

HONESTY IN DESIGN

Expressing humanity through design in our children's health

ALSO:

Dialogue: Svensson & De Roodenbeke
Market reports: Ireland & the Middle East
Inquiry: Is PPP a sustainable global model?
Scientific Review: Lighting design

Contributors

George J Mann

Bold and innovative thinking in international design and architecture can help to head off a global healthcare crisis, says Texas A&M University's George J Mann



Eric De Roodenbeke

New International Hospital Federation director-general De Roodenbeke discusses the economic and clinical value of hospital design within a cultural context



Derek Parker

Design for children's health should express humanity and should never deceive, no matter how well intentioned, says Anshen + Allen's Derek Parker



John Zeisel

Introducing this issue's scientific review Zeisel reflects on 'Salutogenic design' and 'Evidence-based design' as frameworks for design decision making



Sjef Cornelissen

Research suggests that lighting design solutions should address our emotional and biological needs, says Philips lighting specialist, Cornelissen



Paul Willetts

Former clinician and healthcare director at Ryder Architecture, Willetts queries why so few health providers perform post project evaluations



Design challenges

If we are considering the design challenges confronting society at a time of great uncertainty characterised by international terrorism, global poverty and a world economic crisis, then we could do worse than consider our children first. How carefully do we take care of our children's needs when we design environments for their health and wellbeing? There are seven ages of children, all of which have differing physical, physiological and psychological needs. Is a theme park or Disneyland approach to hospitals appropriate for all seven ages?

As Derek Parker points out (p19), the first principle should be to apply honesty in design. Expressing our humanity and that of our children through design is an opportunity to address the multiple social, economic and political challenges we face in the 21st century.

Tools for decision-making help us to make sense of the world, and all three of the children's hospitals we report on purport to have used evidence-based design (EBD) principles. But EBD is in the foetal period of life, and we must continue to question its methodologies (pp 57-61).

All of these issues will be high on the agenda at next year's Design & Health 6th World Congress and Exhibition in Singapore, from 24-28 June, 2009 (See the Preliminary Programme enclosed with this issue). With an unrivalled speaker programme of interdisciplinary world experts, the event is set to break new ground, and is a 'must attend' for researchers and practitioners.

Marc Sansom
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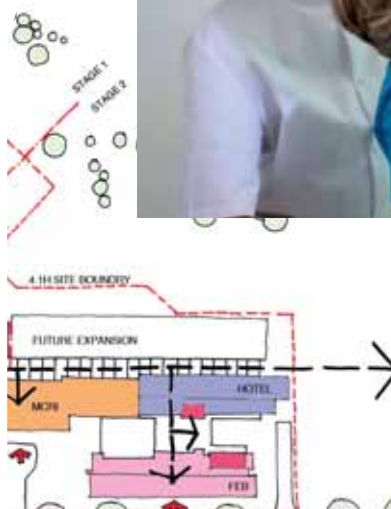


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Setting standards in children's hospitals

Standards in the design of children's hospitals was the hot topic last month, as world experts in the field of design and health gathered together at the striking new Meyer Children's Hospital in Florence, Italy (pictured right), designed by CSPE Architects and Anshen + Allen. Held alongside the Union of International Architects (UIA) Public Health Group Seminar, Design & Health's international conference, Design Quality Standards International was led and hosted by Romano Del Nord, deputy rector of Building and Real Estate at the University of Florence. Describing the philosophy and the advanced architectural solutions implemented to attain a high standard of environmental design at the Meyer, Del Nord said: "Through the design of healthcare facilities and the environment, we can influence, both positively and negatively, the determinants of health and disease." Placing the design of children's hospitals into a broader context, two speakers from Anshen + Allen described the work of Children's Hospitals' Explorers (CHEX), an interdisciplinary design alliance focused on issues such as the role of visual arts, acoustic environments, poetry and kinetics in the creation of spaces to support healing in children. Other speakers included Richard Mazuch of Nightingale Associates who addressed design for the seven ages of children, within the context of research into 'sense sensitive design', 'emotional mapping' and 'design prescription'.



Lifetime achievement

NBBJ Partner Jim Jonassen, FAIA-RAIC, has been awarded the 2008 AIA Seattle Medal, recognising his distinguished lifetime achievement in professional practice in architecture and design.

Seeking out knowledge

Tribal and the Knowledge Corporation have signed a formal Memorandum of Understanding to explore opportunities for joint projects in Dubai and Saudi Arabia. The Knowledge Corporation is the commercial arm of the Gulf Research Centre, a non-profit, non-government organisation based in Dubai, which focuses on research, education solutions, media, consultancy and publishing.

Colourful and courageous

A new £70m mental health facility at Birmingham and Solihull Mental Health NHS Foundation Trust, designed by Nightingale Associates, has been praised for the therapeutic qualities of its colourful and modern design, including its bold use of artwork and natural daylight.

Sweden in Seattle

The new \$140m Swedish Orthopedic Institute opened in Seattle last month. Designed by NBBJ, the specialised orthopaedic facility, is said to be 'unlike a traditional hospital setting' and the first of its kind in the Pacific Northwest.

Indian summer for CPG

CPG Consultants India (CPGI) has been appointed by leading property developers, Realty Majors and the largest healthcare group in Asia to provide master planning, architectural and engineering consultancy services for the following projects: the Apollo Multi Specialty Hospital in Navi Mumbai; a proposed residential township in Kismatpur, Hyderabad; an IT Township and Auto Ancillary Park in Uttarapara, Kolkata; and an integrated mixed-use development in Rajarhat, Kolkata.

Building boom spur for Interserve

The Middle East building and construction boom has been a major factor behind the significant growth of services, maintenance and building group, Interserve in the first half of 2008, said the company in a recent trading statement.

Sad death of UIA vice president

The vice president of the Union of International Architects, Giancarlo Lus died earlier this month on the eve of the 23rd World Congress of Architecture in Turin.

New bed head unit

TLV has launched the MEDIVA Air Evolution bed head unit, which integrates a Photo Catalysis Oxydation miniaturised system. The solution is said to address three hospital concerns, nosocomial infection, odours and ambient air pollution.

Women and children win

CPG Consultants (India) has been appointed as the architect and engineer for the state-of-the-art KVM Monash IVF Women's Hospital and Fertility Centre in Kerala. The project is a joint venture between Kinder Group Singapore, KVM Group of Kerala and Monash University, and is set for completion by the end of 2009.

Moving on up

Gina Kish AIA, LEED AP, has joined Anshen + Allen, bringing with her over two decades of experience, including project work on the Pediatrics Inpatient Unit and Outpatient Clinics at Greenwich Hospital, Greenwich, Connecticut and the Shapiro Cardiovascular Center at Brigham and Women's Hospital in Boston.

Tribal go for globe

Tribal has acquired a majority stake in HELM Corporation in Northern Ireland. Tribal HELM will benefit from the consultancy firm's strong relationships with international donor organisations such as the World Bank, European Union and the Department for International Development.

US expansion for Howarth

Howarth Air Technology has continued its expansion into the US market with the launch of a new facility in Louisville, Kentucky. The new facility offers engineering, project management, assembly and test processes.

Design & Health 6th World Congress & Exhibition set for Singapore success



Uniting the disciplines of architecture, design, psychology, the health sciences and economics, the Design & Health 6th World Congress and Exhibition is set to yet again push back the boundaries of research and practice.

A record number of abstracts submitted from around the world has created unprecedented momentum for the Design & Health 6th World Congress and Exhibition, scheduled for The Ritz Carlton Millenia in Singapore, from 24-28 June, 2009.

Set to yet again break new ground internationally, the number of scientific and professional submissions rose again in both volume and quality, resulting in a programme that includes world-renowned speakers from research and practice in government, business and academia from every part of the globe.

Sessions will include presentations by physicians as well as psychologists, designers, architects, planners, artists, nursing professionals and economists to bring together a rich blend of interdisciplinary perspectives on design & health.

Topics addressed at the congress will include the latest research findings in the field including: design quality standards; evidence-based design / research-based design; mental health; restorative justice; senior care; and children and young people's healthcare.

In addition, the trends and influences on design & health will be considered in sessions covering different global locations, including: the Middle East, China, India, South East Asia, Europe and the US.

Director-general of the International Academy for Design & Health, Professor Alan Dilani said: "The high quality of scientific research, presented in combination with a fascinating range of powerful case studies, a trade show displaying the latest innovations and solutions in the field, and a varied social and cultural programme, will ensure participants enjoy a unique knowledge-enhancing experience."

The Congress will be held at The Ritz-Carlton Hotel, one of the most exciting and accessible venues in the world, surrounded by nature in the centre of Singapore. For a copy of the programme and delegate or sponsor information, visit www.designandhealth.com



Design & Health

6th World Congress and Exhibition

Uniting the disciplines of architecture, design, psychology, the health sciences and economics

24-28 June, 2008 The Ritz Carlton, Singapore

Infrastructure conference calls for papers

Around the world, a renewal of the infrastructure for healthcare is underway. In the UK over £40bn is being spent on new hospitals and other healthcare facilities. Some estimates suggest that €30-50 billion is needed to modernise hospital infrastructure in Germany. Major new investment is planned in eastern Europe and the picture is similar in north America and most of the developing economies.

"Delivering this ambitious programme poses significant challenges for governments, health providers and industry. These relate to the complex relationships between long lasting infrastructures, rapidly changing technologies and services, and a frequently unstable policy context," explains Prof James Barlow, director of the Health and Care Infrastructure Research and Innovation Centre (HaCIRIC).

This conference aims to bring together researchers and practitioners from across disciplines and countries with different healthcare systems to focus on this issue. HaCIRIC is seeking original thinking on how to improve the planning and delivery of healthcare infrastructures through innovative approaches. The deadline for submitting abstracts is 8 September 2008, with full papers to be received by 8 December 2008. Download the conference call for papers at: www.haciric.org/NewsandEvents/

HaCIRIC International Conference 2009

Improving healthcare infrastructures through innovation

2-3 April 2009, Hilton Metropole, Brighton

Only bold, innovative thinking can head-off a global healthcare crisis, according to Texas A&M University's *George J Mann*.

The future belongs to those who prepare for it. By 2050, our planet will support an extra three billion people, placing an incredible strain on healthcare systems and necessitating new and innovative ways to tackle healthcare delivery. Costs, access, quality of delivery, properly trained health professionals and patient safety are complex issues that threaten to overwhelm systems all over the world.

To provide the best for every human being, we will be forced to think outside the box: imagine what healthcare would be like if it was managed by the telephone companies (excellent communications); the airlines (excellent medical records, accessible anywhere in the world); or the hotel/hospitality industry (excellent, comfortable accommodation)?

We need bold thinking and leadership to solve the crisis in healthcare that exists around the world, beginning with the creation of a healthy environment for its citizens. Issues to be addressed include air and water quality; global warming; waste disposal; developing sustainable communities; and limiting non-renewable energy resources while emphasising renewable resources. We must design healthy cities with green spaces that encourage pedestrians to walk and exercise daily; these cities should be places that are designed to be less dependent on cars, buses and trucks powered by fossil fuels, which are linked by high-speed train transportation.

Often, no one thinks to ask the patient for their thoughts and suggestions, or for what they need. Does the patient have easy access to comprehensive healthcare insurance with prescription coverage? Are there patient advocates to help them gain access to health professionals? Is there a continuum of care from the womb to the tomb? Is quality home-care available?

An informed public with high levels of health education can delay or even prevent the onset of many diseases. Closely related to health education is the concept of prevention through self-examination, regular check ups, vaccinations and screening.

Understanding the ageing process is vital in preparing for an increasing ageing population. A continuum of care (independent living, day-care, group homes, assisted living, skilled nursing care, Alzheimer's units, and hospices) is the basic component of comprehensive care for the elderly.

Health is not a business but it must be organised as such. Some countries spend enormous amounts on healthcare, yet their health outcomes do not reflect those expenditures: we need to learn why. We should work to increase funding for healthcare around the world.

We also need to plan better for specific diseases, by identifying those (cancer, heart disease, etc) for which we need to develop individual strategies. We must focus our efforts and establish priorities based on statistical evidence. These facts and projections are vital for focusing plans of action.

We also need a comprehensive approach to the planning of networks of health facilities. Modern technology has revolutionised healthcare delivery and the individual, and the home will be the next level of prevention, diagnosis and treatment. Individuals will monitor vital signs and continuous diagnostic tests through online technology.

The most important discussion has been left for last – ie, the promotion of high-quality design in the context of the above issues and trends. Architects must base their work on evidence-based design that focuses on healing environments. We can – and must – do better, by encouraging innovative approaches to healthcare delivery, and by critically evaluating these varied approaches. Necessity is the mother of invention!

Professor George J Mann AIA is The Skaggs Sprague Endowed Chair in Health Facilities Design, College of Architecture, Texas A&M University. This article was advised and edited by Brian D Briscoe, Master of Architecture Candidate, Texas A&M University, Intern HKS; and Judy Pruitt, administrative assistant, Center for Health Systems & Design, Texas A&M University.



Towards 2020

An action plan for a healthy planet

An informed public with high levels of health education can delay, or even prevent, disease

More must be done to help hospital managers understand the economic and clinical value of good design within their local cultural context, new International Hospital Federation director-general tells *Prof Per Gunnar Svensson*.

In 'pure' economic terms, healthcare is no different from any other industry or business, in respect that it is a scarce resource, subject to the laws and fluctuations of supply and demand. Many health economists also theorize that healthcare is derived from the wider demand for health, such that individuals will allocate their resources in order to both consume and produce health, with the ultimate aim of improving their 'health stock'.

It is perhaps appropriate, therefore, that a health economist has taken the helm at the International Hospital Federation (IHF), one of the most significant healthcare management organisations in the world, with an agenda to develop the role of hospitals within the broader context of public health, particularly in underserved communities.

Founded in 1929 with a membership encompassing national hospital associations, government health ministries and other health institutions and individuals in over 100 countries, the IHF is responsible for around 50,000 hospital facilities and the welfare of more than three billion people. Leading such an organisation requires political skill, financial acumen and a strategic vision, but most importantly it requires a passion for global health improvement, qualities possessed in abundance by the IHF's new director-general.

When *WHD* asked Design & Health president and former IHF director-general, Prof Per Gunnar Svensson to interview his successor, Eric De Roodenbeke, about his reflections on the relationship between design and health, we hoped for an appreciation of the economic as well as the clinical case for good design – and we weren't disappointed.

Per Gunnar Svensson: How important is design and architecture to effective health service provision?

