequently drives behaviour. Outcomes that serve salutogenic and economic goals can thus be analysed using the construct of a scientific method applied to design inquiry.

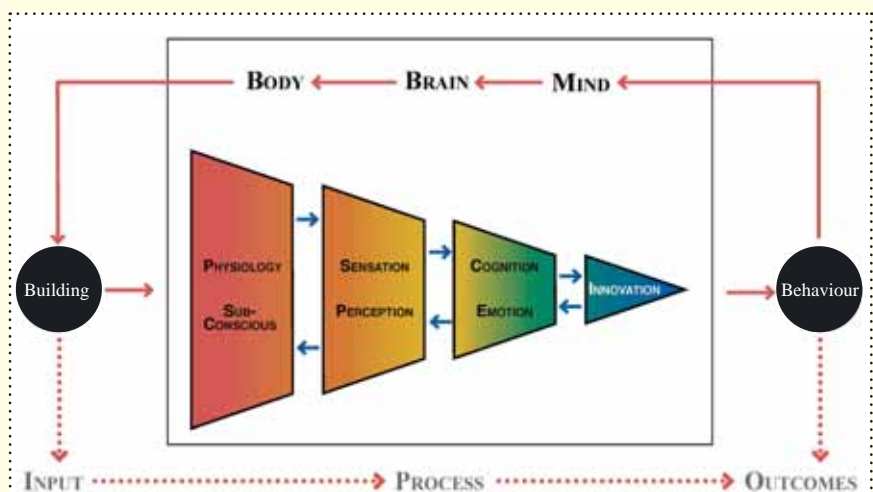


Figure 1: Neuro-architectural design process



Figure 2: Visuo-acoustic simulations in the CAVE evaluate speech intelligibility of doctors reciting 'sound-alike' medication orders when competing with clinical recordings of conversations, ambient noise, equipment alarms and ventilation sounds

The design process is reversed relative to many evidence-based projects; the first step translates clinical and neurophysiological evidence of the impact of physical design components into principles that reflect how the brain and body respond to place. Design that minimises harm in terms of physical health and safety, error and injury is the first priority and considered fundamental to all design decisions. In an iterative feedback loop, the psycho-physiological impact of each design feature is then assessed to 'do no harm' to either mind or body of patients and providers. At this stage, the differing needs of those with specific disabilities or medical conditions are considered. Psycho-physiological responses are considered in terms of their ability to support the quality of care, as well as the quality of work and creativity.

Innovations to enhance outcomes cover all aspects of mind and body. These aspects include sensory, perceptual and cognitive functions for problem-solving and critical decision-making. Socio-cultural constructs inform considerations of private and social spaces to enhance function, engagement and meaning. In this way, design is explored in relation to mind and body as well as health and wellbeing.

Embedded in this approach is the inclusion of guidelines on sustainable design, so that materials, systems and building performance 'do no harm' to the environment or inhabitants. The merger of healthy and sustainable design is evident in the recent development of sustainability guidelines for healthcare facilities, by institutions such as BREEAM for Health, United States Green Building Council, LEED for Healthcare, AIA Facilities Guidelines Institute, the

Joint Commission, and the Global Health and Safety Initiative, among others. Most guidelines focus on exposure to pollutants and toxins in air and water, and via physical contact with materials. But design strategies to improve clinical outcomes are equally important and sustainability guidelines should be directed at improving both human and environmental outcomes.¹

Methods

This scientific research paper reviews the development of several techniques that combine novel biological and environmental sensors in real and virtual simulation settings to test design hypotheses and allow subjects to see and hear the consequences of design. Recent developments in visualisation and acoustic rendering enhance the realism of immersion in virtual mock-ups.

The application of this flexible simulation environment is evaluated below in regard to the impact of sound on medication error and the quality of care; spatial cognition and preference; wayfinding; and the influence of light on human outcomes.

The development of visuo-auditory simulation environments, such as the Cave Automatic Virtual Environments (CAVE), provide controlled settings in which design hypotheses can be tested before design is finalised. Viewers interact with the virtual images using a 3D joystick and a head-tracking infrared sensor system, which registers the subject's location and orientation in space, and moves 3D visual fields according to their point of view. The viewer's head and joystick locations are logged over time, dynamically tracking their first-person perspective, position and interactions within the virtual setting. Use

of collaborative-CAVE software also allows visualisation in many environments to be distributed in synch across many locations around the world.³

A novel computer-aided design system named CAVECAD allows users to alter dynamically the virtual environment while subjects stand within the stereoscopic model itself. This approach eliminates the need to create a 3D model at a desktop computer before importing it to a virtual environment. Thus, a number of design conditions can be tested without necessitating the building of, or change to, mock-ups prior to further testing. By logging subject responses over a sequence of trials, multiple design changes can be tested, according to controlled protocols and during synchronous recording of brainwave responses.

In CAVE simulation environments and dedicated listening environments, acoustic simulation systems have been developed to test, predict and improve the impact of acoustic design on human responses and function. Using dynamic audio-rendering software (SoniCAVE), scenes of sound can integrate databases of materials, audio samples from real healthcare environments and equipment, and geometric reverberation computations to create accurate predictions of real-life scenarios.⁴

Sound design

An acoustic simulation was designed to model the consequences of noise conditions on work errors. The Center for Quality Improvement and Patient Safety report, and analysis of 26,000 records in a US-wide anonymous error-reporting system (MEDMARX), revealed an increased

rate of error in medications with similar-sounding names.⁵ The consequences of this issue were demonstrated at a workshop where speech intelligibility and error were presented in three conditions: a dedicated sound lab, an auditorium, and in CAVE virtual simulations.

Sound-alike medications from the National Patient Safety 'sound-alike' medication list⁶ were recorded in the presence of, and without, competing sounds (eg recordings of medical-instrument alarms, nearby conversations and HVAC noise). In all conditions, the participants were unable to discriminate between 'sound-alike' names from the list if the competing noises were greater than 15dB above the medication list (played at 65dB(A), the approximate level of conversational speech).

Although the participants were not clinicians, and would therefore be unfamiliar with the medication names, these results are consistent with the body of research

that shows intelligibility improves as speech levels rise 15dB, or more, above the background noise level. Even greater separation between speech and noise is required in order to achieve equivalent intelligibility scores for those listening in a second language, and for those with hearing disorders and hearing that has diminished with age.

Unfortunately, the majority of critical-care environments far exceed these levels, dramatically increasing intelligibility and associated error. Figure 3 plots sound levels in a variety of hospital conditions. Using standard protocols for evaluating averaged noise levels, the intensity of sound ranged from 75-85dB(A) Leq in critical-care units such as emergency and intensive-care departments. These findings are consistent with recent studies demonstrating that noise in healthcare environments has been steadily increasing over the past 50 years, with no single facility operating within the

sound levels recommended by the World Health Organization.⁷ When impulse-sound peaks are measured, using time constants capable of recording sounds from alarms and equipment, a near constant impulse level is seen (in green lines), ranging from 100 to 120dB peak during shift changes.

Exposure to such sound levels increases the risk of noise-induced hearing loss, as well as the likelihood of physiological and psychological changes. Increased cardiovascular risk has been observed when daytime noise levels exceed moderate levels, and stress reactions, such as cortisol disturbances, have been observed in children who are exposed, for long periods, to low-frequency traffic noise averaged at less than 55dB(A).⁸ Unwanted noise exposure and lack of speech confidentiality and privacy further diminish performance, communication, satisfaction and the healing quality of healthcare environments.

Findings from surveys of 118 medical practitioners and administrators at the California Institute for Telecommunications and Information Technology (Calit2), at the University of California, San Diego, confirmed concerns regarding acoustic conditions in healthcare settings. The list in Table 1 reveals the priorities for improving sound conditions, among those surveyed. Ordered in a 'hierarchy of care', acoustic modification should first consider the likelihood that unwanted noise may lead to death, or severe adverse events, such as medical or medication error as a result of miscommunication related to competing or high-level sound. The list of needs also considers enhancement of provider performance and the quality of the care environment, in addition to patient needs.

While today's guidelines call for greater attention to acoustic optimisation and acoustic consultation with healthcare design teams, the high sound levels and atypical sound profile generated by equipment and people during the provision of critical care exceed the conditions that minimum acoustic performance standards are designed to address. For example, the recommended wall systems for privacy in standard office spaces are insufficient to ensure confidential-speech privacy – especially in healthcare settings, where voices are often raised to command attention, or to express urgency.