Eric De Roodenbeke: A hospital is a living organism, where construction projects are an every day occurrence, as

part of a continuous cycle of improvement in the environment, either through new buildings or refurbishments. But when we talk about design, we must consider more than its value in improving the aesthetic quality of our surroundings. Design is also concerned with the creation of an efficient and effective product. When we purchase a car, its appearance may rank top of our wish list, but comfort and fuel consumption are also important.

P-GS: How important is flexibility in hospital design to accommodate future changes in technology, work patterns and practices?

EDR: Rapid changes are occurring in patient care, medical technology and clinical practice, and the built environment can be a major constraint on how we respond to these changes. Outpatient treatment is more important today than it was before, so the transition to accommodate this change requires dramatic organisational changes. The issue of flexibility, which for example, allows for the manipulation of room sizes is one of the most difficult challenges facing hospital designers.

P-GS: How important is research and the idea of 'evidence-based' design in international hospital developments?

EDR: These discussions are very important. From my experience of

Think globally, act locally



working in developing countries, I have observed that hospital design is closely related to the local environmental context.

The design response in a developed country can in no way be replicated in a sub-Saharan country, because the environments are so different, not only from a climatic perspective, but also culturally and in terms of the available resources.

Nevertheless, it would be useful to have research-based material from which the best examples and practices could be drawn to avoid a reinvention of the wheel, and shorten the preparation time for new projects. The World Health Organisation (WHO) and the World Bank have published documents on primary healthcare facilities in low income countries that demonstrate that there is a lot of work to be done in the field of hospital design, planning and construction.

P-GS: Almost 70 abstracts were submitted for next year's 6th World Congress for Design & Health in Singapore, but the majority addressed issues in middle and high income countries, with very few tackling the developing world.

EDR: This may be due to the existence in most developing countries of a turnkey hospital system/model, built by foreign agencies. It might be interesting, for example, to contact development agencies, such as the Japanese International Cooperation Agency (JICA), which has experience in international hospital development projects in low-income countries, and request them to prepare a summary document of hospital construction projects in low income countries such as Laos, Cambodia, Philippines.



P-GS: That is an excellent idea. The experience of development agencies could be invaluable to our agenda at Design & Health in the developing world.

EDR: When I worked for the French Development Cooperation on a project for the development of a pediatric hospital in Ouagadougou (Burkina Faso), we established a twinning programme with a French hospital, and the architect was able to capture the local culture and social environment in the design. He also used his knowledge from another hospital construction project undertaken in Burkina Faso to design a 'bio-climatic' structure, which involved a covering over the building that reduced the impact of the heat, and enabled a reduction in operating costs.

P-GS: How important are the connections between design and culture, and in particular the use of art, music and colours to reflect the local social context?

EDR: There are two elements. Firstly, the design of the hospital should reflect the local culture in respect of the building materials used, and the finishing, such as the colours used and the furnishing of the environment. The other important aspect is that the hospital should be at the centre of the local community, hosting activities and social events, that convey the facility to be a positive place of social connection, rather than one of suffering and disease.

As a hospital manager in France, we organised art exhibitions which attracted visitors other than patients and served as a means of integrating with the local community. It is important therefore to consider at the conception stage of a design how areas such as the entrance hall can be used for social and cultural activities, without compromising the core functions of the hospital.

P-GS: What is the role of design in addressing issues such as public health or healthcare-associated infections (HAIs)?

EDR: In the case of HAIs, the material type you use as well as the overall design can have an impact. Things are changing too in the

“When we talk about design, we must consider more than its value in improving the aesthetic quality of the environment”

operating theatre, where practices used to be designed around a 'clean' and 'dirty' circuit. Today, this has been replaced by the use of mobile containers with improved infection control measures. In the case of intensive care, design must take account of hygiene in relation to the flow of patients, health workers and visitors.

P-GS: How important is it to invest heavily in hospital design?

EDR: The biggest financial drains on a hospital are the running costs, and comparatively, the cost of design is relatively small. A primary goal of Design & Health should be to demonstrate the economic value, as well as the aesthetic and functional value of a well-designed hospital.

P-GS: Under your leadership, will the IHF continue to address the issues associated with healthcare design and architecture in your publications and at your events?

EDR: Maintaining continuity in an organisation is of vital importance, and I have no intention of breaking with this tradition. Construction is a part of the every day life of hospital, so design is a central topic at the very heart of the hospital sector.

P-GS: The future plans of Design & Health are to reach out beyond the healthcare environment into sectors such as schools, prisons and the workplace, as there is a developing research-base to suggest that these environments also have an impact on our health and well-being.

EDR: A distinction should perhaps be made between a structure with a public function, such as hospitals, schools and prisons,

and facilities with a commercial function, such as office or retail environments. The guiding design principles and motivations for these two facility types are very different.

In the example of prisons, the movement of occupants is restricted for long periods, but in a retail environment, the flow is fluent and for a short period. In terms of the architectural response, lessons could be learnt from across different sectors.

WHD and the Design & Health World Congress could help enormously to facilitate this knowledge transfer.

P-GS: On a broader level, better public health and an effective hospital system is an important economic and social driver. What motivated you to apply for the post of director-general of the IHF?

EDR: I have spent 25 years of my life in hospital management, designing health systems and policies, and providing expertise to hospitals for various population groups, and especially the poorest groups. The IHF is central to improving the dialogue among and between providers in both the public and private sector with health system decision and policy makers.

Health service providers and related industries must be a part of the forces driving, anticipating and responding to a rapidly evolving environment and growing public expectations. At a national level, Ministries of Health, national hospital federations, professional bodies and the health providers themselves are responsible for an effective healthcare delivery system.

There is also a need, however, to act and advocate at an international level to respond to the global challenges that exist beyond national borders. National organisations also need to be supported with evidence and knowledge of best practice from around the world.

P-GS: Can you share with us your vision for the IHF?

EDR: My ideas are in harmony with the vision statement adopted by the IHF Governing Council in 2006. Therefore, I will be promoting the IHF as a world leader in facilitating the exchange of knowledge in health sector management with the aim of improving the quality of patient care. The emphasis on management has to be understood in a broad sense to sustain the performance of health service delivery organisations in respect of their responsiveness, efficiency, effectiveness, equity, quality

“The issue of flexibility is one of the most difficult challenges facing hospital designers.”



and fairness in financing, as described in WHO's World Health Report 2000. This should lead to a world of healthy communities served by well managed hospitals and health services where all individuals attain their highest potential for health. This should be a goal for each and every country and for the international community.

P-GS: What will be your main priorities in the first six months?

EDR: In tribute to my predecessor, Prof Per Gunnar Svensson, my first priority will be to build on the existing strengths of the IHF, which has grown through a partnership approach both in terms of volume and diversity of activities in recent years.

As the executive of the Governing Council, I will work closely with Council members to achieve the priorities they have set out for the IHF, and be accountable to the Council for the results of our activities. Direct and open relations with IHF members will be my priority, and to develop an understanding of their own priorities.



P-GS: Do you anticipate any changes?

EDR: Major changes will result from the decisions of the Governing Council, so it is a little too early to predict a new direction. However, I do believe the IHF will take advantage of my previous experience in the developing world. One of the IHF's priorities has been to increase membership and activities in poor countries, especially Africa. Having worked on this continent for the last 18 years, there is an important need for expertise in the area of hospitals within health service reforms for low income and transition countries.

P-GS: What will be the style of your approach to achieving your vision?

EDR: Thinking out of the box has always been central to my activities. When I started to work in French public hospitals in 1983, I co-founded an association to promote marketing in public hospitals and ever since I believe that health service delivery organisations should fulfil public interest goals regardless of legal statute. The latest World Bank publication from Alex Preker et al, *Public ends, private means: strategic purchasing of health services* demonstrates that everything can be improved, but only if all possible solutions are considered without dogma. What counts is that healthcare resources are used effectively to provide the most equitable health service of high quality to those who need it.

Prof Per Gunnar Svensson is president of the International Academy for Design & Health and former director-general of the International Hospital Federation.



Eric de Roodenbeke

- 2008 Director General of the International Hospital Federation
 - 2007 Senior Health Specialist, Global Workforce Alliance, World Health Organisation
 - 2004 Senior Health Specialist, World Bank
 - 2001 Director of University Hospital of Tours, France
 - 1999 Senior Officer (Hospital & Health Financing), French Ministry of Foreign Affairs
 - 1996 Senior Officer (Hospital Policy), French Ministry of Cooperation
 - 1994 Deputy Director, University Hospital of Nantes, France
 - 1989 Project Director, Burkino Faso Hospital, West Africa
 - 1984 Deputy Director, Epinal-Vosges General Hospital
- Education: PhD Health Economics, University of Paris 1, Sorbonne, France

Partnership on the precipice

Using private money to finance public healthcare buildings is nothing new in the UK, but as the concept is rolled out around the world, is it a sustainable model for achieving design quality and does it provide value for money? Here, four experts speculate on the future of Public Private Partnerships.



Public Private Partnerships (PPPs) have been widely used by the UK government to support planning, design, delivery and maintenance of healthcare infrastructure. PFI, the main way in which hospital building has been funded in the UK since 1997, is one of many PPP models, and was introduced to allow faster renewal of

healthcare facilities than with conventional public funding. It should also enable the best use of private sector expertise and skills for the benefit of the public sector, supporting design innovation and value for money. PFI is also thought to drive better lifecycle considerations by involving the private sector with the buildings for periods of 25-30 years.

Initial schemes suffered from imbalances in resources and skills between the public and private sectors, the costs of bidding were high, and there were difficulties in understanding risks. The planning and design processes have been scrutinised in terms of their ability to respond to users' needs, due to the type and quality of the interaction between stakeholders imposed by contractual arrangements. There have also been concerns about the potentially adverse consequences of architects having the contractors as their main client in terms of their ability to drive clinical innovation. Over time, high bidding costs have also reduced the number of bidders for schemes.

Learning from 10 years' experience should result in lower costs through more effective processes, as well as innovative solutions, bringing the patient experience to the forefront. Such learning needs to be abstracted and transferred to other countries in which PPP models are being adopted.

Learning from experience should enable lower costs as well as innovative solutions

Dr Patricia Tzortzopoulos Fazenda
Academic fellow, Research Institute for the Built and Human Environment, University of Salford, UK



John Cooper's and Ken Schwarz's pieces in the April issue of *World Health Design* cover many aspects of the PPP/PFI debate in the UK. I think it's worth adding that a key feature of the UK system is the requirement for bidders to produce a complete fixed-price design at preferred bidder stage. Designed to drive risk out of the process, it comes at a huge cost, and makes a mockery of the

Can we refocus on the principle of partnership, not the divestment of risk?

culture of partnership that is supposed to underpin PFI. What is the sense in two, or in some cases three consortia working up detailed design proposals when all but one will be junked? It adds a

further layer of cost to providers, already sweating under the yoke of a £5m-plus typical bid budget. The result will be either higher pricing, or the withdrawal of potential bidders altogether. Neither of these two consequences helps to achieve the original objectives of PFI – healthy competition driving innovation and quality.

Underlying this is a profound disbelief in the potential of partnership. Perhaps it is here that the UK can learn from international experience. PFI is currently being rolled out in Portugal, Spain, Italy, Greece, Turkey, Canada and Australia: have any of these programmes been able to harness the idea of PPP without creating structures that embed mutual suspicion in the process from the outset? Can we refocus the enterprise on the principle of partnership – shared responsibilities – rather than divestment of risk? If so, creativity and excellence will be the victors rather than the victims they are today.

Jonathan Wilson
Partner, David Morley Architects, UK



Canada is in the early days of experimenting with PPP, and one of the greatest challenges it faces is the provision of strong guidance by an architect who can carry through the appropriate design by building on project knowledge and relationships. In Ontario, for example, compliance architects are hired by an arms-length government agency to translate general programmatic and design information into output specifications; at that point, usually three DBFM (design, build, finance and maintain) teams prepare competing proposals, and the original architects remain only to ensure that the intent of the output

specification documents is retained.

In the present model we often see construction and schedule innovation (short-term benefits) with little clinical design innovation (long-term benefits). A better model would see the architect hired by the owner to develop a schematic design that is bid on by DBFM consortia in terms of price and quality. Then, once the preferred consortium is selected, the client's design team would be transferred to the consortium to complete the project. This model allows for clinical design innovation to be transferred, while reducing bidding time and costs.

Architects' valuable contribution cannot be realised if they are asked to compete for commissions merely to produce output specification and act as compliance agents. Governments and citizens don't knowingly aspire to mediocrity, but they need an architect advocate in an active role who can help them understand the consequences of their choices.

Tye Farrow

Senior partner, Farrow Partnership Architects, Canada

We often see construction and schedule innovation with little clinical design innovation



More than \$10 billion-worth of major health projects are currently being procured in Australia. Well over half, including some of the largest, involve traditional procurement methods. PPP will only be adopted if it can be shown to add value.

It is argued that PPP combines the skills, ideas and experience of both the public and private sectors to develop innovative solutions, effectively manage risk and add value over the entire life cycle of infrastructure delivery. Contractual targets ensure regular maintenance facility upgrades and effective delivery of operational services. Funding comes from operational budgets, not capital, enabling more projects to be procured in the short term and avoiding government borrowing. Historically, private operators have successfully provided public healthcare services, particularly through the not-for-profit sector such as the Catholic Church.

However, there have been some failures, with two public hospitals that had been constructed and operated by private for-profit operators reverting to public ownership, at considerable cost. Clinicians have forced a review of a recently awarded PPP hospital project claiming that the planning process was "flawed" and that facilities did not meet current requirements. More generally, Australia's limited market size may reduce the number of bidders willing to risk the substantial costs involved. The process limits interaction with stakeholders, reducing opportunities for innovative solutions. Contractor-led design may result in loss of control over final outcomes and excessive costs to make changes.

PPP is a viable approach, but not the only sustainable approach to healthcare procurement.

Peter Kemp

Director, Kemp Consulting, Australia

In Australia, PPP will only be adopted if it can be shown to add value



Honesty in design

Derek Parker introduces a project report on the design of children's hospitals.

Health is the first liberty, said American philosopher John Dewey. Healthy children can be educated – and healthy, educated children are the foundation of a civilization, and its future.

At Anshen+Allen, we have learned a lot since the design of our first children's hospital, Lucile Packard Hospital for Children at Stanford University, 20 years ago, and we continue to benchmark and research excellence in pediatric design. My colleague Felicia Borkovi founded The Children's Hospital Explorers (CHEX) to encourage a multi-disciplinary discussion about the design of the built environment for sick children and their families. We want to understand more about the link between facility design and quality improvements for pediatric patients, families and staff.