The currently available computational,

Do no harm:
<ul style="list-style-type: none"> • Improve speech intelligibility to reduce medical and medication error: <ul style="list-style-type: none"> - enhance intelligibility of sound-alike medication orders - create controlled sound space for communication • Minimise risk of noise-induced hearing impairment or loss: <ul style="list-style-type: none"> - control sound distribution from helicopters, ambulances, alarms, etc. - reduce the risk of noise-induced hearing loss (e.g. neonates in intensive-care units)
Enhance the quality of care:
<ul style="list-style-type: none"> • Electro-architectural speech enhancement to improve comprehension: <ul style="list-style-type: none"> - narrow-beam speech enhancement and noise abatement where and when necessary • Provision of quiet and private spaces for communication: <ul style="list-style-type: none"> - places for doctors and families to talk - private conversation zones at the bedside to allow visitors to remain during shift reports • Acoustic design enhancements for confidential speech privacy: <ul style="list-style-type: none"> - clinical and critical-care environments where conversation may be louder than average - sensitive areas, such as financial services, admissions, and multi-patient spaces • Electro-architectural control of unwanted sound distribution: <ul style="list-style-type: none"> - narrow distribution of masking sounds to minimise unwanted masking of speech - increased speech privacy and confidentiality where clinical information is exchanged
Enhance the quality of work:
<ul style="list-style-type: none"> • Quiet spaces where concentration can take place (e.g. pharmacy, anesthesia, etc.). • Reduce unwanted or disturbing noise: <ul style="list-style-type: none"> - improve or control distribution of equipment noise - manage and reduce construction sounds and vibration
Enhance the quality of place:
<ul style="list-style-type: none"> • Control of sound profile per user: <ul style="list-style-type: none"> - Narrow-beamed music and sound scenes for each individual patient or provider - Narrow-beamed masking to separate sound sources

Table 1: Innovation-team survey results. The hierarchy of design priorities for acoustic modulation of healthcare environments

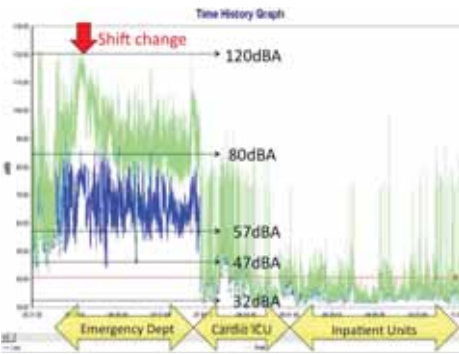


Figure 3: Unacceptable sound levels in critical-care settings. Sound-level equivalent (Leq) averages in decibels (dB(A)) = blue lines and impulse sounds (green lines) as a function of time and clinical-care function



Figure 4: The National Patient Safety list of 'sound-alike' and 'look-alike' medications associated with serious adverse events reveals a great need to create visual (pink labels) and auditory environments to reduce error

digital acoustic-modelling systems are based on algorithms with greater predictive accuracy for large theatre and concert spaces, yet low accuracy for small spaces such as patient rooms or emergency bays. New acoustic modelling software is being developed to overcome these limitations; promising new tunable beam-forming speaker-array systems are being developed to enhance communication more effectively where needed, and masking only where desired, using narrow beams to avoid unwanted masking effects. These techniques will afford designers the means to control unwanted sound distribution without use of walls or physical barriers that impede access, or obscure views.⁹

A view through space

Designers have typically considered the visual domain as the primary stimuli driving the human response to design. Several authors hypothesise that innate responses based on evolutionary pressures may account for design preference. A preference for places of prospect and refuge is thought to derive from adaptation to survival in a savanna ecosystem, where sightlines to predators are essential.¹⁰

It is further suggested that places of refuge, characterised by visual occlusion, appeal where safety is desired; however, places lacking permeability that limit escape or foresight of oncoming intrusion may induce a sense of fear. Completely enclosed spaces such as rooms with no windows, or confined spaces such as an MRI tube, can elicit a strong sense of discomfort, and evoke agoraphobia or claustrophobia.¹¹ In

contrast, places of prospect, with a broad visual access from a single vantage point, may reduce stress.

It is also hypothesised that the design of spaces with high visibility and connectivity with multiple vantage points may promote environmental comprehension, and entice curiosity and engagement with a place.¹² Varying levels of visual and locomotive permeability have been found to determine probabilistic movement. Biederman and Vessel¹³ suggest that the neurobiological system that rewards learning, via endomorphin release in parts of the brain involved in memory of place (parahippocampal cortex), may encourage exploration. Therefore, views that hint of the presence of concealed information and locomotive accessibility may, in fact, entice learning and increase preference of environmental experiences.

Analytic programmes, such as Space Syntax, have been widely used to map the relationship between spatial interconnectivity, visual vantage point and architectural form to the inclination to travel in a particular direction, and predict the aspects of space most likely to be learned.¹⁴ Such methods, however, do not strongly consider the significance of vertical dimension and sense of volume, or the ease with which an observer may acquire spatial knowledge as they move their head position through several vantage points. In order to address these issues, systems have been developed to test the response of subjects to specific features of design while they move through immersive, stereoscopic CAVE visualisations of full-scale photo-

realistic buildings.¹⁵ Head-tracking systems allow for more natural exploratory movement and multiple vantage points, in comparison with computer navigation of a digital model on a desktop screen. Several spatial prototypes can be used, each one expressing a different balance between visual permeability and occlusion, and variation in depth layers evaluated.

Hamilton¹² tested this methodology in a pilot evaluation using a virtual model of the Salk Institute for Biological Studies, La Jolla, California, designed by Louis I Kahn (Figure 5). In this case study, specific design attributes were modified to offer different degrees of permeability and occlusion. A forced-choice assessment of paired spaces around a single vantage point indicated initial preference, followed by free movement, a post-test survey and open-ended questions to reveal changes in preference after exploration. Spatial-quality 'measurands' [quantities intended to be measured] were then analysed to determine if qualities other than permeability and occlusion were primary determinants of visual preference.

This study found spaces that achieved a volume of visual permeability from 20 to 40% were preferred. No participant preferred the most occluded space, in which the total volume of visual permeability was only 13%.

There was also a preference for visual volume and permeability that permitted the greatest depth of view. In the post-test survey, trends revealed preference of both visual complexity and order, which may be consistent with the reward for learning in a complex environment, and the desire to

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Figure 5: Virtual simulation of the Salk Institute is modified to test preference for permeability and depth

comprehend an ordered, permeable and easy-to-learn environment.

Greater understanding of visual attributes may be gained by emerging technologies using eye-tracking systems that can test visual attention to design features, presented as a factor of depth and visual tracking. For example, Jansen et al.¹⁶ showed that saccadic eye movements tend to follow depth cues. Visual-attention tracking that includes depth, as well as the dimension of time, have been tested in virtual-reality CAVE simulations, where carefully controlled calibration can begin to map visual attention to specific architectural features.¹⁷ Such measures are more accurate than tracking head movements alone, as eye and head movement are not always in alignment. Ongoing studies combining these technologies will add clarity to initial findings and enable more specific exploration of the preferred balance between occlusion and permeability, complexity and order, and a vast range of design attributes.

Memory in real and virtual places

A user's attention to many architectural features (visual, auditory, tactile, kinesthetic, etc.) can be studied by recording the subconscious 'experience' of design. Wearable and wireless bio-sensors, combined with environmental sensors, can track the body, brain and behaviour, as subjects are exposed to controlled elements of real or virtual buildings. For example, technologies that record heart rate and electroencephalographic (EEG) brainwaves can reveal and correlate cognitive reactions to specific design features, during wayfinding strategies, attention, concentration,

relaxation or stress. Edelstein et al.¹⁷ used a 256-electrode array to reveal activity of individual components of the brain's cortical areas, as subjects navigated through CAVE simulations of real environments. Tracking systems logged the subjects' head position and view angle, as well as movement within the full-scale digital mock-up. Differences were observed in the frequency spectrum and intensity of responses during spatial navigation when the subject was in a space absent of cues to location, versus a setting rich with navigational cues.

In this early study, significantly stronger synchronisation in theta brainwaves and stronger desynchronisation of the lower alpha brainwave frequencies were observed in areas of the cortex that play a role in spatial and visual orientation (parietal and occipitotemporal areas). The parietal cortex uses visuo-spatial information from a first-person perspective, along with parietal and occipitotemporal areas involved in processing changes in direction and planning of future paths. Disorientation associated with increased alpha-wave desynchronisation likely reflected increased demands on attention.

In contrast, most psycho-physiological studies use desktop screens to show small architectural visualisations of 3D digital buildings. In such simulations, the subjects must imagine themselves interacting within the building – a difficult task for many clients, students and professional designers, even. In this way, virtual CAVE simulations, in which micro-sensors monitor subjects as they move through full-scale architectural spaces, clearly offer more 'ecologically relevant' simulations.

Integrating light

The human visual system is not merely engaged in sight but also in the integration of light to assess the body's exposure to diurnal and nocturnal patterns. A body of neuroscientific and clinical research, dating from before the 17th century, reveals that exposure to light has significant impact on mental state, cognitive function, behaviour and physical health. Recent epidemiological studies suggest that elevated cancer rates in nurses, night-shift workers and flight crew may be related to unnatural patterns of light or dark exposure. Measures of neuroendocrine levels reveal the correlation between daily fluctuations in melatonin,

which modulates sleep and wakefulness, and elevated cortisol levels, which prepare the body for activity.

Consistent with these findings, Edelstein et al.¹⁸ found significant differences in heart-rate variability (HRV) – a well-established indicator of health risk and stress – during performance of memory tasks when subjects were exposed to less than 15 minutes of red light, versus bright white (with a blue peak) light. Whereas many studies have focused on the influence of blue and bright white light on melatonin responses, this experiment demonstrated that red light is associated with changes in cardiac responses. In red light, HRV relaxation was appropriate during rest, and activated only during the memory task. In contrast, bright white light with a blue peak was associated with a constantly active heart rate throughout the experiment. In a parallel study, brainwaves recorded via a 256-electrode EEG array tended to be different during red-light conditions versus bright white-light conditions in a single-subject self-control study.¹⁹

Such research suggests that sustainable-design guidelines should include findings that reveal the spectral range, intensity and pattern of light important to human health and function, as well as vision. Rather than guidelines that suggest average light levels across an entire building, or propose percentages of exposure, lighting design should respond to the specific needs of the users, in addition to the uses of a space. In this manner, programming of spaces for night-shift workers, such as clinicians, factory workers, aircrew or business travellers, could be prioritised when planning access to spaces with natural light.