We have learned the importance of honesty in design; design which does not deceive, no matter how well intentioned. Children's hospitals are not theme parks. Children are in the hospital not because they want to be there but because they need to be there. We have also learned about designs that express humanity. For instance, well-designed places feel right, and that spills over to the staff, the body language, the voices and the vase of flowers – magic can happen in places like that. Designs should express confidence. These buildings are places for serious medicine, and children and families can pick up the clues about quality of care and safety from the torrent of clues presented by the physical environment.

Another colleague, Annie Coull, has described the need for a holistic experience for hospitalised children and their families. The best design response recognises the dualities inherent in these defining human events, and addresses them in a way that allows people to have authentic experiences in environments that accommodate: diversion and contemplation; stimulus and solitude; universality and uniqueness; exploration and reflection; observation and privacy; access and security.

We believe children's hospitals should be non-trendy, timeless, and caring and supportive of the individual child/family. Their environment should be safe and secure, and be a backdrop for varying ages and cultures. It should not only allow children to arrange their space to suit their individual needs, but it should be designed to encourage it.

Our work has to be based on research that utilises the best evidence regarding light, sound, art, air quality, colour and nature. The Center for Health Design and NACHRI (National Association of Children's Hospitals and Related Institutions) have come together to launch an initiative, Transformation by Design, to explore the state of evidence-based design in children's hospitals that will lead to better health outcomes and a higher quality of care for children. There is, however, much still to learn. We have, therefore, committed substantial resources to continued research, to CHEX, and to active participation in the work of the new collaborative partnership between The Center for Health Design and NACHRI.

Designing for sick children to provide healing, to aid their recovery to health, and to return them whole to their families, is, I believe, the highest calling for an architect.

Derek Parker FAIA, FACHA, RIBA is chairman of Anshen+Allen



A place for exploration: Great Ormond Street Children's Hospital Octav Botnar Wing, designed by Anshen + Allen



The natural prescription

Surrounded by nature yet minutes from the city, the new Royal Children's Hospital in Melbourne incorporates the latest evidence and research-based design principles to enhance and support healing, reports *Helen Wayland*.

Reaching seamlessly into its natural setting and bringing the light, textures and forms of the park inside, the concept for the new Royal Children's Hospital (RCH) in Melbourne was inspired by its site. A 'bushland' character has been thoughtfully integrated into the delivery of a family-focused healing environment.

The design incorporates extensive positive connection with nature, an imaginative approach to cognitive wayfinding, and a scale that can be easily 'read' by people of all ages. Central to the concept is the idea that

the children who are the patients, as well as their parents, visitors and staff on site can feel connected to the natural cycle of each day, due to the changing natural light and direct engagement with the parkland setting. A natural palette of textures and colours brings the landscape inside, while the healing potential of a home-like environment, rich with distraction, play and imagination has been explored for every age group.

The new RCH is being delivered as a Public Private Partnership (PPP) under the Victorian Government's Partnerships Victoria policy, which will see the public sector continue to own and operate the hospital and provide all core clinical services, staffing, teaching, training and research, while the private sector will finance, design, construct and maintain the new building.

Easy orientation

The new hospital is located in Royal Park, Melbourne's largest park, close to Melbourne Zoo and the main roads into the city. "You couldn't imagine a better site," says Kristen Whittle, director of Bates Smart, one of a number of collaborators in the Children's Health Partnership (CHP) consortium, answering the hospital's 'world-benchmark' brief.

"Royal Park is close to the city centre yet feels like you are in the country. It is filled with eucalypt trees, rolling grasslands and big open skies. It has a real feeling of space, openness and air." Thanks to



Main entrance: From first arrival, nature is an inherent part of the visitor's experience



an allocation of 4.1 hectares, the buildings have been given a low profile, separated into their functional areas in a 'campus' arrangement. Threading all together and creating a social heart for the hospital is a central 'street'. "In Australia, the amenities in any town are grouped around a key main street," Whittle explains. "So even if you are a family from a small town, this is a really easy way to orientate yourself."

As well as a planned shopping precinct, the hospital has a number of other orientation devices linking amenities to the central street. Parts of the Melbourne skyline and the parkland setting will always be in sight along the main street, allowing an instant recognition of the time of day and direction one is facing. There are also several large internal place markers. These include a giant aquarium near the reception desk and room for playful yet massive installations – a timber dinosaur, for example.

The play of light

All sides of the hospital enjoy direct sunlight. To take advantage of all-day natural light, the street was oriented to run north/south, allowing the central street and north-facing garden court at the end of the street to get great midday sun and making the building light, airy and attractive for staff, patients and visitors.

The north-facing wall of the street is glass and opens onto the Great Garden Court, the largest of the gardens surrounding the hospital. With a glazed roof, the central street is naturally lit. Louvres in the roof allow natural ventilation to enter the street and in fine weather the doors can be opened to admit natural air currents. Colourful mobiles moving in these air currents create a gentle play of soothing dappled shadows across the space. Walkways and bridges across the higher levels of the street appear much as branches would from a tree.

Externally, a range of innovative sunshades and window treatments merge the buildings into their surroundings. The main west-facing entrance feels like the entry to a treetop canopy due to the curved units of glass that fit like ethereal 'leaves' around the façade.

Fingers into the park

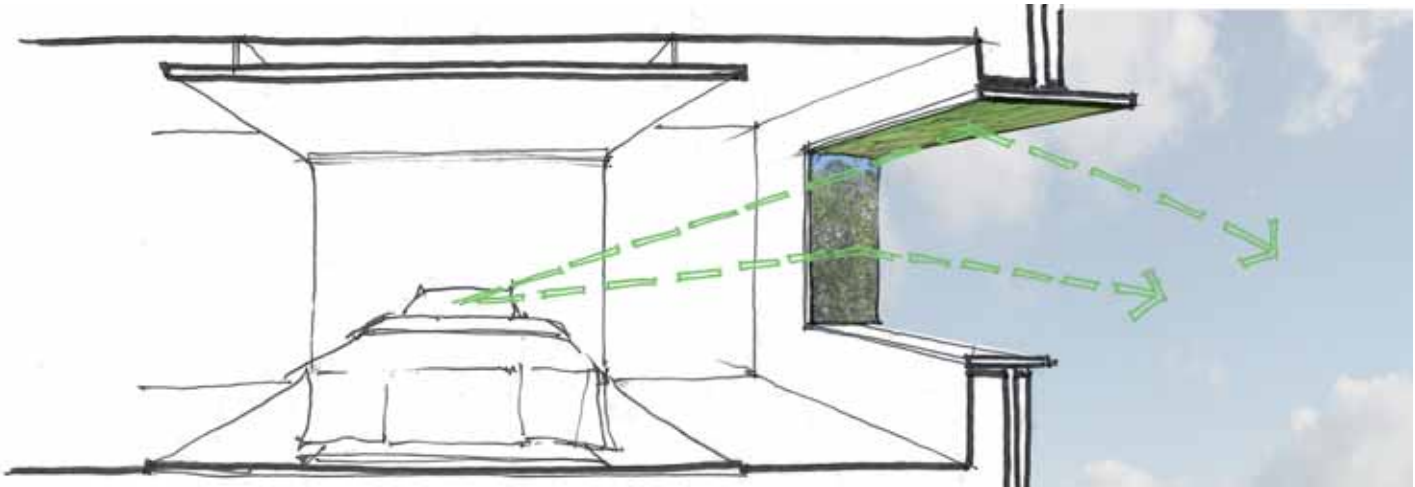
The north building, which houses all the inpatient accommodation, is positioned deepest into the park setting. The accommodation unit is planned as a multi-finger-shaped building. Each finger is wedge-shaped to allow open social spaces to be centrally located within each section. This also brings views and natural light into the social spaces as well as the bedrooms. "In this way, as the building extends into the park, the park is brought into the building," notes Ron Billard, principal of Billard Leece Partnership, joint venture architects with Bates Smart. More than 80% of inpatient rooms have park views, with the rest looking into courtyards. Clever placement of reflective surfaces brings the views inside the bedrooms, so that even children confined to bed can see what's happening in the garden.

Externally, pre-cast elements fit together almost like a jigsaw, with natural aggregate tones imparting a camouflage quality to the building. "To enhance this effect we also used some overclad translucent glazed areas, interspersed both to reflect the park inside and to create coloured 'halos' around the building in certain areas," says Whittle. "They almost

There is potential here, given how progressive the brief is and the quality of the proposal, to create an international exemplar hospital

Dr Roger Ulrich, Professor of Architecture, Texas A&M University

Above: Western facade: The interplay of glazed sunshades and innovative treatments merges the buildings into the parkland



look like blossom bursting out as you walk around the building. We use the same glass as on the sunshades in the west, but more intensely saturated with colour."

The healing power of imagination

Research into the emotional requirements of children of all ages underpins the aesthetic criteria of the project and informs all the design factors and the finishes. The intention was not to create a manufactured or cartoonish children's world but a rich and layered experience, sourced from the natural surroundings, bringing the imagination into play while providing the cosiness and warmth of home.

CHP has developed partnerships with Melbourne Aquarium, Melbourne Zoo and Scienceworks Museum, all of which will provide installations, performance and other content within the hospital to distract and engage imaginations of every age. There are multiple spaces for play, for family contact, and for group activities.

Green in all ways

The building itself is designed to be sustainable, aiming to be Australia's first 5-Star Green Star Hospital using the Green Building Council of Australia's healthcare pilot tool. Scheduled to open in 2011, the design is planned to be 'future proof', with room to grow as needs arise.

Once the project is completed, including a hotel and refurbishment of older buildings in phase two, much of the old site will be demolished and restored as parkland – with an overall gain in vegetation.

Helen Wayland is a writer and journalist

Royal Children's Hospital, Melbourne

- Project completion date: December 2011 (Stage 1), December 2014 (Stage 2)
- Contract form: PPP (Public Private Partnership)
- Construction Cost: AUS\$960m
- Project Cost: AUS\$1billion approx.
- Client: The Department of Human Services
- Architects: Billard Leece & Bates Smart with HKS
- Structural engineer: Irwin Consult
- Services and environmental engineer: Norman Disney & Young
- Quantity surveyor and planning supervisor: Bovis Lend Lease
- Main contractor: Bovis Lend Lease



Above: Reflective surface in the windows ensure that even bed bound children can see into the park

Left: The site has a natural fall

Positive performance

Since its founding in 1908, The Children's Hospital (TCH) in Denver, Colorado, has grown from a mere 200 inpatient visits to more than 10,000 visits a year. During the last century, TCH has established a national reputation as a top-five pediatric hospital (as ranked by *US News and World Report*), and with the 2007 opening of its new home, it is looking to further enhance its reputation by providing ever-better care in an environment designed to enhance healing as much as possible.

Housing 270 patient beds, outpatient clinics, a pavilion for specialised services, and offices and research spaces, the 134,000-square-metre (1.44m square foot) hospital is organised around a central atrium that draws light deep into the structure. The spirit of the hospital is captured in a terrazzo floor that runs across the entire space and incorporates butterflies, snowflakes, fish and other motifs. The floor is part of a larger art programme intended to reinforce connections to nature and the Colorado region, foster a sense of optimism, and provide distraction for patients and staff alike.

Drawing on colour theory and research demonstrating the benefits of colour on healing^{1,2,3}, careful consideration was given to the amount, intensity and value of colours used throughout the hospital. As a result, five distinct colour palettes were developed and applied to areas where their impact is most beneficial – brighter palettes are used in areas like the

atrium, cafeteria and clinic areas, while a more subdued palette was applied in the chapel, intensive care and respite areas.

Harvesting natural light

Utilising natural light was another design priority. With studies showing the benefits of bright light in reducing depression and agitation, improving sleep and circadian rhythms, reducing pain, and even shortening the length of stay in a hospital⁴, ample natural light is provided via windows and light wells. The front of the outpatient wing consists of floor-to-ceiling glass, and interior roof terraces are used throughout to further harvest natural light and enhance interior spaces.

Additional design decisions were driven by information gathered from

focus groups held with patients, families and staff, and from observations collected by a team of designers who spent two weeks shadowing and interviewing families, patients and more than 250 hospital staff. This process led to redesigned nursing stations, an improved patient room layout, changes to the surgical and emergency departments, and features designed to improve lighting, reduce noise and prevent infections.

The design team was asked by nursing leadership to consider decentralised charting stations to maximise bedside care while retaining a caregivers' 'hub' for collaborative team consultations, private conversations, visitors and administrative functions. The resulting caregiver stations are a unique hybrid design, coupling a centralised station that maintains a strong sense of community and provides privacy for caregivers with decentralised workstations that improve caregiver-to-patient contact.

Research into patient rooms made it clear that crowding, lack of storage and inadequate sleeping accommodation for parents were disadvantageous. As a result, single-patient rooms are organised into patient, family and caregiver 'zones' to provide adequate space



The abundant use of natural light was a design priority



Clear wayfinding in outpatient areas helps to prevent stress



Bright colour palettes have been used in areas like the cafeteria and servery

and minimise encroachment of space for clinical care – a solution in alignment with observations by medical professionals elsewhere⁵.

Additional amenities include a gelato bar, landscaped gardens, play areas, outdoor terraces, and for teenage patients, an area with a cinema, pool table and music/reading room. Staff can enjoy their own exercise facilities, lounges, showers and a terrace.

Improved performance

The hospital's ability to translate patient, staff and family feedback into the new design has been critical. Relative to patient and family satisfaction, TCH is now a national leader, with performance evaluations showing improvement in every measured category, from the appearance (76 to 96) and overall comfort of patient rooms (83 to 91), to the comfort of overnight facilities (>60 to 74) and visitor accommodations (70 to 86), to the cheerfulness of the hospital (87 to 94).

The new hospital has delivered financial benefits for TCH and its patients as well, with the cost of treatment dropping \$24 per adjusted patient day due to increased efficiencies. Voluntary turnover for hospital staff and nurses has declined from almost 10% to 7.3% and 4.4% respectively, and turnover for first-year employees has declined from 13% to 8%. The critical role that the hospital's design has played in these and other positive results is undeniable.



The Children's Hospital (TCH), Denver, US

Project completion date:
October 2007

Contract form:
Design, Bid, Build with CM/GC
Project Cost: \$560m

Construction Cost: \$425m
Client: The Children's Hospital
Design Architect:

Zimmer Gunsul Frasca Architects
Architect of Record:
H+L Architecture

Structural engineer: S.A. Miro,
M/E/P Engineer: Bard, Rao +
Athanas Consulting Engineers

Main contractor:
Phipps/McCarthy Joint Venture

Sharron van der Meulen and Terri Johnson are both principals of Zimmer Gunsul Frasca Architects

References

1. Andrews, T. How to Heal with Color; 2001.
2. Gimble, T. Healing with Color and Light; 1994.
3. Roeder, C. Using Color & Light as Medicine. Journal of Healthcare Design; 1996.
4. Ulrich, R.S. How Design Impacts Wellness. Healthcare Forum Journal; September 1992, 20-25.
5. Jones, W. MOH, President of the New Century Healthcare Institute, Healthcare Design; March 2003, 71.