Furthermore, spaces for control of light and access to darkness would also drive design decisions. The unwanted distribution of light into places occupied by others should be a primary consideration in lighting design for healthy places. Rather than a 'one size fits all' approach, thoughtful lighting strategies should provide for safety and egress, as well as individual controls to modulate light exposure according to clinical needs, functional tasks and individual circadian status.¹⁹

Conclusions

Synchronous measurements of human responses, including both biosensors and,

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environmental sensors, and behavioural-tracking techniques, now offer the means to explore architectural issues that have, to date, remained as design hypotheses. Using a variety of emerging technologies in pre-design studies and post-occupancy evaluations, rigorous research can inform the design of environments that support, rather than impede, health and wellbeing.

An interdisciplinary neuro-architectural framework for design thinking employs such technologies, merging scientific methods with observational, ethnographic, sociological, psychological, physiological and medical results. This approach is particularly relevant to healthcare facilities, which serve the most fragile and most gifted. Moreover, healthcare environments represent all architectural types, being, as they are, places of healing and health, teaching and learning, and business and rest. Similarly, as places that encounter birth, death, discovery and recovery, healthcare facilities must meet the broadest of human challenges.

As healthcare design increasingly incorporates sustainable-design guidelines, we can apply the evidence derived to address human needs that go beyond reduction of noxious and toxic exposures. Architectural, technical and medical knowledge can, in this manner, accelerate such best practice to enhance human experience, performance and health itself.

These applications of new technologies sit at the interface between neuroscience and architecture, and enables the provision of more rigorous data for research-based design. The ultimate goal is to support the design of healthy places for all: the healthy, the infirm, the gifted, and those with special needs, and to promote and enhance health and wellbeing across all peoples.

Author

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Figure 6: Dr Edelstein navigates through the virtual-reality stereoscopic model of the Calit2 Atkinson Hall in the StarCAVE

team, including Thomas DeFanti and Jurgen Schulze; the CAVECAD team, including Lelin Zhang, Cathy Hughes and Daniel Reirden; the virtual bio-engineering team, including Gert Cauwenberghs, Michael Chi, Lelin Zhang and Cory Stevenson; the wayfinding team, including Klaus Gramann, Elke van Erp, Andrey Vankov and Nimo Bigley; and, finally, the circadian HRV-studies team, including Julian Thayer, John Sollers III, Robert Ellis, Tzzy-Ping Jung and Reason Song.

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Nature in design: The effect on mood of a 'living' work environment

Research suggests that nature can have a positive effect on mood, but which aspects have the greatest influence? This study investigates the link between the living component of nature (as opposed to artificial nature) and restorative potential

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In many cultures, both past and present, behaviour reflects a positive engagement with nature; from the ancient Greeks' custom of protecting their sacred gardens, to the native American animistic practice of giving thanks to the trees, a preference for the world of nature has long been expressed through ritual, art and myth.¹

An investigation of city landscape planning for urban green spaces found that in a population of city dwellers more than 70% of residents wished they could visit 'nature' and green spaces more often than they did.² Moreover, people tend to show an overwhelming preference for natural environments over man-made and often perceive natural scenes as more beautiful than artificial environments.^{3,4}

The biophilia hypothesis

The evolutionary psychologist EO Wilson asserted that there is a genetic basis to human beings' "ubiquitous fondness for nature,"⁴ a phenomenon he named the 'biophilia hypothesis'. Kellert and Wilson declared this inherent preference for nature to be a result of our evolutionary history.⁵ Since we went through years of living and depending on nature for survival, we developed an innate emotional affiliation with other organisms, such that contact with nature became a basic human need.⁶

According to the biophilia hypothesis, the reason people favour nature over man-made objects may result from an innate belief that exposure to nature can foster wellbeing and bring about positive changes in cognition and emotion.⁶ Regan and Horn³ addressed preferences for nature in relation to mood states and found that people exhibited a desire for being around nature when relaxed, suggesting people may

have a belief that exposure to nature is a good way to remain in a relaxed state. Is there functional benefit to our apparent preference for nature? Biophilia has become a scientific field of research that explores this very question and considers the human connection to nature and how the latter can improve our health and wellbeing.

Research on the restorative benefits of nature

A growing amount of research supports the idea that exposure to nature can be beneficial for one's health in creating a restorative environment.^{7,8,9,10,11} By definition, restorative environments are those which can help reduce emotional stress and increase wellbeing.¹²

Grahn and Stigsdotter² found that the more time people spend outdoors in urban green spaces, the less they are affected by stress. Ulrich¹⁰ found that patients with views of nature had shorter hospital stays overall, required less pain medication and received fewer negative evaluative comments from their nurses. A prison study found that inmates with outer-facing cells with views of vegetation and landscape recorded fewer days at the health clinic than those with inner-facing cells.¹³ However, green nature (ie trees and plants) is not the only form of nature that can bring about positive restoration. Exposure to animals can also foster psychological wellbeing in terms of reducing signs of stress and promoting happiness,^{8,14} as well as inducing feelings of calm and relaxation.^{15,16,17}

Theoretical frameworks

Research into the effects of the restorative effects of nature tend to employ either of the following theoretical standpoints: attention restoration,¹⁸ or stress recovery.¹¹

Attention restoration theory (ART) focuses on cognitive processes and

suggests that nature creates a restorative environment for our brains to recover from the demands of daily mental activity.² ART suggests that because nature requires very little attention to be sorted and assessed it attracts involuntary attention, or 'soft fascination'. Therefore, when viewing nature our higher cognitive function rests while soft fascination takes over and more primitive parts of our brain are stimulated.¹⁸

Stress-recovery theory focuses on human evolutionary adaptation, in respect of our positive response to nature,¹⁹ to understand the physiological and emotional changes that occur in the presence of nature. Exposure to natural elements, such as plants and water – potentially associated with sustenance and safety – may send a positive signal to suggest that the body can relax and recover from stress. It is through this process that viewing nature is said to be able to provide a restful experience and to have a positive physiological and psychological impact.¹

It has been empirically demonstrated that exposure to nature can be restorative for health, in terms of better recovery.¹² This recognition is reflected in many hospitals having therapeutic gardens for patients²⁰ and the widespread implementation of animal-assisted therapy.¹⁷ Furthermore, many nursing homes have either residential animals or animal visitation schemes as part of an overall recreation programme.¹⁶

Nature in the workplace

Even though most adults spend a greater part of their day at work, very little attention has been devoted to the role of nature in the workplace.²¹ The majority of research has instead been carried out in therapeutic settings, hospitals or prisons. What research has been carried out in work environments supports the idea that exposure to nature can have positive implications for employee

wellbeing and job satisfaction. Nature in the workplace may reduce stress,²² decrease sick days and improve mood and job satisfaction,²³ increase productivity,²⁴ and even stimulate creativity.²⁵ One study carried out in a workplace setting showed that offices allowing employees access to views of nature resulted in fewer worker reports of headaches and illnesses.²⁶ Another study found that feelings of stress and anger decreased the most when nature content was present in art posters decorating an office.²²

Artificial versus living nature

Grinde and Patil,⁷ whose 2009 review explored the restorative potential of exposure to nature, concluded that nature appeared to offer qualities useful for stress relief and mental restoration, thereby improving mood. What remained inconclusive was which aspects of nature were responsible for the positive effects found in the 50-plus empirical papers reviewed. Were the restorative benefits of nature due to the aesthetic qualities of stimuli – visual features, such as colour or shape? Were the benefits dependent on nature's organic characteristics? The core premise of biophilia is that people have a genetic predisposition to react to biological phenomena, suggesting that the 'living' component of nature stimuli is what is inherently valued and restorative.²² Given that, particularly in the workplace, the nature stimuli are mere artificial representations (eg artificial plants, nature screensavers), it is important to determine if these are suitable substitutes for living nature in relation to restorative potential.

Most studies exploring the 'living' aspect of nature have only compared living nature stimuli (eg plants and fish) with artificial non nature-related stimuli (eg art or posters). There are, however, some exceptions. A study by Katcher, Segal, and Beck²⁸ found that viewing living fish in an aquarium reduced anxiety and discomfort during dental surgery compared with viewing a picture of a waterfall nature scene. In contrast, DeSchrive and Riddick¹⁴ found that living nature is not always better than simulations of nature in terms of restoration. Their study comprised three groups of elderly participants – one gazing at an aquarium of live fish, one gazing at a video of the same, and a control group. The group viewing the



Figure 1: Nature stimuli used for living plant condition



Figure 2: Nature stimuli used for artificial plant condition

video showed the lowest physiological signs of stress. Although these results could be due to the fact that watching videos is a similar activity to watching TV, a favourite pastime of the participants, DeSchrive and Riddick concluded that a nature stimuli "need not be animate" in order to evoke a positive response.¹⁴

In another study, by Friedman, Freier, Kahn, Lin and Sodeman,²⁹ the restorative qualities

of viewing real nature versus artificial nature were explored in a workplace. Participants were assigned to one of three conditions: a glass window with a view to nature, a plasma screen with a high-definition view of the same setting, or a curtained wall. Heart-rate recovery measurements suggested the view to real nature provided significantly more restorative qualities than both the plasma screen and the curtained wall.