With a worldwide reputation, Great Ormond Street Hospital for Children's new Mittal Children's Centre needs to enhance clinical excellence, present a friendly face and put sustainability at its heart. *Steve Featherstone* finds out how a London landmark is changing.

The Mittal Children's Centre represents the second of four phases in the long-term development of Great Ormond Street Hospital for Children, the UK's leading tertiary care hospital. Llewelyn Davies Yeang's masterplan will transform a congested and confusing site, accumulated over a period of 150 years, into a more legible, accessible and sustainable whole.

The second of four phases of the hospital's long-term development plans, the Mittal Children's Centre will provide 31,500 square metres (340,000 square feet) of modern clinical facilities. The new buildings needed to recognise not only the normal statutory restrictions of a sensitive site (within a Conservation Area, and with strict height limitations), but to deliver an energy-efficient design, and the new development will be one of the greenest hospital projects in the UK, achieving a 20% reduction in carbon emissions through renewable sources (BREEAM rating 77%).

World reputation, world knowledge

GOSH is a world centre of excellence providing the widest range of specialist paediatric services in the UK, alongside teaching, training, and research and development, with referrals mainly from other local hospitals in London and south-east England, but

also from other UK commissioners and from abroad. The GOSH redevelopment team, working in partnership with other health providers and the design team, used evidence-based design to inform clinical and operational principles; it also consulted various institutions, visited other hospitals, studied appraisals of UK children's hospitals and researched theoretical projects, papers and reports. Finally, by engaging children, families and staff throughout, an innovative design process emerged between the hospital and its design team.

Greening and healing

Choice, sensitivity and discovery

A family- and patient-centred approach to design was critical in order to generate a patient-responsive environment. Most of the inpatient accommodation will be in single rooms with provision for family presence, bringing added benefits of noise control, patient safety, and control of infection. Each room encloses three distinct zones: the child or young person's area, the parent area and the clinical area. Each has its own en-suite bathroom and a parent/carer is able to sleep in the room. The single bedroom allows patients to maintain privacy and offers the opportunity to personalise their space and have links through their entertainment system to other children and a school network.

Decentralised nurse stations in the cardiac intensive care unit and the inpatient bedpools will allow a close relationship between staff and children and their families by providing constant physical staff presence, without interfering in day-to-day family life.

Great Ormond Street Hospital for Children, London, UK

Project completion date: 2011

Cost: £220m

Client: Great Ormond Street Hospital

Architect: Llewelyn Davies Yeang

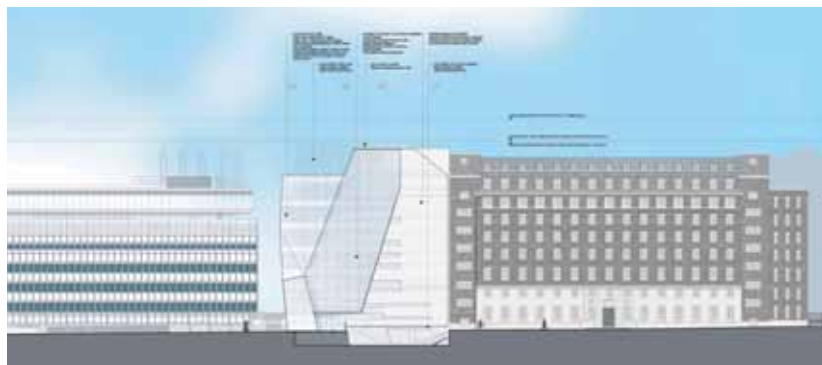
Structural engineer: WSP Group

Services and environmental engineer:

WSP Group

Quantity surveyor and planning

supervisor: Gardiner & Theobald



The north elevation of the Mittal Children's Centre, showing its relationship to the existing hospital buildings





Light- and plant-filled courtyard areas will provide an attractive welcome

Theatre layouts will provide a 'double corridor' that separates children and families from staff and supply flows, while providing individual anaesthetic rooms that allow a more private environment for patients and their families.

Patient environments and interiors are designed to stimulate discovery and patient senses, by the following means:

- Integrating interior design and arts strategies throughout the design process, in public areas and bedpools, and to assist orientation. Consultation with patients, visitors and staff is key to developing a relevant architectural response, especially for spaces adjacent to patient areas.
- Arranging bedpool zoning to facilitate discovery, with a gradual transition from public to more private zones. Public, reception, parent and play areas (for children and adolescents) overlook a landscaped green courtyard, an oasis within the densely developed hospital site that can also accommodate performances.
- A cranked block design within a tight site that maximises the penetration of natural daylight into the children's bedrooms, reducing stress and anxiety among patients.
- An inventive restaurant interior that will seek to inspire with interactive artworks, performance and music. The space will be designed around 'The Rainbow', an LED-based lighting system behind a translucent ceiling to create variations in mood lighting. Externally, a double glass skin expresses the natural ventilation flue to the restaurant, visibly expressing the environmental aspirations of the hospital.

A nurturing environment

Rethinking hospital design has been an occupational imperative for architects in the UK during the last 50 years. The hospitals that have emerged have been in response to a series of design priorities – functionality, flexibility, low cost – that have prescribed formulaic design outcomes. By contrast, the recent wave of Private Finance Initiative (PFI) buildings has seen hospital trusts wanting to create a sense of identity, often demanding buildings with 'corporate' individuality.

At the heart of GOSH's development plan was the desire to create a healing environment based on sustainable resources, fully accessible to children and their families, staff and visitors. In the design of the Mittal Children's Centre, Llewelyn Davies Yeang has sought to deliver a world class, signature, 'deep green' building and environment that recognises concerns including patient privacy and dignity, improved infection control and energy efficiency.

Steve Featherstone is managing director of Llewelyn Davies Yeang

The Middle East continues to be a hotbed of construction activity – with medical facilities high up the list of priorities. *Veronica Simpson* reports on the potential risks and rewards for Western architectural firms involved in the building boom.

As Western economies topple towards recession, the Middle East shows no sign of a slowdown. The building boom that has come to typify this region continues unabated, and state-of-the-art medical facilities for both the growing ex-patriot populations and the wealthy residents of the United Arab Emirates are top of the wish-list.

"The opportunities to build high quality medical buildings of a variety of sizes and specialties are greater in the Middle East than anywhere else in the world right now," says Greg Chang, principal and director of healthcare at Ellerbe Becket, which has been operating in the UAE since 1999. It is currently working alongside world leading university medical partners such as Cornell and Harvard to create facilities that address both design and functionality issues head-on.

Where Asia is largely looking for 1,000-bed mega-hospitals, the Middle East offers a wider range, from small speciality units of 100 beds upwards. Chang adds that it's not only the buildings but also the institutions that are being constructed afresh: "Unlike in the US or Europe, where there's a lot of institutional memory, there's a real opportunity [in the Middle East] to do something new."

Risks and rewards

But, as anyone who's had any dealings with the region knows, this is no El Dorado. There are just as many risks as there are opportunities, and consultants can spend years and frightening amounts of money chasing after 'dead cert' projects only for them to vanish into thin air – or, worse still, for the major part of the contracts to be awarded to cheaper, local firms, once all the sweat and hard work has gone into the masterplan. Those with a track record in the region, and who have made careful partnerships with the right developers and consultants, are certainly reaping the rewards. There are interesting new opportunities to create cutting-edge facilities that take the best of the West's ideas and, in some cases, add to them.

Like Ellerbe Becket, NBBJ is one of those long active in the region – though only recently establishing a permanent office there – with several projects underway. It recently completed a \$38m flagship diabetic facility in Kuwait, the Dasman Center for the Treatment and Research of Diabetes, which includes dedicated fitness facilities plus a kitchen where patients' family or staff can be re-trained to cook delicious but diabetic-friendly food. Still in the pipeline are a 1,000-bed hospital within a massive 'health city' just

outside the Yemeni capital, utilising a combination of vernacular and cutting-edge architectural techniques to minimise environmental impact, plus a state-of-the-art hospital in Sharjah that combines the highest clinical care with five-star spa facilities and styling.

High-end hospitality

As governments, developers and investors seek to create globally competitive healthcare provision, it is Canadian, North American, British, Australian and German medical and architectural firms that seem to dominate the expertise being brought in from abroad. InterHealth Canada (IHC) has been active as a consultancy in the region since 1999, and manages and operates hospital facilities throughout the UAE.

Gaining ground



Flagship: The \$38m Dasman Centre for the Treatment and Research of Diabetes in Kuwait



University Hospital Dubai, United Arab Emirates

Set within the massive Dubai Healthcare City (DHCC), Ellerbe Becket's University Hospital Dubai will be a 400-bed unit with a mixture of inpatient and outpatient consultations and surgeries, imaging, laboratory and invasive procedures, and non-trauma emergency care. With 149,000 square metres (1.6m square feet) of space, it will be the main tertiary care unit within Dubai Healthcare City, adjacent and connected to the existing Harvard Medical School Dubai Centre. Owned by Tatweer Corporation (a subsidiary of Dubai Holding Company) the clinical and educational side is being developed by partners Harvard Medical International (HMI).

The overarching ambition is to create a centre that will break down the traditional barriers between specialities to create truly multidisciplinary care. "It has also

University Hospital Dubai, United Arab Emirates

Contract form: Project Partnering Contract (PCC) between owner, design firm and contractor

Project completion date: February 2011

Cost: confidential per client request

Client: Dubai Healthcare City

Design architect: Ellerbe Becket

Architect of record: GHD

Structural engineer: GHD

Services and environmental engineer:

Ellerbe Becket and SKM

Quantity surveyor and planning supervisor:

Davis Langdon

Main contractor: ANLOR

been designed as a learning centre," says Greg Chang of Ellerbe Becket. "It will really be setting a standard as a teaching hospital, not just for the Middle East, but worldwide." Ellerbe Becket has been closely involved in the design and planning of this unit, working with HMI to develop surrogate user groups whose feedback directly informed the planning and layout of the spaces. Sustainability is also high on the agenda. Ellerbe Becket is aiming for LEED certification, and if successful, will be the first hospital in the Middle East to achieve it.

The design adapts traditional Islamic architectural techniques with modern building technologies in a kind of 'Islamic fusion'. A four-storey stone base maximises temperature stability and the open double skin on the exterior features two layers of glass, one to create a comfortable interior environment and the second to act as a screen, filtering sunlight and mitigating the heat of the sun with a traditional Islamic pattern.

The base draws inspiration from the traditional stone forms of wind towers and mosques found in the region. The spaces are large scale and transition seamlessly from the exterior to the interior, giving patients and visitors a clear sense of place within the context of DHCC.

Where the opportunity arises, IHC likes to be involved in the planning and provision for new hospitals, and recently worked from concept to handover on a maternity hospital project in Kuwait with NBBJ that takes patient care to a new level.

The Royale Hyatt Center for Women's Health couples top-end private medical care with levels of hospitality that cater specifically for the Middle Eastern market, where births are celebrated as lavishly as weddings. With 49 private postpartum rooms, 18 labour and delivery rooms, 12 recovery rooms, six paediatric rooms, four operating theatres, six special care baby units, an outpatient clinic and comprehensive ancillary services, its resources are enviable

But the size of the bedrooms – which Hildebrand says compare to the average five-star luxury suite – are also scaled to accommodate postpartum celebrations (the largest being 130 square metres/1,400 square feet); alternatively, a ballroom downstairs can accommodate a feast for 150 guests, with lifts to deliver a new mother from her private bedroom to the party without leaving her bed.

"There is a real quest for excellence here," says James Hildebrand, InterHealth Canada's project director, speaking from the firm's offices in Dubai. Being involved in a project from the early stages means IHC can make a difference to "getting the basic stuff right", says Hildebrand, including the provision of the right number of hand-wash sinks, separate from work sinks, and in the right locations to encourage frequent use. "We managed to design in a high level of infection control to the Royale Hyatt Center," Hildebrand adds.

Even operating on a clinical level, there are still hazards. Says Hildebrand: "When you go into a country you need to have a clear picture of supply and demand – population statistics and clinical needs. Figures like that are sketchy here, so you have to do your own analysis." And although there are plenty of people willing to build hospitals, there is a shortage of skilled labour to operate them, especially nurses.

"There are more projects that don't get through than those that do," he says.



The south atrium of the University Hospital Dubai gives visitors a clear sense of place

Sheikh Khalifa Specialist Hospital in Ras Al-Khaimah, UAE

Perkins Eastman has designed this 55,000-square-metre (592,000 square foot), 248-bed medical facility to accommodate the unique healthcare requirements in the United Arab Emirates (where whole families may need to be accommodated nearby or onsite) and is flexible enough in design to accommodate an additional 250 beds. The major specialties comprise oncology, cardiology and a trauma centre.

The six-storey structure incorporates the latest international design and medical planning solutions, with materials, forms and colours inspired by the surrounding terrain, from rolling sand dunes to the rich red colouration of the surrounding desert. Groves of drought-resistant plants decorate the exterior scheme, while the interiors maintain the shades of ochre and red that typify the desert palette, with bright highlight colours in furnishings and fittings. The idea is to create a welcoming environment that is functional and efficient without compromising aesthetics. Overall, the design is modern, flexible, and sensitively integrated within the natural environment.