Another study explored differences in the psychological impact of real and artificial plants and flowers.³⁰ Researchers decorated tables with either cut (real) flowers and plants or artificial versions and asked participants to evaluate the tables. Artificial and cut plants triggered evaluations based on similar adjectives related to aesthetic pleasantness, such as 'colourful' and 'bright'; however, the cut flowers showed significantly more evaluations related to positive mood conditions, such as pleasantness and relaxation. Shibata and

Suzuki also found a significant difference between self-reports of positive mood when exposed to real plant conditions compared with artificial plant conditions.³¹

The latest study

The objective of this latest study was twofold. Firstly, it aimed to replicate previous findings that suggest viewing nature can have a positive effect on mood. Secondly, it aimed to explore whether or not living nature stimuli are superior to artificial ones in terms of restorative potential.

Based on findings from previous research, it was hypothesised that: participants would report higher levels of positive mood during the nature stimuli conditions (both live and artificial) as compared with the control (no nature) condition; and that participants would report higher levels of positive mood during exposure to living nature (live plant and live fish) as compared with exposure to artificial nature (fake plant and fish screen).

Six female employees at a New Zealand high school participated. They worked separately in adjacent offices, in administrative roles. The four conditions of living nature stimuli and the control condition formed the independent variables. In the living plant condition the environmental stimulus was a potted, living green plant (Figure 1). In the artificial plant condition it was a potted, artificial green plant (Figure 2), of similar size to the living plant. In the living fish condition (Figure 3), the environmental stimulus was a 20-litre-capacity glass aquarium holding two live goldfish, with rocks, but no aquatic plants. The artificial fish condition was an illuminated screen playing a moving image of a similar-sized aquarium with many fish (Figure 4). In the simulated conditions (artificial plant and artificial fish) the stimuli were selected to represent as close a match to the living version as possible.

The dependent variable was participants' mood state. Mood scores were collected daily using an adapted version of the Profile of Mood States (POMS-Bi) (Bipolar version).³² The POMS-Bi is a 72-item questionnaire with subscales covering six mood dimensions: composed-anxious (CA), agreeable-hostile (AH), elated-depressed (ED), confident-unsure (CV), energetic-tired (ET), and clear-headed-confused (CC). The questionnaire, titled 'How did you feel today?', uses a four-point Likert scale (zero to three) with responses to the above mood dimensions ranging from "much unlike this" to "much like this". On all subscales a higher score reflects a more positive mood. An optional section was provided for additional comments.

A small-N study was conducted over a period of five weeks in participants' own offices. Participants were randomly assigned to one of the four nature stimuli conditions, or the control condition – ie their office, with no added item. They were



Figure 3: Nature stimuli used for living fish condition



Figure 4: Nature stimuli used for artificial fish (screen) condition

Table 1: POMS-Bi subscale mean group scores across nature conditions

Nature Condition	POMS-Bi Subscale					
	CA Composed - Anxious	AH Agreeable - Hostile	ED Elated - Depressed	CV Confident - Unsure	ET Energetic - Tired	CC Clear-headed - Confused
Control	24.92	25.69	23.92	23.38	21.85	23.31
Live Fish	31.22	29.22	30.11	26.11	26.11	29.56
Live Plant	26.36	26.55	23.36	22.64	23.91	24.36
Artificial Fish	23.78	22.39	22	21.39	20.44	22.28
Artificial Plant	25.27	24.47	20.2	20.33	14.73	23.8

told that they would have a different item introduced into their office in four of the five weeks. Participants arrived at work each Monday during the study to find one of the nature items placed in a clearly visible location – which remained constant for each item – or no item if they were in the control condition that week. Completed daily questionnaires were collected at week end and, at the end of the fifth stage (week five), the researcher carried out a brief semi-structured interview with each participant to record their perceptions and experiences of participation.

Quantitative analysis of the mood scores converted raw data for the 72 items to t-scores for each nature-condition. Participants' daily mood was plotted and compared with published norms. The overall group-norm profile for the six subscales across the five conditions are presented in Figure 10. Group profiles were derived from the information presented in Table 1, which reports the mean data for participants' scores on the POMS-Bi subscales across each condition. The subscale scores of 31.22 and 14.73 in bold indicate the range of mood scores obtained.

The scores for the living fish condition were the highest across all six subscales (see Figure 5), with the CA subscale being the highest overall (mean score (m)=31, t=61). The t-scores for the artificial fish conditions were below the norm on five of the six subscales and below the control condition on every subscale, with the lowest being on AH (m=22, t=42). The control subscale scores formed a baseline measure for the group. In the control condition, the group scored close to the norm-group mean across the six subscales.

Participants showed definite fluctuations in subscale scores across the five conditions, although there were no extreme scores to distort the group score for one particular subscale or condition. The control-condition scores were generally all in the mid-range.

Qualitative evaluations elicited from the participants revealed an overall sentiment that the presence of living fish in their office was a beneficial and enjoyable experience. Indicative of this are such comments as "The fish made my day"; "I think every school should have fish"; and "They [fish] have a calming effect on one's mind." Moreover, at the conclusion of the study, a number of participants expressed their disappointment when the fish were removed. Such positive comments were not made in reference to any of the other items.

Discussion

This study aimed to investigate the effects on mood of viewing nature in a work environment, and if any effects found might differ depending on whether the nature stimuli are living or artificial. Predicting that all four nature stimuli would bring about positive changes in mood relative to the control, the artificial fish condition was, in fact, below the control on all subscales.

The second hypothesis – that living nature would elicit higher mood scores than artificial nature – was supported. Mood scores were more positive for both of the living nature conditions compared with the artificial conditions. The living fish condition resulted in the highest positive mood overall. Qualitative evaluations further indicated a preference for the living fish over the other nature stimuli.

These results provide preliminary

evidence that living nature can offer greater restorative potential in terms of mood improvement than an artificial equivalent. In line with these findings, Adachi, Takano, and Kendle³⁰ found that while artificial nature may be aesthetically pleasing, it may be inadequate in terms of "biophilia compatibility". In the latest study, it is possible that the artificial nature conditions had less of a positive effect on mood, as participants could not experience the same feelings of comfort and relaxation as they did when exposed to the living nature.

In accordance with the biophilia hypothesis, it is possible that if we know something is alive then our attention is drawn to it. This theory provides one possible explanation for why participants reported more negative moods when the artificial nature stimuli were present in their office compared with the other conditions – a finding that could have resulted from participants' awareness of the artificiality of the stimuli. In a study addressing the effects on mood of real versus artificial plants, Shibatu and Susuki³¹ found that participants who *thought* that plants were real had higher mood scores than those who thought they were artificial. These researchers suggested that the positive influence of nature may not be caused by actually looking at living nature, but instead by the *belief* that looking at living nature has a restorative effect.

In the present study, it was obvious that the artificial plant and the fish on the screen were not alive. As such, mood evaluations during the artificial conditions may have been influenced not by the fact that the stimuli were artificial but by participants' *knowledge* of their artificiality. It would be

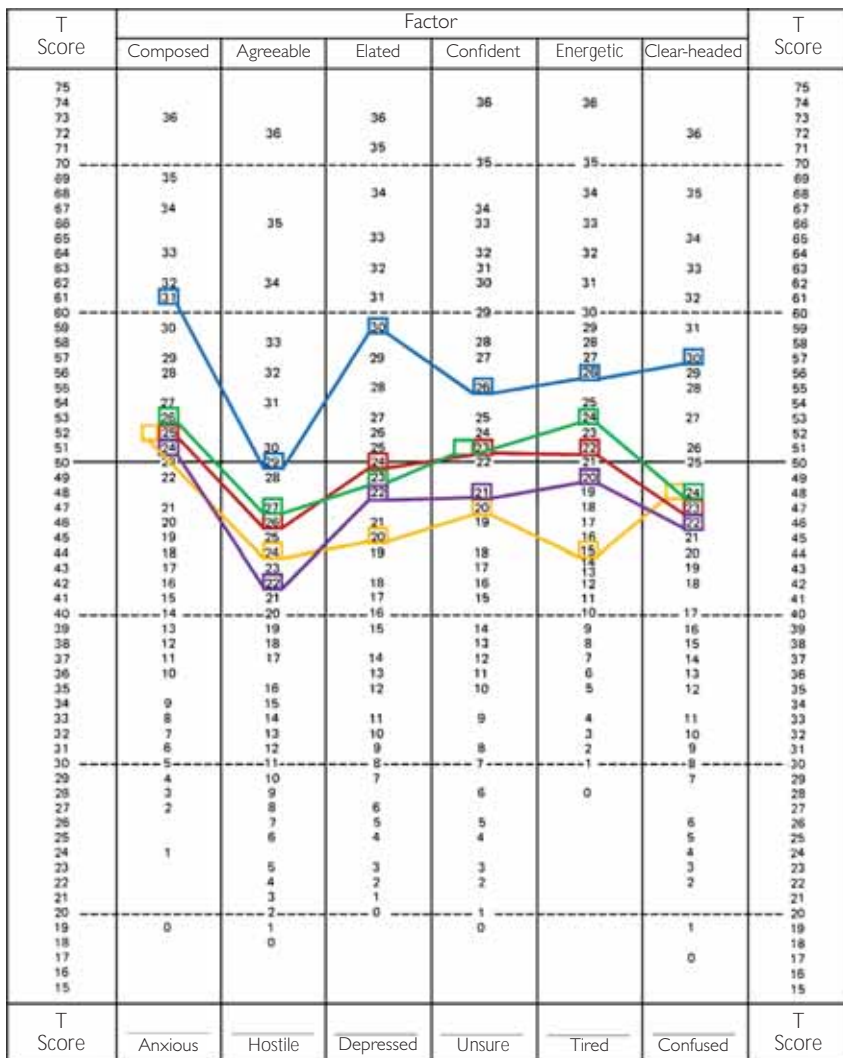


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POMS Bi-Polar Profile Sheet



Key:

- Living Fish
- Artificial Fish
- Living Plant
- Artificial Plant
- Control

the relative complexity of a stimulus is what determines its restorative potential, then it may be the case that a sufficiently complex and detailed representation of nature could equal living nature in terms of providing restoration. The issue of complexity and restorative potential is worth exploring in future research.

The dynamic movement of the real fish may also be what led to the positive impact on mood and may also account for the apparent less positive impact of the live plant. Friedman et al.,²⁹ who, as noted above, found that a view of real nature surpassed a high-definition plasma screen of the same view, in terms of physiological recovery, also highlighted the importance of dynamic nature, such as moving water and trees swaying in the wind. According to Friedman et al, movement in nature evokes all the senses, not just visual stimulation; it is this sensory interaction with life that we thrive on.

The noted positive effect on mood while exposed to the living fish condition can possibly be explained by theories of social research.³² Animals have been described as "social catalysts" in the way they encourage social interaction among people.³³ According to Beck and Katcher,³⁴ companion animals, such as fish, birds, and dogs, provide social support by acting as facilitators of social interactions between people. They can become conversation points by providing a common ground for discussion with others. Animals have also been shown to make social interactions more positive, which, in turn, can bring about more positive mood experiences, such as joy and humour.¹⁶

In a workplace environment, negative interactions with co-workers can create feelings of irritability, tension and frustration. A study found that on days in which interactions with co-workers were described as negative, participants also reported more negative moods.³⁵

Given that participants in this study work in an environment where social contact is

interesting for future research to explore whether awareness alone of stimuli's artificiality influences mood evaluations.

Participants' moods were most positive during exposure to the living fish, with scores in this condition being the highest overall on the six subscales. Furthermore, qualitative evaluations elicited from participants during the live fish condition support the conclusion that participants also had a preference for the living fish over the other nature conditions.

These findings suggest that living fish offer greater restorative potential than representations of nature. As mentioned above, Katcher et al.²⁸ found that viewing a real aquarium was superior to viewing a picture of nature, in relation to reducing

stress and discomfort in dental patients. Proposing that the complexity of a stimulus is a key determinant of its restorative potential, Katcher et al. concluded that the reason the living fish in their study were able to provide a greater source of positive distraction was because they were visually more complex than the poster representation of nature. In the latest study, the fish aquarium was also visually more complex and detailed than its artificial equivalent. Linking the current results to Attention Restoration Theory (ART), the complexity of the fish aquarium may have been a greater source of fascination for participants than that of the fish screen, and it therefore provided more opportunity for distraction away from negative moods.²⁶ If



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Figure 6: Nature in the workplace can have a positive impact on wellbeing



Figure 7: Living nature was found to improve mood more than artificial nature

a frequent and necessary part of the job, such interactions will no doubt affect their daily moods. If the living fish in this study were able to make these social interactions more pleasant, then this provides a plausible explanation for how the living fish may have inadvertently had a positive effect on mood. This theory that social interactions at work could be made more pleasant by introducing living animals is an area worth exploring in future studies.

In contrast to much previous research, the current study found that the live plant made little difference to participants' moods. While the work of Larsen et al.²³ also indicates that a single plant in an office has little effect on mood, they did discover that mood was positively related to plant density. So, as the number of plants in an office increased, so did positive mood evaluations. Such findings suggest that the single plant used in this study may have been insufficient to provide a restorative environment for participants. Nature stimuli density and restoration are also worth exploring in future research.

Limitations and implications

There are a few limitations to this study that should be noted. Stress levels in participants prior to the study may have impacted the results. Studies have shown that the effects of nature are greater for those who have relatively high levels of stress, and the restorative benefits of nature could be less potent if participants have moderate restoration needs.³⁶

In addition to existing stress levels, there are numerous other workplace factors that may have influenced mood evaluations. A worker's individual characteristics, too, can affect their attitude and mood.³⁷ While this study may have been more reflective of what actually occurs in the workplace, it lacked much of the control of confounding variables often exercised in a laboratory setting. With these factors in mind, future research could attempt to replicate these preliminary findings while minimising potential confounds, by setting controls for both participant state and trait characteristics.

The small sample size of this investigation is another limitation. The small-N design was chosen because the study required a fairly lengthy exposure to the nature stimuli, plus it was deemed most feasible to meet time and resource constraints. Nonetheless, hopefully this study has sparked interest for future research to explore the biophilia hypothesis in a sample large enough to determine if statistically significant differences in mood can be identified among the various nature conditions.

In spite of these limitations, the results of this study suggest that living nature can have a positive effect on mood in the workplace. Such findings have implications for managing stress and wellbeing at work. Positive emotional states may predict factors such as job satisfaction and wellbeing, whereas negative ones may have a stronger relationship with undesirable workplace outcomes, such as stress.³⁸

In New Zealand, organisations are required by law to play an active role in managing workplace stress. Part of this role involves taking practical steps to ensure that the workplace environment supports employees' wellbeing and helps prevent unnecessary stress.³⁹ Current findings indicate that something as simple as adding a piece of living nature to an office environment could have positive effects on mood, and therefore help reduce some of the negative consequences associated with stress. If the results of this study were to be applied to the workplace, the stimulus likely to provide the most positive benefit would be an aquarium with living fish.

The results of this study also suggest that substitutes for nature may be inadequate in providing a restorative environment. With the growth of technology-based artefacts in our modern society, it is important to consider the implications of this study when designing a work environment to maximise the benefit to its occupants. The reality is that in some workplaces it may not be feasible to bring living nature inside (eg in sterile laboratories). In these situations it may be beneficial for employers to encourage employees to spend time, during breaks or after work, exposed to living nature.

Further analysis

In addition to the previously mentioned suggestions, future research could explore whether the effects of nature on mood are dependent on the particular work environment. Larsen et al²³ concluded that

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while plants may have a positive effect in creative environments, they may be detrimental to productivity in workplaces demanding repetitive action. Furthermore, there may be workplaces, such as industrial sites, where some of the psychology effects of living nature could come into conflict with the tasks of the employees. Industries requiring quick reflexes or the operation of heavy machinery, for example, may find a relaxed mood state to be counterproductive to the requirements of the role. In these types of workplace, the introduction of living nature may actually have negative repercussions.

Conclusion

This study examined differences in participants' moods when their office settings included a live plant, an artificial

plant, an aquarium with living fish, a fish screen, or no nature stimuli. A review of the literature suggests that it was one of the first of its kind to investigate whether the living component of nature influences the effect it may have on mood.

The results indicated that living nature is superior to artificial nature in providing restoration and that an aquarium may have a significant impact on improving the mood of employees in their office environment. In essence, the introduction of living nature into the workplace may be a simple and effective way to improve wellbeing for employees. As one passionate advocate of the natural world once said: "Nature can trap us involuntarily, occupy our minds, temporarily remove us from stresses of everyday life, and leave us feeling refreshed and in a better mood."¹

This investigation provides support for the biophilia hypothesis applied to the work environment. As people move into a high-tech world with artificial substitutions for nature,²⁹ designers should consider opportunities to bring real nature inside for the benefit of both workers and – through their enhanced psychological health – the businesses for whom they work. As EO Wilson said: "Life around us exceeds in complexity and beauty anything else humanity is ever likely to encounter."⁴⁰

Authors

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Workplace design: Design characteristics of healthcare environments: the nurses' perspective

This study aims to identify the most important characteristics of a work environment that fully support nurse health and performance, as expressed by nursing staff

Rana Sagha Zadeh, Mardelle McCuskey Shepley, Laurie Waggener, and Laura Kennedy

By its very nature, nursing is a stressful profession. To succeed in the field, nurses must possess the technical skill to solve complex problems, the emotional strength to deal with sick patients, and the stamina to endure long, arduous shifts.¹ Demand for nursing professionals has increased steadily in recent years owing to the following factors: ageing populations,² rising life expectancy³ and increasingly complex medical issues globally.⁴ Meanwhile, the difficulties associated with recruiting and retaining nurses have exacerbated.⁵ With nursing positions accounting for up to 75% of vacant jobs in the hospital workplace,⁶ the shortage is already a prominent issue and is expected to almost double by 2020.⁴

Both physically and mentally demanding, nursing is a profession for those who possess a unique and selfless passion to care for others.^{7,8} Yet, the challenging quality of the work has resulted in high job-dissatisfaction rates,^{7,8,9} high turnover rates¹⁰ and increased stress.¹¹ Nursing ranks as one of the top-10 least satisfying professions in the United States.⁸ Because of its reputation, nursing has become less attractive to younger generations;⁵ consequently the nursing population is ageing rapidly.² Older nurses become less physically able to perform tasks with age,² and employed nurses further feel the burden of the nursing shortage by taking on longer work hours and more patients.¹

The current shortage is thus a combination of three related issues – declining enrollments in nursing schools,^{13,14} reduced motivation to stay in the field, and the high number of nurses retiring and leaving the profession prematurely – which must be addressed separately.¹⁴ The most common tactic used to solve nursing shortages is to invest in increasing recruitment of younger generations.^{15,16}



Figure 1: A 'boxed-off' design and some types of artificial lighting can create an institutional feel



Figure 2: Connections to the outdoors help with orientation. Apply light fixtures and finishes that minimise glare and create a non-institutional feel

But these fall short in solving the current complex nursing shortage.^{17,18,19} A practical solution is to focus on improving nurses' working conditions, especially the nursing work environment, which, according to Peterson,²⁰ is the most influential factor for recruitment and retention.