The Al Hassawi Medical Facility, Sharjah

Project completion date: 2010

Cost: AED 600m

Client: The Executive Committee for Developing Rural Areas

Architect: Perkins Eastman, Al Bayaty Architects (UAE)

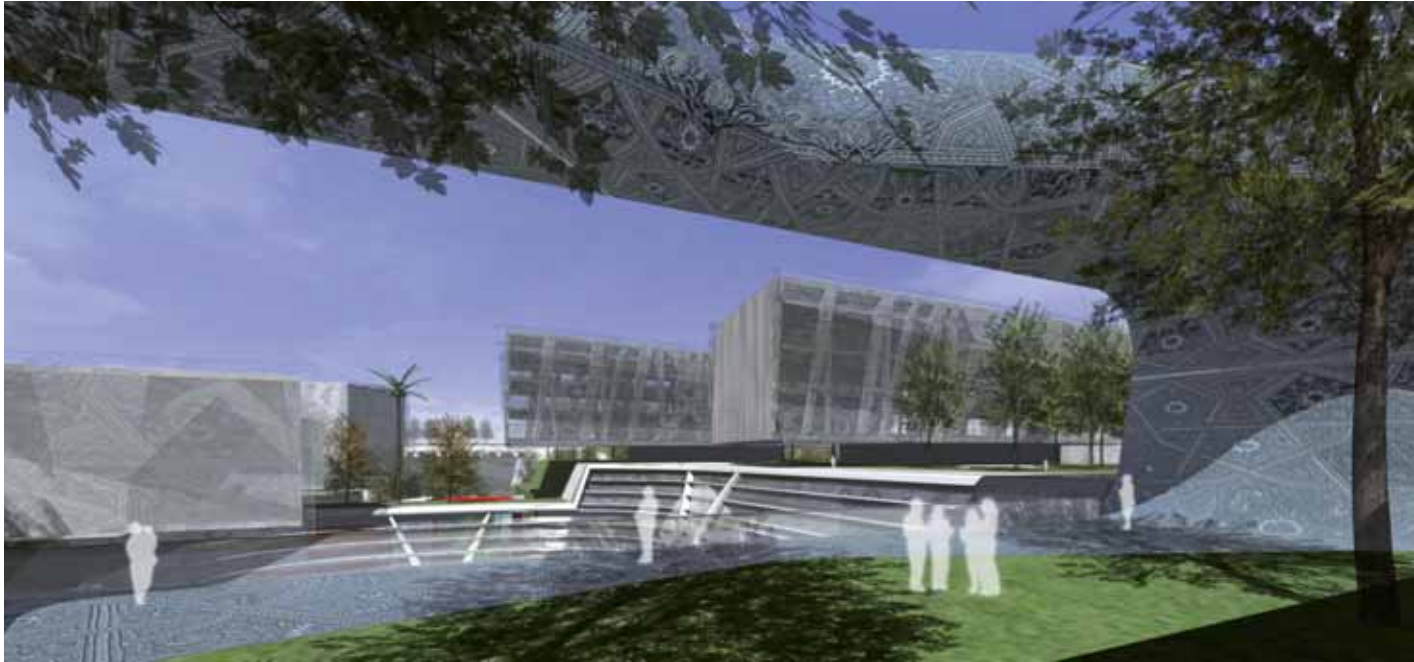
Structural and MEPL engineer: Al Bayaty Architects (UAE)

Lighting engineer: Crossey Engineering

Middle Eastern ideas head West

As you'd expect, having a presence in the region makes all the difference – both to understanding the real opportunities, and seizing them as they arise. NBBJ principal Alistair Cory says: "Having people on the ground now, we are starting to see that investment bear fruit, in terms of being able to consolidate relationships. It is still, in some ways, a hazardous region to operate in. But it is evolving. They are realising that it is worth investing in Western expertise [throughout the process] if you want to maintain the quality of a project."

What's more, as Middle Eastern companies start to invest in healthcare projects outside of their region (the Jumeirah Group, owners of the definitive Dubai luxury hotel, the Burj Al Arab, are said to be looking at taking Middle Eastern-style luxury healthcare into Europe), it pays to have developed strong relationships with them in their own territory.



The AI Hassawi Medical Facility, Sharjah

Fawzia Mubarak Al Hassawi has conceived a unique five-star hospital as a memorial to her father, Mubarak Al Hassawi. The family's solid background in the development of five-star hotels in the region means the luxury hospitality side of the project is assured. NBBJ has been appointed to provide architecture and masterplanning, bringing in additional Canadian and German clinical consultancy input, to create a fusion of cutting-edge medical practice with the most advanced complementary medical healing practices within a luxurious environment. Spa interiors specialist Syntax is also involved in the public areas.

A low-level facility with ample landscaping and privacy for inpatients has been designed to occupy a 32,500 square-metre (350,000 square-foot) site. The plan is for an assortment of layered buildings, no higher than three storeys, with multiple roof gardens and terraces disguising the lower floors. Some areas have been sunk below the landscaping to minimise the complex's visual impact and maximise sustainability, through passive cooling techniques. Therapeutic gardens surround the rehabilitation and treatment blocks, with water features and planting to maximise shade.

Situated on the side of the main highway to Dubai, the hospital is shielded from the road by a large medical office block, and at the rear by an L-shaped leisure and retail facility. Staff residential facilities, a hotel and extensive leisure and retail facilities are also part of the scheme, unified by NBBJ's exterior treatment which uses a double-skin glazed finish to maintain interior temperatures, with a decorative patterned screen shielding the building from sunlight.



The AI Hassawi Medical Facility, Sharjah

Contract form: FIDIC – unsigned

Project completion date: 2010

Cost: \$900m

Client: Mubarak Al Hassawi Group

Architect: NBBJ

Associated consultants: Syntax Architects

Cost Consultants: Davis Langdon LLP

A tale of two countries

Kathleen Armstrong explains how Northern Ireland and the Republic of Ireland – both surfing a wave of new economic opportunity – are approaching their ambitious healthcare building programmes.

His is a man with a vision. As head of Northern Ireland's Health Estates Agency, John Cole is in charge of developing a healthcare estate that radiates design quality and provides healing spaces for a population of more than 1,700,000 people. His strategy is ambitious and challenging, but for those who want to be part of the creation of innovative health facilities, it is an exciting place to be.

Much of the healthcare stock in Northern Ireland is in real need of refurbishment. During the 'Troubles', the period of civil conflict that took place in the country between the 1960s and the mid-1990s, very little development took place. Most of it now needs to be replaced, and Cole is determined that the standard of design and quality remains high throughout the programme.

"That's what attracts us to be involved," says Justin De Syllas from Avanti Architects, the London-based firm that has worked on Belfast's Grove Health and Wellbeing Centre in partnership with local architects Kennedy FitzGerald. The Grove is one of a range of primary- and community-care centres being developed throughout the country, and it is part of the reconfiguration of healthcare services that is going hand-in-hand with the redevelopment of facilities.

The three-storey building brings together primary care services – such as physiotherapy, podiatry, a small minor treatment suite, GP practices and social services – with a sport and leisure centre. Built on a long, thin site between a main road and a park, the building design aims to create a feeling of space, bringing in natural light through glazed walls and clear circulation routes.

A tiered system

There are five levels of healthcare facilities in Northern Ireland. Level 1 is the local GP and small surgery. At the next level up are polyclinics – serving 20,000-70,000 people, and bringing together diagnostics, consultancies and other services that can be dealt with out of hospital. Level 3 is the community hospital providing respite beds, GP-managed beds and step-down care for people recovering from treatment in acute hospitals. Level 4 is the acute hospital, while Level 5 hospitals provide the centre for a particular specialist procedure or treatment such as cardiac surgery or brain surgery.

There is work going on throughout the country to develop and redevelop such facilities at all levels. Bids are also currently being considered for the redevelopment of acute hospitals such as Omagh Hospital and the £190m capital investment approved for the redevelopment of Ulster Hospital.

The £150m redevelopment of the Altnagelvin Area Hospital, an acute facility in Londonderry, was master-planned by HLM Architects in association with Hall Black Douglas Architects. As part of the development, the hospital's original modernist tower block will receive a dramatic makeover, with new lighter, brighter wards and 100% single-bedroom accommodation.

The hospital's new South Block, currently under construction, was one of the first major healthcare buildings in Northern Ireland to



Altnagelvin Area Hospital, Northern Ireland

Cost: £150 million

Client: Western Health & Social Care Trust

Lead Consultant: HLM Architects

Architect: HLM Architects/Hall Black Douglas Architects

Structural Engineer: Doran Consulting

Services and Environmental Engineer: Arup

Quantity Surveyor and Planning Supervisor:

WH Stephens & Sons

Landscape Architect: HLM Landscape



be procured under a scheme known as Performance Related Partnering (PRP). Developed by John Cole and his team to help ensure quality is maintained, design and construction teams are appointed on a partnership basis for more than one project, but have to demonstrate performance for each phase of their work to be able to ensure their appointment for the next phase.

Welcoming spaces

The recently completed mental health unit at Craigavon Area Hospital is another example of progressive design. The single-storey building creates a non-threatening, welcoming space for both patients and visitors, designed to support the therapeutic process. Outdoor spaces remain secure without the need for too many fences, while circulation routes have outside views and have been designed to ease orientation. At the same time, the geometry of the facility means that members of staff have the level of observation and control that they need, without making the building feel too dominating.

Up until now, Private Finance Initiative (PFI) funding, where all or most of the funds for a particular project are provided, and controlled by, a private sector consortium, has been little used for healthcare building development in Northern Ireland. However, it is now being brought in for some of the larger developments, including the redevelopment of Omagh Hospital.

John Cole has adapted the PFI model for Northern Ireland in order to retain control of design quality: an architectural firm is selected through an initial competition to draw up an exemplar design of the facility; once the client's needs have been established and the exemplar drawn up, the final budget is established and contractors appointed. Cole's aim is to budget realistically from the start for the design and quality that need to be achieved for a project by putting the work in at the beginning, setting down the quality criteria that need to be achieved: "Contractors are not allowed to dumb these down," he explains. The approach has been dubbed 'smart PFI' by the Royal Institute for British Architects (RIBA) and forms the basis of a model that the organisation has tried to promote throughout the rest of the UK.

Cole is also working on a combination of PFI and PRP that he calls "strategic partnering for PFI", whereby two architectural teams will be appointed – one to work with the contractor throughout the project, and the other to remain with the client in order to ensure that the client's needs continue to be met.

"The standard of design in the country is very good – and it's all down to John Cole and the Health Estates Agency," comments Christopher Shaw from MAAP Architects. "There is no one like him anywhere else in the UK." Shaw's practice is partnering with Donnelly O'Neill on the design and development of a children's home in Newry. "It is easy to design an adult

Craigavon Area Hospital Mental Health Unit Northern Ireland

Contract form: GC Works (within Health Estates NI's performance related partnering framework)

Project completion date: April 2008

Cost: £11.8m

Client: Southern Health and Social Care Trust

Architect: David Morley Architects and

Hall Black Douglas Architects

Structural engineer: Buro Happold

Services and environmental engineer: Buro Happold

Landscape Architect: Livingston Eyre Associates

Quantity surveyor: WH Stephens

Project Manager: Health Estates Northern Ireland

Main contractor: Heron Bros Limited

building and stick cartoons on it," he says. "This will be a child-centred building, carefully choreographed around the lives of the child, parent and carer."

South of the border

Quality is also high on the agenda in the Republic of Ireland, where the refurbishment, redevelopment and reconfiguration of services and facilities are also in full swing.

As in Northern Ireland, investment in healthcare facilities slowed down during the 1970s and 1980s, reflecting a downturn in the economy. But over the last ten years, the economy has boomed, along with government recognition of the need for capital investment to bring healthcare facilities into the 21st century.

The way that hospital services are being delivered is also changing, requiring new and/or reconfigured estates. Acute services will be provided in regional hospitals, serving a wider area than the previous county hospital model, while out-of-hospital treatments and diagnostic tests are shifting into community hospitals, often housed in the county hospital facility.

This is also accompanied by the development of community nursing units, long-stay residential care facilities of around 50

beds each – smaller facilities located closer to the local community in the place of previous larger, more centralised care homes. As a model for these facilities, Brian O'Connell Associates, in partnership with Murray Ó Laoire Architects, has developed a design for St Mary's Community Nursing Unit in Dublin that consists of a series of modules in which patient accommodation is designed around a series of courtyards. A second module provides the central foyer and community space, while a third houses support services.

Complementary private care

Another major government strategy is co-location. The healthcare system in Ireland differs in at least one major way from its neighbour to the north in that running alongside the public health system is a complementary system of private healthcare. Currently a certain percentage of patients treated in public hospitals are private patients. But the government's co-location policy will see a number of private hospitals built on the same site as selected public hospitals. In addition, a new wing will be constructed onto the public hospital for private patients who are currently treated in the state hospital, in order to free up beds for patients treated under the state system.

Further impacting on the design and planning of such facilities is the recommendation from the Strategy for the control of Antimicrobial Resistance (SARI) working group that new hospitals be required to have (and existing hospitals aim to have) at least 50% single beds, and, where there are multi-bedded rooms, that there be greater space between beds. Currently the typical ward in an Irish hospital has around 30-32 beds, including around four single-bedded rooms; the new policy will result in around 24 beds in the same space.

The new private hospital on the site of Dublin's St Vincent's University Hospital will feature 80% single beds. Designed by Scott Tallon Walker Architects, it will have a 'hotel feel' with views out over the bay and mountains, and will be constructed to BREEAM environmental standards.

Hospice-friendly hospitals

The creation of more space and the increase in single-bedded rooms is also driving the redevelopment of hospices. The Hospice Friendly Hospitals Programme – a collaborative initiative involving government, medical staff, architects and others involved in the provision of end-of-life care – has developed guidelines for the physical environment of hospice-friendly hospitals, recommending how to create a calm, reassuring environment for patients, families



Marymount Hospice, Republic of Ireland

Contract form: GCCC New government form of contract

Project completion date: First quarter of 2010

Cost: € 65m

Client: Curraheen Hospital

Architect: Donal Blake, Scott Tallon Walker

Structural engineer: Arup

Services and environmental engineer: Varming

Quantity surveyor and planning supervisor:

O'Reilly Hyland Tierney

Main contractor: As-yet unappointed

and staff with the use of space, colour, fabrics, views and the natural environment.

One of the first facilities to be developed using the recommendations from the programme is the Marymount Hospice at St Patrick's Hospital. "The design is based on maximising the capabilities of the individual as their life is failing," explains architect Donal Blake from Scott Tallon Walker. Walkways will be designed for easy wayfinding, with intermediary sitting areas. There are clear routes to bathrooms, and hoists over each bed. All bedrooms will have an east or west orientation, as well as balconies overlooking landscaped grounds. Courtyards and a rooftop garden will provide further access to nature. "The hospice will be a revelation in the way hospice care is delivered," concludes Blake.

Art also has a significant place in the design of every healthcare facility and is supported by the government's Per Cent for Art Scheme, which allows public capital construction projects to ring-fence up to 1% of the budget for an art project. At the Our Lady's Children's Hospital in Crumlin, Dublin, murals of animals and aquatic scenes cover the walls in the new cardiac wing, the MRI room and the intensive care unit. Artist Lynne Misiewicz from Misha Design canvassed children, parents and medical staff to find out what designs would help to provide a relaxed and friendly atmosphere and reduce children's stress while in hospital.



A mural at Our Lady's Children's Hospital in Crumlin, Dublin, created by artist, Lynne Misiewicz from Misha Design

The approval process

Design quality remains a key to healthcare facility development in the Republic. Until fairly recently, the quality of design was the main criterion for the selection of the design team, with fees being agreed later. Now, however, cost is included as a factor when a project goes out to tender. Most projects are procured through traditional methods, but more recently there has been a clear move towards design-build, where the design and construction are combined and paid for in a single tender process, particularly for projects where similar facilities are needed around the country. Each design will be adapted to suit the community and environment in which it is located.

One of the common complaints from design teams is that by the time a project gets to completion in Ireland, it is often out of date.

The design for Cashel Community Hospital, for example, was drawn up in 1996, but the first phase of the project was not completed until nearly a decade later, and the second phase is still under construction.

Design-build aims to shorten that time by removing some of the steps in the assessment and approval process, and bringing the interaction with the end-user in at an earlier stage. And, says Desmond Fitzgerald, acting deputy chief architectural advisor for the Health Service Executive, it should enable more flexibility to ensure the design continues to meet the client's needs.

Unlike in the UK, public-private partnership (PPP) funding has not been used much in Ireland for the development of facilities in the healthcare sector. However, it is being considered as part of the strategy to build specialist centres for radiation and oncology. How design fares in this regime comes down to how the tender documentation is put together, says Fitzgerald: "If the tender is structured correctly, we can maintain quality and service with the best equipment available," he explains. "We are always keen to have good quality and I don't think it costs any more."

Assessing a changing landscape

Throughout Ireland, in both the North and the Republic, the healthcare landscape is changing, as old buildings and methods of healthcare delivery are brought into the 21st century, revealing innovative new design at both ends of the geographical spectrum. The focus, according to those leading the change in both countries, is on improving and making more efficient the delivery of care to patients and communities.

As John Cole says: "Buildings are not ends in themselves. They are a response to a need. Understanding that need will lead to better buildings – and better buildings heal better."

Kathleen Armstrong is a health writer and journalist

The power to change lives

Solar and wind-up lighting will soon be available to Africa's poorest people, thanks to a new deal between Philips and the Dutch government.

The Netherlands is aiming to reduce poverty in sub-Saharan Africa by supplying sustainable lighting to its poorest citizens. A Public Private Partnership (PPP) between Eindhoven-based Philips and the Dutch government will see the development of a new generation of solar- and man-powered lighting, in order to help fulfil the UN's eight Millennium Development Goals to cut poverty by 2015.

An estimated 500 million Africans currently live without electricity, relying instead on candles or kerosene lamps. Kerosene prices have risen dramatically in recent years however, meaning that for many, life simply comes to a stop after dark, impacting upon quality of life: children can't do their homework; work and other economic activities come to a halt.

As Gerard Kleisterlee, president and CEO of Philips, explains: "The rural lighting market for low-income people in developing countries is not very well known or explored. It is essential that governments and international organisations such as NGOs, the World Bank and various companies get together to work out appropriate business models."

While the Dutch government will focus on providing support for market development and project management, Philips will work on developing an appropriate range of products. The solar Uday lantern, for example, is a portable compact lighting system, powered by a solar panel and built-in battery pack, which provides 250 lumens (the equivalent of 250 candles) when charged in the sun for a day. The Uday is complemented by a wind-up LED torch that provides 17 minutes of lighting for every two minutes' winding. Philips is also working on affordable solar LED lighting systems that will offer high-quality white light at the lowest possible cost, a development that's expected to bear fruit in 2009.

www.philips.com



Inside out

Light-filled geodesic domes – more commonly used as conservatories, spa-pool covers or artist's studios – have found a new use in the healthcare sector. Mental health patients using rehabilitation services at Mandalay House in Aylesbury are using a Solardome as a sociable garden social space that can be used year-round: Oxfordshire and Buckinghamshire Mental Health Partnership NHS Trust was awarded £35,000 by the King's Fund as part of their 'Enhancing the Healing Environment' programme for the dome, which acts as a striking focal point in the garden.

"The design, with its ability to be outdoors yet indoors, with access to natural light and transparency, was a real selling point for us," says David Stalker, who led the project for the NHS Trust. "Therapeutically, there is researched and anecdotal evidence about the positive effects of solar light on melanin levels, Seasonal Affective Disorder (SAD) and overall wellbeing. It also encourages those who are potentially vulnerable and isolated to the immediate confines of the existing building to go outside throughout the year. This means they have much needed calming, warm and safe social and recreational space."

Creating the perfect balance between science and nature, Solardomes provide optimum light transmission, heat retention and ventilation, making them ideal for a range of applications in the modern world. The glass and aluminium structures create an inviting, tranquil, 'back to nature' environment that in turn, stimulates a feeling of wellbeing. This makes them appealing for the health sector – because they address the need for an innovative approach to rehabilitation and therapeutic activities.

www.solardome.co.uk



Turn on, turn off

Magnetic stimulation is a non-invasive and painless method of exciting neurons using strong, time varying magnetic fields generated by a stimulating coil held close to the intended site of stimulation. Used for research, diagnosis, prognosis and therapy in nervous and psychiatric disorders, it is able to stimulate the human cortex, spinal roots and peripheral nerves.

Transcranial Direct Current Stimulation (tDCS) involves applying weak electrical currents to the head, to generate an electromagnetic field that modulates the activity of brain neurons. tDCS is known to selectively modulate neuronal excitability and can be used alongside Transcranial Magnetic Stimulation (TMS), fMRI or centrally acting drugs. Emerging as a major research tool in its own right, tDCS is complementary to conventional TMS, and is being investigated as a non-invasive treatment for a variety of conditions such as stroke recovery, depression and migraine. In trials, tDCS has shown promising indications of a positive role for non-invasive direct current stimulation in stroke rehabilitation¹.

TMS and tDCS could enable more targeted neuropharmacology delivery through greater understanding of brain processes. Using TMS as a research tool, brain activity can be triggered with minimal discomfort while the circuitry and connections of the brain can be studied using MRI. By stimulating and 'turning off' targeted areas of the brain, researchers can identify which regions are responsible for specific tasks.

Based in Wales, The Magstim Company has pioneered the development of new magnetic stimulation technologies, providing neuroscientists with the means to work with the human brain in awake subjects by manufacturing and supplying state-of-the-art clinical and research instruments in the fields of neurology, neurophysiology, psychiatry and rehabilitation.

www.magstim.com

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Design & Health Scientific Review

Stalactites and stalagmites



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



Prof Romano Del Nord is chair of the scientific committee of the International Academy for Design & Health and deputy rector of the University of Florence

Research and design collaboration requires two separate and equal approaches to successfully bridge the perennial gap between the two. This issue's articles represent these two approaches – theoretical and applied. One is top-down like stalactites and the other is bottom-up like stalagmites. Eventually they meet in the middle and form a firm basis for designers, researcher, their clients and the users of their buildings and open spaces to make informed decisions.

Two articles in this issue represent the top-down theoretical approach. Dilani has carried out an extensive literature review to create a “salutogenic” framework for design

decision-making in healthcare and other environments. One extremely useful next step in developing salutogenic designs – those that develop and promote health and wellness as opposed to those that identify and avoid ill-health – would be for readers of *WHD* to begin employing the term in their work with clients and in promotional material.

The other theoretical article – Vischer and Zeisel – makes a critical distinction between traditional Programming and Post-Occupancy Evaluation (POE) research and evidence based design (EBD); namely that EBD puts into the hands of designers the decision over what information they find useful for design decision-making, thus avoiding the traditional judgmental nature of “evaluation” by outsiders to the design process.

A useful next step would be for us all to keep this distinction in mind when we use the term “evidence-based design”. Cormelissen and Kroop take the other approach in their study of lighting in scan rooms, finding that both fear of scans and the rate of scan failures are reduced when lighting is provided that better meets the emotional and biological needs of Magnetic Resonance and other scan subjects.

Of course, readers of the three articles will quickly see that the distinctions I make here are false. Both theoretical articles use detailed applied examples to make their points, and the applied article sets the stage with an extensive theoretical and neuroscience introduction. It's just a question of where we begin – with the theory or the practice.

Both end up in the same place. Both are extremely practical contributions to the field of research and design. Design and Health is well on the way to making obsolete the historical “gap” between research and design.



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Psychosocially Supportive Design: A Salutogenic Approach to the Design of the Physical Environment

Prof Alan Dilani, Ph.D., general director, International Academy for Design & Health



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Evidence-based Design: Bridging the gap between research and design

Jacqueline C Vischer, professor of design, University of Montreal; John Zeisel, president of Hearststone Alzheimer Care



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Lighting Design: Creating a less intimidating hospital ambience

Sjeff Cornelissen, senior lighting specialist, Philips Lighting; Martine Knoop, visiting professor, faculty of architecture, Eindhoven University of Technology

Psychosocially Supportive Design: A Salutogenic Approach to the Design of the Physical Environment

While clinical practice focuses on treating illness, there's also a raft of research to suggest that the quality of our everyday surroundings has a highly important role to play in sustaining wellness.

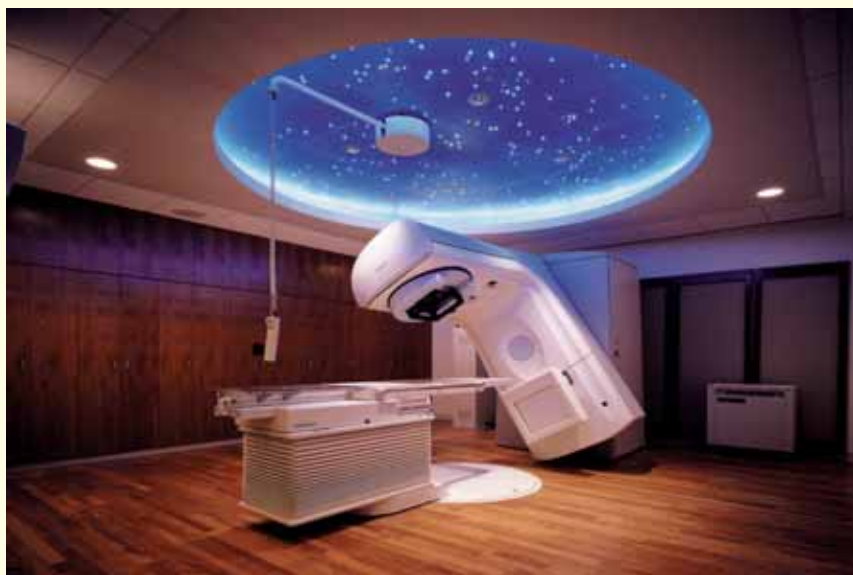
Architecture and design have been influenced by industrial societies for decades, and as a result, public buildings such as airports and hospitals have often been designed to function and look like factories. Clinical practice in hospitals focuses mainly on treating illness while often neglecting a patient's psychological, social and spiritual needs. Environmental qualities that could be considered as psychosocially supportive have not been developed properly. Psychosocially supportive design stimulates and engages people, both mentally and socially, and supports an individual's sense of coherence.

The basic function of psychosocially supportive design is to start a mental process by attracting human attention, which may reduce anxiety and promote positive psychological emotions. Health processes could be strengthened and promoted by implementing design that is salutogenic – ie, that focuses on the factors that keep us well, rather than those that make us unwell. The aim of psychosocially supportive design is to stimulate the mind in order to create pleasure, creativity, satisfaction and enjoyment. There is an important relationship between an individual's sense of coherence and the characteristics of the physical environment.

In this literature review we have studied more than 300 articles as well as other literature that had relevant connection to the field of physical environment, health and behaviour, to shed light on psychosocially supportive design.

Theories and perspectives on health

Health is difficult to define, since it is a subjectively experienced condition¹. It is affected by norms and expectations and is also formed by previous experiences. There



A salutogenic approach to the physical environment includes design features that support our wellbeing

are a few different definitions of health. For example, Lawrence² has defined health as a condition where resources are developed in the relationship between humans and their biological, chemical, physical and social environment.

Health can be divided into two different perspectives: the biomedical and the holistic. From a biomedical viewpoint, health is considered to be a condition without diseases³. In the western world, the biomedical perspective has been the leading perspective and has therefore formed the medical and healthcare field⁴. The holistic viewpoint emphasises multiple dimensions of health, including the physical, psychological, emotional, spiritual and social.

From a research perspective, health can be divided into a pathogenic and salutogenic starting point. Pathogenic research focuses on explaining why certain etiological factors cause disease and how they are developed in the physiological organism⁵. The primary

aim of pathogenic research is often to find medical treatments (ibid.). Salutogenic research is based on identifying wellness factors that maintain and promote health, rather than investigating factors that cause disease⁶. Together, the salutogenic and the pathogenic approach offer a deeper knowledge and understanding of health and disease (ibid.). To be able to answer the salutogenic question – what is causing and maintaining healthy people? – Antonovsky⁶ developed the concept of a sense of coherence (SOC). It maintains that a person with a high sense of coherence chooses the most appropriate coping strategy in a stressful situation. For example, the person may decide to fight, flee or be quiet depending on what kind of stressor the individual is exposed to.

Research has shown that it is possible to measure a person's sense of coherence and thereby predict an individual's health⁷. A strong sense of coherence predicts good

health and a low sense of coherence predicts poor health (ibid.). In his study, Heiman⁹ showed that students with a high sense of coherence did not experience high levels of stress. The research also showed that coping strategies were significantly correlated with the individual's sense of coherence (ibid.).

The concept of sense of coherence has three vital components (1) comprehensibility, (2) manageability and (3) meaningfulness⁶. A person with a strong sense of coherence scores high on all three components. According to Antonovsky⁶, the term comprehensibility implies that the individual perceives the surrounding environment and that which is happening in the world as coherent. If something unexpected is happening, such as an accident or personal failure, the person who understands why they are happening has a higher sense of coherence than one who cannot. A person with a low sense of coherence perceives himself as unlucky.

Manageability means that the individual experiences that she is disposed of all the required resources necessary to cope with a given challenge or demand. This means that the individual feels that she is influencing that which is happening around her and does not perceive herself as a victim of circumstance (ibid.). Antonovsky⁶ believes that a person's sense of meaningfulness is connected to his or her perception that there are important and meaningful phenomena in life. Meaningfulness is the component that motivates a person's sense of coherence.

The physical environment

There is an interaction between humans and the physical environment. According to Dilani^{9,10}, the physical environment is not only vital for good health, but can also be a critical stressor for the individual. Physical elements in an organisation can contribute to stress and are therefore essential factors for increasing comfort¹¹. Despite that, the majority of humans in the western world spend most of their time in indoor environments; there is a lack of knowledge about how these environments affect a person's health and wellbeing¹². There is a general belief that humans are always adapting to the environment (ibid.). Often called the theory of adaptation, this belief indicates that people become less conscious of the environment the longer they reside or



Wellness factors in the environment, such as daylight and nature, are evident in the radiology bunker at the Thunder Bay Regional Health Sciences Centre in Canada, designed by Farrow Partnership Architects

work in that given environment¹³. A general belief is that if one lets oneself be affected by the physical surroundings then it is a sign of weakness¹⁴.