As healthcare operations and services grow ever more complex, all of the aforementioned conditions – the increasing demand for nursing professionals, the current shortage in the nursing workforce, the ageing of the workforce, and deteriorating job-satisfaction ratings – have immense implications for the future of healthcare design. Creating a supportive, high-performing work environment could not only increase recruitment and retention but also enhance the job satisfaction and efficiency of those already working in the field.²¹ In short, if nurses are less exhausted, both physically and mentally, they provide better and safer care for their patients.

In this study we make use of those closest to the issue of the workplace environment to best understand potential solutions. Nurses should have the most influence on healthcare workspace design because they can identify a large number of issues from personal experience.²² Recording and analysing nurse feedback on their existing work environments can help prioritise strategies for change and uncover innovative design solutions that stem from user experience. This report identifies the most important strategic design solutions to create a high-performance work environment for nurses, with the goal of improving nurse health, productivity and work satisfaction.

Methods

This study was conducted in two healthcare facilities in the United States: one outpatient clinic with 20 exam rooms providing primary and preventative care, and one 80-bed inpatient unit within a hospital providing comprehensive care. Full-time registered nurses (RNs) in inpatient and outpatient settings were eligible participants for this study. Participants included both female and male nurses working either the day shift or the night shift.

Anonymous-survey forms and information sheets were distributed to the RNs during monthly staff meetings in both facilities, and made available in staff



Figure 3: There is a need for more personal space. Lack of sufficient space affects posture and comfort, resulting in unnecessary fatigue

work areas for those who were unable to attend the meetings. A number of survey drop boxes were provided at each facility for RNs to return their responses.

Participants supplied responses to the unstructured survey, describing the characteristics of a work environment that would support their health and performance. The feedback was compiled by content into various categories, and those containing the most frequently discussed topics were identified. The aforementioned method of ethnographic data analysis is called content analysis,²³ and it was used in this study to identify objectively the most important characteristics of nursing workspaces.

Results

Of the RNs who were eligible for this study, 71% participated (n=80): 86% (n=69) female, and 14% (n=11) male. Fifty-three (n=53) respondents (66%) at the inpatient facility worked the day shift, while 34% (n=27) worked the night shift.

According to content analysis of nurse responses from both day and night shifts, the most important characteristic of a healthy and productive workplace is "adequate workspace". The summary of nurses' descriptions indicates that a lack of adequate space has negative consequences for productivity, physical health and social wellbeing. Half of the surveys included at least one comment emphasising the need

for appropriately sized workspace.

Several factors were noted as being particularly important to creating a productive workspace: adequate desktop surface space, specifically for charting; sufficient room to move around; avoidance of clutter; and ample space to accommodate all staff (including RNs, ancillary staff and physicians) concurrently, especially during shift changes, or when reports or rounds are carried out. Insufficient space was associated with incidents resulting in added stress, inefficiency and reduced personal privacy. Moreover, interpersonal conflicts among RNs, or between RNs and physicians, have resulted from lack of space. One nurse stated that the ideal workspace would have sufficient room "for which I do not have to fight"! Ergonomic issues can also arise when physical space is limited, because staff cannot stretch their legs or work comfortably with the computers. Two nurses pointed out this issue, specifically asking for "room to stretch limbs" and "elbow room".

The second most frequently mentioned environmental condition was lighting. The RNs emphasised the necessity for well-lit spaces and absence of glare. Most RNs also described the need to have natural lighting, sunlight and windows at workstations. Desired qualities described by a number of RNs were adjustability, uniformity and less institutional fluorescent lighting (Figures 1 and 2).



Figure 4: Hospitals should anticipate storage needs and provide easily accessible storage space, including space for computers on wheels, soiled baskets, isolation storage carts and advanced-cardiac life-support carts

The next most frequently-mentioned need among nurses was ergonomically designed and comfortable furniture. Adjustable desk-height, comfortable and supportive chairs, well-designed keyboards and desks, and a large computer screen with appropriate line of sight were specifically emphasised by the RNs in this study (Figure 3). A healthy and productive workspace design should not require frequent bending or stretching to access basic equipment and supplies, or to complete tasks.

The fourth most important element in healthy and productive workspace, according to the RNs, is sufficient and suitably located equipment and supplies, such as power outlets, which satisfy required environmental considerations. Easy access to sufficient equipment and supplies with ample storage, reachable and sufficient electric outlets, computers, phones, fax machines, call bells and office supplies help improve productivity.

Design that helps maximise work organisation and supports preparedness is the fifth most important characteristic of a well-planned nursing workspace. Preparedness in the workplace design enables staff to act quickly in case of emergency. Sufficient room that allows easy organisation and visual and physical access to supplies and equipment improves efficiency and reduces time spent hunting and gathering. Consistent organisational features among nurse stations, medication rooms, and supply areas are important for time efficiency and boosting productivity. Designated spaces for staff and well-marked equipment areas are key (Figure 4). Design elements that enable staff to identify quickly or mark non-functional equipment, and spot missing or non-stocked supplies could lead to considerable improvement in productivity. Furthermore, designated workspaces for RNs, physicians and social workers – and those who undertake

rounds, such as physicians and physical therapists – will enhance work organisation and reduce disturbances when staff leave their stations.

Other important characteristics described in the surveys include efficient layout, convenient physical access and visual access, privacy and security, minimal noise, and the availability of windows and nature views.

The findings of this study indicate that general architectural features – including allocated floor space, layout, circulation, visibility, access to the outdoors and natural light – form the foundation for creating a high-performance, healthy workspace. But detailed interior design features, such as furniture, finishes, fixtures and equipment, are critical in transforming a facility into a high-performance workspace for health and productivity.

When analysing the subgroups of day shift and night shift, variations emerge in which healthy workplace characteristics were most emphasised. Night-shift nurses discussed more frequently the need for adequate space at individual workstations and good ergonomics, adequate space for stretching, “elbow room” and charting space (Figure 5). The next most popular characteristics for night-shift staff were comfortable, height-adjustable furniture and seating. Lighting was equally important for night-shift and day-shift workers, but



Figure 6: Lighting; physical access; location, layout and noise

ample bright light and high-quality lighting is particularly critical during night shifts (Figure 6). Environmental design considerations to maximise work organisation and preparedness were highlighted more by night-shift workers, especially with regard to storage and stocking. However, noise at the nursing workstations posed less of an issue to work during the night shift than during the day shift. These results indicate the value of designing for flexibility to allow staff to adjust their workstations according to their needs.

Design suggestions

The key characteristics of the work environment that promote productivity and health, according to the surveyed RNs, are listed below in order of importance.

1. Adequate workspace

- Provide adequate circulation spaces and workstations to ensure that nurses are not interrupted when undertaking charting work, and to prevent clutter.
- Consider that, at times, doctors, ancillary staff and RNs gather simultaneously around the nurse station. Anticipate how the space accommodates staff during shift-change reports, when the number of staff doubles while critical patient information is communicated to those on the next shift. Additional foldable or appropriately sized furniture can be

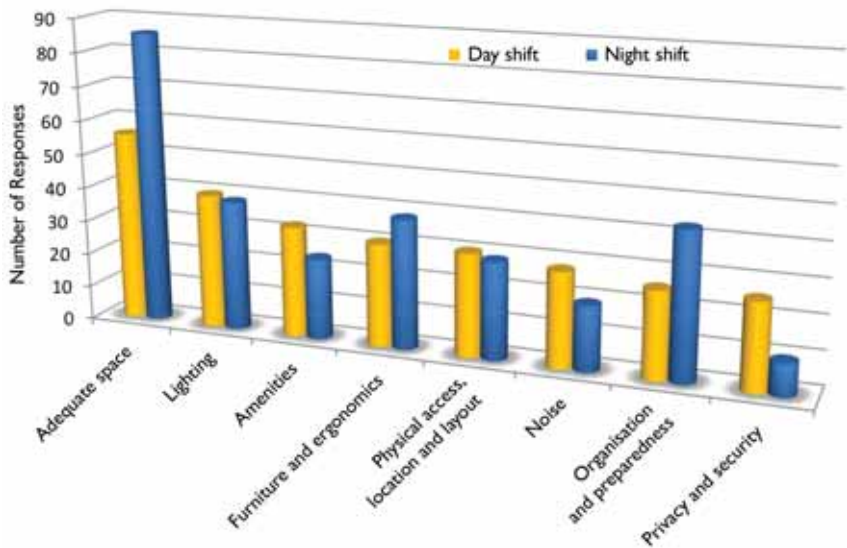


Figure 5: The most important design characteristics of nursing workstations vary between day-shift and night-shift RNs

stored. Lack of space disturbs privacy and can undermine the atmosphere of teamwork, and cause conflict.

2. Appropriate lighting

- Provide bright, glare-free and soft light and design to allow for as much natural daylighting as possible. One nurse stated: "Natural lighting keeps [me] from getting depressed"; another commented: "I would like to be able to see well when

working on patient charts and retrieving medication."

- Fluorescent lighting or finishes, which give a sense of institutional atmosphere, should be avoided. Apply finish surfaces that "look good, fresh and clean". Remember that nurses work long hours, so use warm colours and peaceful themes. Nurses report that they "get eye strain when all their surroundings are ... stark white".