In order to create supportive physical environments it is crucial to understand an individual's fundamental needs¹⁴. It is also necessary for different professional disciplines to willingly cooperate in creating the best conditions for humans^{2,14}. Before a zoo is built, it is common practice for architects, designers, biologists, landscape architects, animal psychologists and building specialists to collaborate in creating an environment that optimises the living conditions for the animals¹⁴. Factors such as materials, vegetation and lighting are taken into consideration; animals need enough space to eat, sleep and decide when to be social or seek solitude, and even their need for control and choice have been noticed. The aim is to create an environment that will support the animal's physical, psychological and social wellbeing. Ironically, humans do not seem to make the same demands when a workplace is going to be designed¹⁴.

Heerwagen et al.¹⁴, created a framework and guideline for a salutogenic design, which highlighted the following factors: (1) Social cohesion, both formal and informal meeting points; (2) personal control for regulating lighting, daylight, sound, temperature, and access to private rooms; (3) restoration and relaxation with quiet rooms, soft lighting, access to nature and a good view. Stokols¹⁵

has also contributed with design suggestions for health-promoting environments that stem from three different dimensions of health: physical, mental and social. Physical health can be promoted by an ergonomic design with non-toxic environments. Mental health can be promoted by personal control and predictability as well as aesthetic, symbolic and spiritual elements. Social health can be promoted by access to a social support network, and participation in the design process.

It is not a new idea to view the physical environment as a health-promoting factor. During the nineteenth century, Florence Nightingale developed a theory of healthcare that emphasised that physical elements are vital for the individuals' health¹⁶. Examples of physical elements, such as noise, illumination and daylight were considered vital factors for a person's mood (ibid.).

Levi¹⁷ founded the stress theory model, which was later developed by Kagan and Levi¹⁸. The model is based on a system that points to a deeper understanding between the physical environment and different human components¹⁹. According to Dilani⁹, the model describes how the physical environment is the foundation on which societal organisation is built and, in the long run, promotes health or disease. The model is used within the field of architecture to integrate design elements with health and wellbeing (ibid.).

Emdad²⁰ has recently developed a



Research suggests that barn theatres, such as this one at Broadgreen Hospital, Liverpool, designed by Nightingale Associates, enhance surgical performance by providing social and professional support to staff

is it that makes people feel at ease in nature? Does the natural environment affect people in different ways? Is it possible to draw any general conclusions about nature's influence on the human being?

Kaplan and Kaplan³¹ have developed the Attentional Restorative Theory (ART), which identifies two attention systems – direct and indirect attention – and how they are related. Indirect attention does not demand any energy or effort from the person and it is activated when something exciting suddenly happens or when one does not have to focus on something in particular. Direct attention is activated as soon as a person needs to concentrate and focus on a task and simultaneously block other disturbing stimuli. After an intense period of direct attention, a person is in need of restoration; otherwise she will easily become mentally exhausted. People who have been using their direct attention without resting often become impatient and irritated and it has been shown that a mentally exhausted person often commits so called “human errors” (ibid.). A person who does not have the capacity to concentrate often becomes thoughtless, less cooperative and less competent^{31, 32, 33}. Therefore, in order to work efficiently, it is vital to have a well-functioning attention system and find time for restoration.

These studies have been able to distinguish the following four needs when individuals are in need of restoration and recreation: (1) The need for being away from everyday life and its surrounding sounds, routines, crowding, etc; (2) The need for fascinating stimuli that effortlessly stimulate the individual, and diminish the risk of becoming bored; (3) The need for extent, which at the same time can create a feeling of being in a completely different world^{31, 32}; (4) The need for compatibility while performing one's tasks^{31, 32}.

The restorative environment should be inviting, well-balanced with aesthetic beauty, and allow people to reflect³³. Nature, with its colours, forms and scents, is unparalleled in encouraging people to forget about their everyday life. It is therefore very important that natural environments are accessible at the workplace (ibid.). The ART has been tested and confirmed by different researchers^{33, 34}. For example, one of the studies³³ showed that three of the four components – being

model called Instability of Pyramids of Stress (IPS), where architecture and art are measurable variables. Emdad²⁰ presents a new framework that, in relation to health at the workplace, has taken neuroergonomics into consideration. For example, there is a risk that the employee will develop stress-related symptoms and disease if he or she experiences high demands from the surrounding environment but does not receive any reward. The employee will experience stress if the reward is too low or not adequate, or if he does not have any suitable effort strategies in relation to psychosocial factors, home and family factors or neuroergonomics. The mode integrates all of these factors and focuses on health, burnout, cardiovascular diseases and short-term memory (ibid.).

Social support and the physical environment

Social support is an important factor when the aim is to promote an individual's health and wellbeing^{21, 22, 23, 24}. The knowledge and consciousness of social support and its relation to health increased in the 1950s²⁵. At the same time, researchers established that the physical environment and how it influences people's emotions, behaviours and motivation are important to take into consideration when the aim is to promote health and wellbeing (ibid.). It is therefore essential to identify factors in the physical environment and, through design and

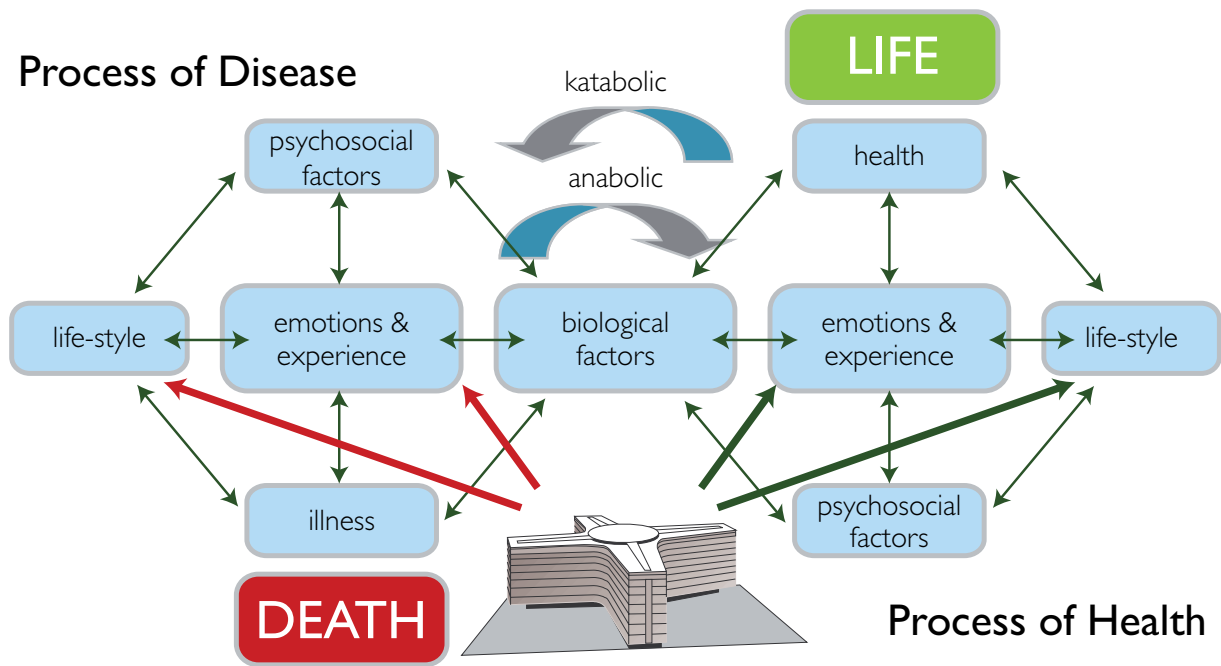
architecture, create meeting points that can promote spontaneous social interaction and social support^{25, 26}. For example, research has shown that a certain length and layout of student dormitories can increase the number of social activities and promote social interaction, create a higher sense of control and reduce a sense of crowding²⁷.

Crowding

Crowding is closely linked to social support²⁸ and is often defined as the number of persons in a certain area or how much space every individual has received in a certain area (ibid.). Altman²⁹ describes crowding as a condition where a person's private sphere is trespassed. If there is too much undesirable contact, an individual may experience a sense of crowding. On the other hand, if an individual experiences too little contact, there is a risk that he or she may feel lonely and isolated (ibid.). This balance between social interaction and desired loneliness can, according to Maxwell³⁰, be regulated and achieved if one can control his or her own levels of social interaction.

Nature and its meaning for health

Most people have some kind of relationship to nature and there are many people who greatly value diverse natural environments. Also, there are many people who want to get away from everyday life during weekends and holidays, and regain their strength in relaxing and natural recreational areas. What



away, extent and compatibility – are seen as measurable indicators of how to create a restorative environment.

According to Van den Berg, Hartig and Staats³⁵, several studies have confirmed that human beings perceive natural environments as more restorative than urban environments. Therefore, when human beings are tired and mentally exhausted, nature is the appropriate place for restoration. Other studies have shown that viewing nature through a window has positive health outcomes^{36, 37, 38, 39}.

Daylight, windows and lighting

There is a great deal of research on daylight's positive effects on humans' psychological wellbeing¹². A lack of daylight can lead to both physiological and psychological difficulties⁴⁰. Research has also shown that daylight in a classroom is necessary for the pupils to maintain a balanced hormone level⁴¹. It is also shown that a window can have positive health outcomes on patients^{42, 43}. The window can contribute by allowing fresh air and daylight to enter as well as providing a view. It can also be the link to the outer world – thus satisfying a patient's or prisoner's need for viewing the season's variations, etc. (ibid.). Another study showed that exposure to direct sunlight via windows at the workplace increased workers' wellbeing and had a positive impact on their attitudes and job satisfaction³⁸.

Research has shown that illumination can

have an impact on factors in daily life, such as sleep and work performance. For example, Lack and Wright⁴⁴ showed that exposure to lighting at certain times during a 24-hour period can prolong sleep and improve the quality of sleep. Energy consumption and costs can decrease if the individual has the ability to control the illumination levels (ibid.), which also has positive affects on environmental resources⁴⁵. Research also showed that an individual's general satisfaction was higher when they had the ability to control the lighting levels themselves (ibid.). Küller⁴⁶ concludes that lighting will become more important in the future, especially since it is becoming more common with buildings without windows that have no access to daylight.

Colour, space and landmarks

Colours can possibly affect the brain's activity and create a sense of wellbeing and originality within architecture⁴⁷. Colours can also have symbolic value and in that way contribute to the building's identity and/or cultural meaning. Colours should be of high interest to city planners, mainly because of the aesthetic values, but also because of their symbolic values, which can reflect an organisation's philosophy (ibid.). The so-called warm colours (red, yellow and orange) are considered to have an activating affect, while the so-called cold colours (blue, purple and green) are considered to have a calming effect⁴⁸.

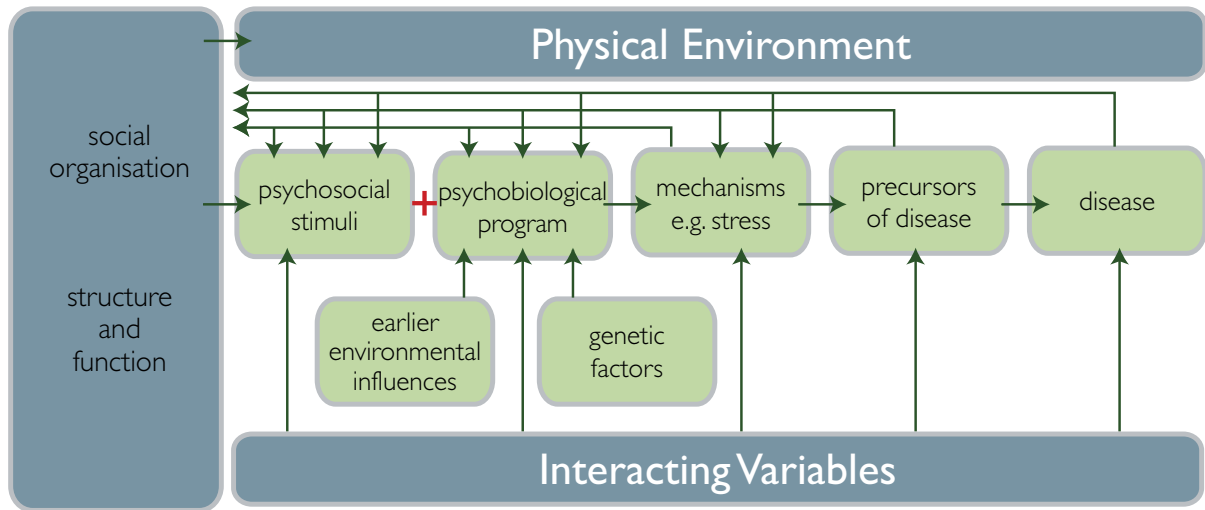
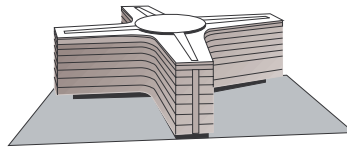
Küller⁴⁸ refers to a well-known colour study from 1958 in which researchers conducted different physiological tests to investigate the brain's activity during exposure to different colours. When the participants were exposed to the colour red, their brain activity increased more than when exposed to the colour blue. The results showed differences in blood pressure, breathing, and blinking frequencies (ibid.).

Goldstein⁴⁹ calls attention to an important viewpoint, which asserts that the individual's former experiences can affect their emotions, actions and behaviour, dependent on what colour they are exposed to. There are also geographical, cultural and historical factors that can affect a person's colour choice; some colours have religious meaning (ibid.). Berlyne⁵⁰ and Janssen⁴⁷ highlight that the colour should suit the contextual environment and it is important that colour activation be well balanced to fit the environment.

In his book "The Language of Space"⁴³, Lawson considers that space is both that which separates people from one another and that which bonds them together. It is the architecture, with its buildings, rooms, surfaces, dormitories and facilities, that create the prerequisites for individuals to cooperate, work in privacy, create relationships and fulfill their general social, psychological and physiological needs (ibid.).

According to Vischer⁵¹, the organisation's image and identity are viewed and expressed

Theory Model for Psychosocially Meditated Disease



through the architectural facilities. Vischer⁵¹ also maintains that the employee's working identity and role are associated with the working environment and therefore the architectural design partly forms the employee's identity.

Furthermore, the physical work environment's design has a pronounced effect on worker performance and in the long run affects the organisation's productivity.

Physical, psychological and functional comfort can have positive outcomes on employee performance and morale (ibid.).

Taylor⁵² uses the concept of therapeutic design. He maintains that a well-designed physical environment within the hospital can positively affect the rehabilitation process. An inviting lobby or reception area may decrease anxiety (ibid.)