Figure 7: Adequate space; furniture and ergonomics; and amenities



Figure 8: Organisation and preparedness; and windows

3. Furniture and ergonomics

- Provide workplaces that are designed ergonomically to maintain the health and performance of staff. Easy-to-reach supplies without the need to bend or stretch constantly and chairs and tables that are adjustable and comfortable, reduce fatigue and improve health.

4. Amenities

- Anticipate adequate supplies and equipment, such as phones, computers, printers, fax machines, etc. Provide ample reachable power outlets. Provide easy access to bathrooms and refreshments.
- Consider access to music or radio for individuals, as RNs noted that music "could help the day pass".
- Frequently accessed resources, such as linens, medication, nourishment, supplies and refreshments, should be nearby, within "quick access to the hub".

5. Organisation and preparedness

- Design "consistent features and organisation at each desk/work area". Designate spaces for staff and allocate areas for organising equipment, materials, and supplies. Anticipate designated spaces for RNs, doctors, social workers and other staff. Label storage spaces for supplies and ensure they are easy to reach and visible. One nurse requested "supplies in a visible order for ease of

use and restocking". Anticipating design features that help signal missing supplies for restocking or broken equipment is an effective way to reduce wasted time. Informed by unit staff, designers should designate areas for that which is most important (eg vital-signs machines) in the nurse station, or within a few feet.

6. Physical access, location and layout

- Layout is key to work performance. Locate the most frequently accessed supplies around the nurse station "with the least amount of walking to patient nourishment, linens and medication". The ideal layout, as visualised by RNs, is one where the "nurse station is the hub for a unit, with the patient rooms being not too far from it".

7. Noise

- Noise must be suitably controlled, so consider movable and fold-down screens that can be deployed as needed. Nursing staff often "have difficulty concentrating when [it is] noisy" and are "frequently distracted", but the use of acoustic surfaces and physical barriers, such as glass, to control noise should ensure that nurses can concentrate during their work.

8. Privacy and security

- The outside windows opening into nurses' stations should "be semi-secluded

from public eye" to respect patient-information privacy.

- One nurse suggested that the hub should be "surrounded by glass windows above the countertop, with easy access points; this will reduce noise and help keep the patient records private".

9. Windows

- Include windows in nurses' workstations. Nurses stated their desire for a "view to [the] outside or nature," "pleasant scenery" in the form of artwork, or a soothing and stress-reducing artefact "like a fish tank, flowers or trees". Such features are restorative for cognition and help with mental balance during work. A well-designed workspace does not "isolate staff in a box without windows, [or without an] open view of [the] workplace".
- Nursing areas should have good ventilation and ambient temperature. As one nurse expressed, staff need "clean air to breathe".

10. Visual access

- Visibility to the surroundings is critical. Consider patient visibility for every location, specifically those areas where nurses frequently work. "Enable nursing staff to see the patients, with the least amount of walking" and provide views of the hallways and rooms.



Figure 9: Privacy and security, and visual access

Conclusion

Design of nursing-work environments can facilitate or hinder care. Good facility design is a strategic investment that can support staff health and boost their productivity. The primary needs of staff, as suggested by this study, are adequate space, lighting, furniture and ergonomics, amenities, and organisation and preparedness.

This study was conducted in the United States, so further research in more facilities and in a variety of geographical regions would help provide a broader picture of suitable design solutions for nurses' work environments. The study was also limited in respect that only feedback from RNs was

recorded, so additional research is needed to capture the key characteristics of the work environment for other medical staff, including physicians.

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Richard Rogers RA: Inside Out

Royal Academy, London

18 July to 13 October 2013

Associated catalogue: *Richard Rogers: Inside Out* (Royal Academy Publications, £19.95, ISBN 978-1-907533-61-7)

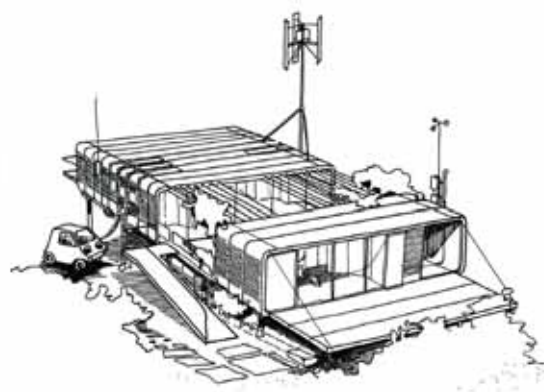
Richard Rogers RA: Inside Out, an exhibition at the Royal Academy in London, celebrates the Pritzker Prize-winning architect's 80th birthday and analyses how his architectural practice was shaped by interrelated social, political and cultural influences.

The first project to gain him international attention was the Zip-Up House (1968), conceived as a prototype for mass-produced affordable housing. Rogers and his then-wife Su designed a single-storey, rectangular yellow tube, constructed from 1.2-metre-long aluminium modular panels. It was supported by bright pink steel columns, which could be jacked up or down to accommodate sloping terrains. Further modules could be added to increase floor area. Flexible building design, coupled with the capability to accommodate future expansion or modified use, therefore came to characterise the architect's work.

Rogers's reputation for innovative flexibility was consolidated with the Pompidou Centre (designed with Renzo Piano, 1971-77), which changed the public's perception of museums from inert mausoleums to lively spaces for social and cultural exchange. He described how it was conceived "as a live centre of information and entertainment – a flexible container and a dynamic communications machine, highly serviced and made from prefabricated parts". Its high visibility and public success replicated that of Jørn Utzon's iconic Sydney Opera House.



A model of the Zip-Up House (1968) by Richard and Su Rogers



The Zip-Up House was a prototype for mass-produced housing

A model for emergency healthcare

In 1971, Piano + Rogers designed a standardised hospital unit for the Association of Rural Aid in Medicine (ARAM), for use in deprived urban or rural areas in developing countries. The brief matched their interest in creating well-serviced and adaptable buildings, designed to accommodate change. Their proposal consisted of a fixed core, accommodating the services required to diagnose and treat patients, and a flexible space to hold as many as 200 patient beds.

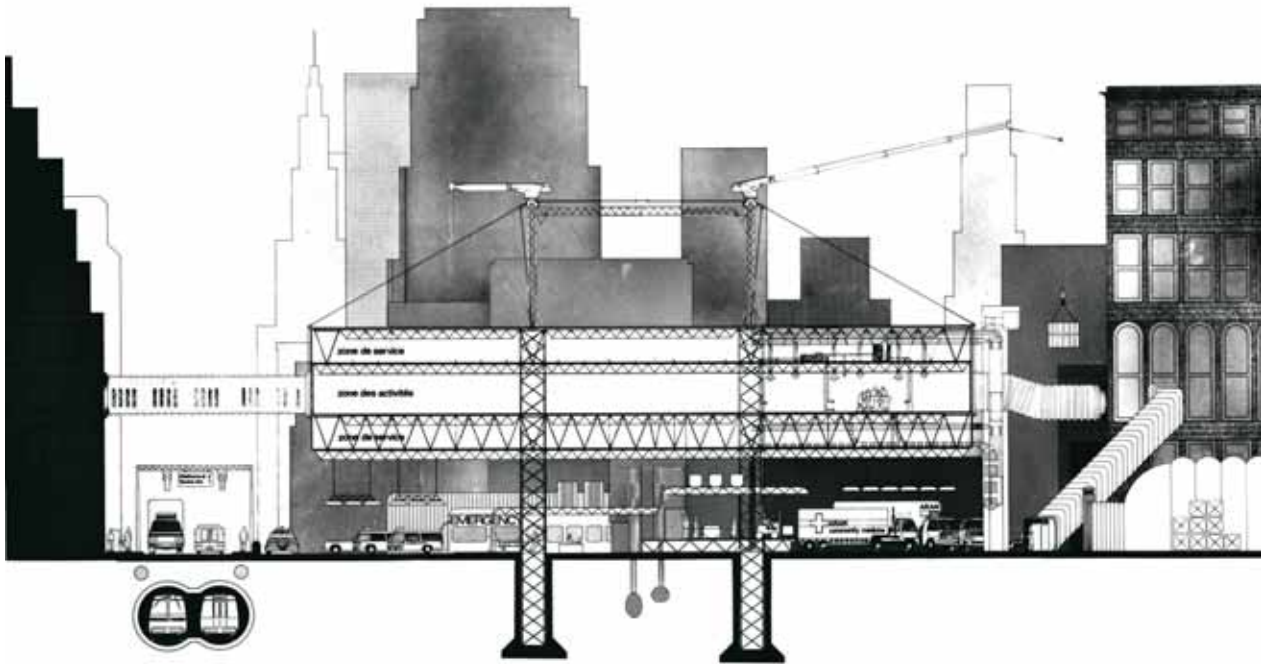
Constructed from small-scale, standardised parts, the ARAM hospital could theoretically be packed into shipping containers and airlifted to developing countries, where a non-specialist team could assemble it to provide emergency healthcare for the community. Permanent cranes, anchored on its roof, could be used to add services to suit local needs and resources. Although the ARAM design was never built, other 21st-century architectural practices, such as Emergency Architects Australia, and Healthabitat (also an Australian practice), are working internationally using similar approaches. Rogers's involvement with emergency healthcare continues to this day, as a trustee of Doctors of the World.

In the developed world, the Maggie's Cancer Caring Centre (Maggie's London), designed by Rogers Stirk Harbour + Partners (RSH), opened at the Charing Cross Hospital in west London in 2008. "There is a long history linking well-designed buildings and space with health," says Rogers. "Maggie's centres (there are numerous in the UK and a few based overseas) are a vital example of good design serving communities and those in need." Awarded the RIBA's Stirling Prize in 2009, Maggie's London was described by the judges as "a timeless work of

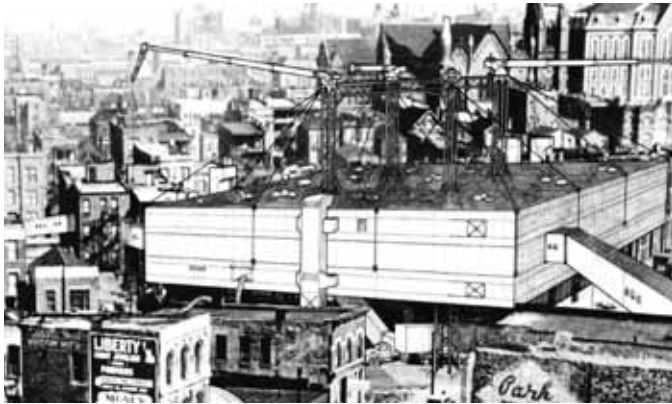
Andrew Zuckerman/Rogers Stirk Harbour + Partners



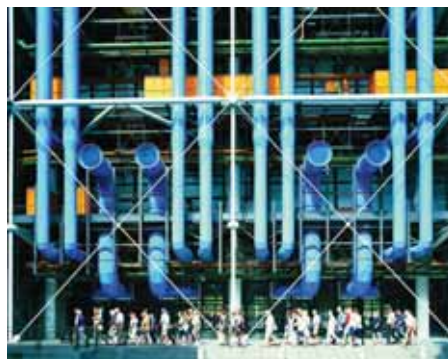
Richard Rogers, subject of an exhibition at the RA



Renzo Piano and Richard Rogers's unrealised emergency hospital (1971), designed for the Association of Rural Aid in Medicine (ARAM)



The ARAM module had a standardised design with permanent cranes for adding services



Piano + Rogers's Pompidou Centre in Paris (1971-77) with its colour-coded external services

architecture, which not only distills the intentions of its brief but expresses, in built form, compassion, sensitivity and a deep sense of our common humanity”.

‘Care villages’ for Guy’s

Since 2010, RSHP has been designing a 14-storey Cancer Treatment Centre for Guy’s & St Thomas’ NHS Foundation Trust. Scheduled for completion in 2016, the building is the Trust’s first step in its transformation of the Guy’s Hospital site at London Bridge in south London, adjacent to Rogers’ former partner Renzo Piano’s Shard building. The RSHP design is founded on patient pathways and, following Rogers’s established approach, the building has been designed to support change in clinical and accommodation needs over time. Guy’s facilities will be grouped as three ‘care villages’ – chemotherapy, radiotherapy and a one-stop area – to provide human scale within an unavoidably large centre. Each ‘village’ will incorporate all the services that a patient may require during a single visit, such as outpatients, imaging and day surgery. Throughout the centre, patients and staff will have external views to green spaces and natural light. Even scanning equipment, traditionally held in hospital basements, will be housed on upper floors.

Colin Martin is a writer on architecture, art and design, with a particular interest in their intersection with medicine and science

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Design for Care: Innovating Healthcare Experiences

Peter H Jones

Rosenfeld Media, 2013

Price: US\$39

ISBN: 1-933820-23-3

This new book by Dr Peter Jones is a comprehensive overview of an emerging design movement focusing on healthcare experiences. It appears that the industry is moving away from traditional design and a reliance on templates, user groups and projects, and simultaneously refocusing its energies around a new healthcare-design leadership.

This leadership is slowly integrating itself into the day-to-day activities of policy-makers and healthcare providers, using cross-functional teams and design research, and focusing on continuous improvement. Just consider how many innovation centres have opened in the past year.

There are many possible reasons for this emerging trend, including fiscal constraints and the unsustainability of the healthcare economy; the emergence of the healthcare quality agenda, which focuses, among other things, on patient-centred care and continuous improvement; or a movement away from hospitals towards community services and a continuum of care. It could also be the realisation that despite billions of dollars having been spent on new capital investments in the past decade, healthcare quality and experiences have not improved significantly.

Design for Care systematically focuses on defining many of these problems, before going on to align them with an appropriate healthcare experience and suitable design strategy, of which a multitude are covered, including design thinking, human-centred design, patient-experience design and co-creating.

Jones's approach to leadership and the use of design strategies to solve problems is not new to the wider business community, but it is just now emerging as a trend in healthcare. So what took healthcare so long? The short answer is that business has always been free to respond quickly to market forces, while healthcare is part of a system that does not allow for the means to expedite. Business schools are producing design-thinking CEOs, but where are the design-thinking hospital CEOs, ministers of health, chiefs of staff, and clinical managers? There maybe moments of brilliance in different parts of the system, but they alone are not enough to transform the entire system.

In *Design for Care*, Dr Jones suggests that there is room for design to be infused at every level throughout the system. He shows how designers can work with practice professionals, patients, care providers and other stakeholders to make a positive difference at all levels. The book's message speaks to several perspectives: the designer; the design researcher; the healthcare professional; the clinical practice leader; and the service, product and innovation managers in the healthcare industry.

The book is able to map out the boundaries of a healthcare system and reconfigure them according to a rising scale of complexity for design strategies: level 1: traditional design; level 2: service design; level 3: organisational design; and level 4: social transformational design. Dr Jones examines the evolving nature of different healthcare experiences through the lens of consumers, patients and the wider system, and then formulates these experiences, the system boundaries and the design strategies into a picture of the emerging design leadership in the industry. Finally, he proposes the following four levels of complexity in terms of clinical design: CD1: individual care; CD2: healthcare services; CD3: clinical institutions; and CD4: social and policy design.

Further clarity is brought to the complex world of healthcare by threading through the book a story persona: Elena and her healthcare journey. Each chapter introduces Elena to a new healthcare experience, which is supported by explanatory text on design strategies relating to her issues. Each chapter then ends with lessons learned, methods and case studies on real-life projects.

For those who are just starting out or moving into the realm of healthcare design, this is a great primer. For those with design or clinical experience, the book clearly illustrates why everyone in healthcare should take notice of this emerging design leadership.

Reading *Design for Care* will prepare you for what will be the future of healthcare: design leadership through healthcare experiences.

Clifford Harvey is the senior architect with the Ministry of Health and Long-term Care in Ontario, Canada; Martha Harvey is a registered nurse

Australian Healthcare Design 2000-2015: A Critical Review of the Design and Build of Healthcare Infrastructure in Australia

Edited by Kate Copeland, with Marc Sansom,

Kathleen Armstrong and Emily Brooks

International Academy for Design and Health, 2013

Price: £80/AU\$120

ISBN: 978-91-637-3470-0

A booming economy, marked by unprecedented national investment in hospital-building projects, has given Australian healthcare designers the opportunity to re-imagine the healthcare landscape. Featuring case studies galore, this new 'coffee table-style' book, *Australian Healthcare Design 2000-2015*, displays the results of late 20th-century architectural innovation and research-based salutogenic design in all their glory.

Australian Healthcare Design 2000-2015 is a practical compendium of essays from leaders in the fields of medicine, architecture, engineering and academia. The book's publisher, the International Academy for Design and Health, describes the Australian hospitals presented in its pages as visionary and as some of the most advanced healthcare buildings in the world.

The book outlines the approaches taken to deliver successful rural, primary-care and mental-health facilities with elegant results. It also showcases Australian thinking and research on myriad issues, including the shape of our future healthcare system, improving health standards in the community, creating safer clinical environments, the framework for building good health facilities, and workplaces designed to promote clinical teamwork.

This is the first compendium of recently-built Australian healthcare facilities, and it illustrates the breadth and strength of planning and design that went into each project, with information on many of the companies involved in their gestation.

Thought-provoking articles on the plans behind Melbourne's new Royal Children's Hospital, and how these were translated into healthcare delivery while creating a professionally supportive environment, are supported by a bountiful stock of striking images. Further sections on Fiona Stanley Hospital, Royal Adelaide Hospital, Olivia Newton-John Cancer and Wellness Centre, Robina Hospital, the South Australian Health & Medical Research Institute – or indeed any of the 33 major facilities featured – underline that the standard of preparation and delivery of these projects was very high. Succinct information on an additional 53 health and research facilities supports this conclusion.

Easy-to-read and beautifully presented, this book explains why our hospitals are designed the way they are and why change, grounded in research, is important to delivering effective patient-centred facilities. The transition to single-patient rooms is one particular trend highlighted in a number of projects.

Delving deep into the issues around why change had become – and remains to this day – so necessary, the book explores how research and thinking within the public sector, universities, and architectural and engineering community have been carefully orchestrated to create intelligent environments that can make us healthier.

This book is an excellent overview of new health facilities in Australia, and it gives insight into how the country can influence and frame healthcare over the next 20 years. It will be useful and essential reading for all health administrators, clinicians concerned about their working environments, and politicians.

Indeed, health managers might be wise to use the book as a platform to begin conversations with directors, clinicians, the media and politicians on what the physical framework for future healthcare should entail. *Australian Healthcare Design 2000-2015* provides an easy way of sampling some of the world's most impressive new healthcare facilities without enduring a long flight.

Rhonda Kerr is principal health planner at Hames Sharley



**The book gives
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Rendering by Bates Smart

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