Edvardsson's research⁵³ showed that healthcare environments that are welcoming, inviting, enriched by beautiful objects and that create space for social meetings, affect patients by making them more receptive to rehabilitation. The research also showed that it was easier for patients, visitors, relatives

and personnel to relax, follow their own rhythm and feel secure and safe in these kinds of settings.

Other factors for wellbeing are, according to Dilani^{54,55}, landmarks in buildings. These landmarks are closely related to the perception of stress⁵⁴ seeing as these landmarks can serve as reference points in the buildings for easy orientation and creating our cognitive maps of the environment⁵⁵. These landmarks could be objects such as sculptures, paintings, aquarium or different colours in different rooms.



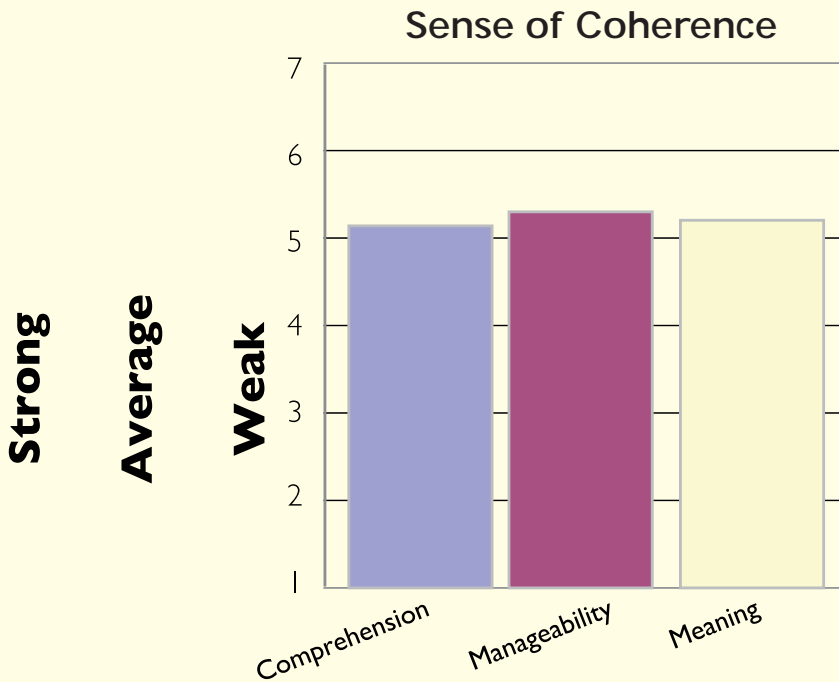
Research suggests that the sound of music can decrease stress and anxiety

Sound, music and health

The experience of sound is highly individual⁵⁶ and Kryter⁵⁷ describes that there are three variables that affect an individual's sound experience; volume, predictability and possibilities for control.

Studies have shown that noise can lead to physiological, psychological and social health consequences. Noise is a regular factor in the physical environment, which can contribute to stressful experiences⁴⁰ and irritation, which can lead to stress and cause stress related diseases⁵⁸.

Leather, Beale and Sullivan⁵⁹ have shown that noise can have a significant relation to working demands, where workers' perception of work stress decreases with lower noise levels. Leather et al.⁵⁹ explain that workers in a less noisy environment possibly need fewer coping strategies for adapting to the physical environment and



Measuring the Impact of the Environment on Health Outcomes

can therefore focus their energy and coping strategies on other stressful events. In that way, the physical auditory environment can be a vital factor in helping individuals cope with other stressors (ibid.).

Lang, Fouriaud and Jacquinet-Salord⁶⁰ and Evans, Bullinger and Hygge⁶¹ proved that noise can increase an individual's blood pressure, and other researchers⁶² showed that noise can increase cortisol levels. Research has also shown that noise can negatively influence the healing process⁶³. Noise can contribute to mental exhaustion, which in turn can affect the amount of medication that a patient takes^{64, 65}. Investigations have also established the connections between noise, irritation and lack of concentration⁵⁸. Finally, other studies indicate that the perception of life quality decreases in a noisy environment⁶¹ and that high noise levels can also inhibit social interaction⁶⁶.

There are sounds that promote health and Lai, Chen, Chang, Hseih, Huang, Chang and Peng⁶⁷ maintain that music can promote health, since it may contribute to a decreased activation in the sympathetic nervous system. Music may also lead to lower heart and breathing frequencies, and increase body temperature (ibid.). Lee, Chung, Chan and Chan⁶⁸ conclude

that music can be an efficient method for decreasing negative physiological affects when people are suffering from anxiety and stress. Music, or music in combination with therapeutic treatment, can improve a patient's rehabilitation process⁶⁹. McCaffrey and Good⁷⁰ showed that patients who listened to music after surgery experienced less pain, anxiety and fear than those who did not. The patients claimed that, instead of being frustrated over pain and fear, music helped them to focus on healing, (ibid.).

In her research, Spychiger⁷¹ showed that music lessons in school had emotional, social and cognitive effects and that the pupils with more music education cooperated better than the control groups. The atmosphere was better and motivation for learning was stronger (ibid.).

Art, health and wellbeing

According to art historians, humans live nowadays in a more aesthetic world, where art, fashion and design offer countless aesthetic experiences⁷². When a person observes and appreciates different visual scenes, such as a piece of art, complex cognitive and emotional processes arise⁷³.

In order to understand the meaning of a painting one often has to understand its

different parts before one can understand the whole. During the observation of a painting and in the process of understanding it, a person can, for example, experience joy, participation, discomfort or interest. These emotional and cognitive responses are called aesthetic experiences (ibid.) and, according to Leder et al⁷², often lead to positive, satisfying and rewarding experiences for the viewer.

According to Kreitler and Kreitler⁷⁴, art psychology is an empirical, scientific discipline that focuses on a person's internal and external behaviour and how they are related to art. They believe that psychological models regarding art perception should be based on the homeostatic behaviour model, which suggests that there is an optimal physical condition in which humans strive to reach the balance between tensions and relief. This condition of tension and relief can explain some parts of the individual's relationship to art, and that the art experience can help the person to restore the homeostatic balance (ibid.).

The physical environment and productivity

When a company's management wants to increase productivity, they often focus on employee competence and personal motivation rather than on the physical environment and design¹⁴. In his study, Herzberg⁷⁵ observed the employee's motivation and the relationship between workers' behaviour and the physical environment. When the physical environment is perceived as disturbing, it can negatively affect the employee's motivation and thereby productivity. Herzberg emphasised that it is necessary to have access to a physically supportive environment, which can contribute to the employee's motivation (ibid.).

Maslows⁷⁶ theory of motivation is one of the most well-known theories related to human need and motivation: it was developed to analyse and explain the social environment, but it can be applicable to the physical environment¹⁴. For instance, the need for safety can be achieved through designed environments that allow people to have a good visual overview (ibid.). If humans are not stimulated by their surroundings, they can easily lose interest and this can result in reduced performance⁴³. On the other hand, too much stimulation can lead to stress,

since a person may not have the capability to deal with the stimulation (ibid.).

Increased knowledge and consciousness about the relationship between improved health and increased profitability would affect how designers, architects and managers design, build and maintain buildings⁷⁷. For instance, improved indoor climate could improve employees' health, decrease the number of sick days, reduce healthcare needs and increase productivity, which in turn strengthens the humane capital and leads to higher company profitability. Ergonomic improvement for the employees has also been proven to increase a company's profitability (ibid.).

For instance, IBM invested \$186,000 in ergonomic education and implemented extended ergonomic changes, whereby they changed the design of the workplace and different working tools⁷⁸. The improvements contributed to better working positions, improved illumination, lower noise levels and better support with heavy work routines. The project decreased sick days by 19%, which generated a profit of \$68,000 per year. In addition, the changes contributed to higher productivity and improved quality, which lead to a profit of \$7,400,000 per year. In other words, investments and changes within the physical environment lead to profits through an increase in health conditions and productivity (ibid.).

Research in the field of health is still primarily focused on risk and prevention of diseases – a pathogenic approach – rather than applying the salutogenic perspective that focuses on factors that promote and strengthen individual health and wellbeing. A new research field, which focuses on the relationship between different factors in the physical environment and positive health promoting factors, should be developed. Knowledge of which environment factors contribute to health and wellbeing can thereafter be guidelines in making subsequent political decisions.

It is also important to have an interdisciplinary perspective where different individuals with different backgrounds and knowledge work together in this field – people like psychologists, architects, landscape architects, doctors, behavioural scientists, health promoters and so on.

The salutogenic approach provides a basic theoretical framework for psychosocially



Residents enjoying a sun-drenched courtyard at Colliers Gardens in Bristol, designed by Penoyre & Prasad. Designing places for restoration and relaxation help to support our health and wellbeing (Pic: Tim Crocker)

supportive design, which can promote health and wellbeing.

Psychosocially supportive design should incorporate and consider factors such as access to symbolic and spiritual elements; access to art; good lighting; attractive space for social interactions; private spaces; and an interior environment that provides positive experiences. Other factors include visual and physical access to nature, and personal control over, for example, lighting, daylight, sound, indoor temperature and contact with other people.

These factors can stimulate, engage and improve a person's sense of coherence, thereby enhancing his or her coping strategies and health. Psychosocially supportive design is not only the task for one person, but requires that the entire organisation understands the meaning of salutary management.

A new health paradigm

In summary, one of our intentions with this article was to shed light on factors in the physical environment that could promote health, wellbeing and increase an organisation's productivity and profitability.

There is a need to systematically conduct more empirical studies that investigate and verify the salutogenic model and identify a

range of wellness factors in psychosocially supportive design.

The study encourages decision-makers to implement psychosocially supportive design that in turn promotes health and wellbeing. It is time to step into the new millennium where the salutogenic approach and psychosocially supportive design lead the way for a new paradigm. Finally, it is necessary to understand Winston Churchill's quotation – "We shape our buildings, then they shape us" – which states the buildings we design have a significant impact on human behaviour.

Author biography

Alan Dilani is the founder and general director of the International Academy for Design and Health. His research at the Karolinska Institutet Department of Learning, Informatics, Management and Ethics (LIME) is based on a multidisciplinary approach, leading to a new definition of design that not only fosters functional efficiency, but also improves health processes.

References

This research is supported by a large number of references, which we are unfortunately unable to publish here for space considerations. For a downloadable copy of this paper with a full list of references, please visit: www.designandhealth.com

Process management: Bridging the Gap Between Research and Design

First there was evidence-based medicine – and now evidence-based design applies the same empirical approach to buildings. How are scientific methods being used to guide design decisions?

Jacqueline C. Vischer; John Zeisel

Evidence-based design (EBD) has taken over the imagination of the design community. Conferences and seminars in the UK and in North America increasingly include papers on what it is, how it's done and why it's needed.

Evidence-based design is built on the precedent of evidence-based medicine – that is, relying on up-to-date published research results to make diagnostic and treatment decisions. In part because of its medical roots, EBD has found favour among healthcare designers and architects, especially in North America. In the UK, the concept is being applied more broadly: to housing and new community planning, to crime prevention through environmental design, and to schools and offices¹.

Traditionally, the link between research into building design and use and the practical world of design and construction lies in a cluster of pre-design activities known as programming or briefing and post-occupancy evaluation (POE). The time-honoured POE approach identifies studies of existing building use and performance as a prerequisite to new building design. Study findings on how users function in the spaces provided, and also on how a building performs in terms of its systems and operation, provide a basis for new building design. Pre-design programming gathers information about users' needs from available POE studies and other research, and synthesises this information into both broad and generic, and targeted and specific sets of design guidelines and prescriptions to which the design team refers throughout the building design process². The goal of this process is to learn from previous projects and to apply this learning to new projects, in a context of continuous improvement.

In reality, this neat link between post-occupancy research and design often has more of a hit-or-miss character. The often

voluminous results of POE studies commonly lie unread on researchers' shelves, or are published in academic journals infrequently consulted by practitioners. Moreover, pre-design programming frequently takes the form of a rapid summary of square footage requirements and projected growth in numbers of users, thus allowing each design team to reinvent the wheel, or, more commonly, to reuse ideas they have developed on their previous projects³. One challenge the EBD approach seems prepared to take up is whether or not an EBD process can replace the typical hit-or-miss application of POE and programming with systematic acquisition of relevant information about building use and users' requirements that is easily and usefully applied to new design.

Defining evidence-based design

Definitions of EBD include:

"The conscientious and judicious use of current best evidence related to the physical environment's effects on wellbeing, and its critical interpretation, to make significant

design decisions based on sound hypotheses (concepts) related to measurable outcomes, for each unique project."⁴

And, more simply:

"The use of scientific method to guide design decisions based on empirical knowledge."⁵

Attempts have also been made to set priorities on what 'evidence' means. It is useful to set priorities on what can be considered evidence:

1. Strong evidence based on independently verified data;
2. Evidence based on weaker data;
3. Evidence from respected authorities based on available data."⁶

Evidence-based medicine

These definitions, and indeed the whole notion of EBD, are based on a widely respected approach to medical research known as evidence-based medicine (EBM). EBM lightens the decision-making burden on medical professionals by using research to inform medical decisions. Studies of medical



Daylight penetration enhances wellbeing at the new Bexley Wing, St James Institute of Oncology in Leeds, designed by Anshen + Allen (Pic: Nick Kane)

and surgical procedures, their difficulties and their likely outcomes; of treatments such as pharmaceutical products and doses; and of new medical technology and tools, help practitioners to make the best possible diagnosis and select the best treatment.

By referring to the ongoing accumulation of published evidence, a medical professional treats a patient's condition by using up-to-date objective facts (rather than relying on previously acquired knowledge), as well as their hunches and convictions resulting from experience. For example, although it may seem obvious that inserting feeding tubes in elderly patients prolongs life, evidence from research has shown that feeding tubes increase infection, and do not in fact prolong life. In theory, the same evidence is available to others involved in treating the patient and even to the patients themselves.

Increasingly, doctors choose to explain to their patients the evidential basis for their decisions – something immediate access to electronic databases makes possible. Responsibility for an important medical decision is thereby shared between provider and consumer of medical treatments. Moreover, it has been demonstrated that the opportunity for a patient to participate in his or her own care increases the likelihood of a positive medical outcome. Similarly, then, using EBD to support architectural and planning decisions by design professionals provides an opportunity to building users and other consumers of design services to participate in design decision-making. And studies have indicated that in buildings, as in medicine, informed and engaged users have a more positive experience of the built environment they occupy⁷.

The users' perspective

Basing important decisions on research results rather than on experience, intuition and creativity – whether in medicine or in design – has an effect on the political role of the professional and on the balance of power between providers and consumers of specialised services.

Employing EBD equalises an unequal relationship in the building industry just as it does in modern medicine. Just as the patient has a more important role to play in a medical situation where the doctor shares 'evidence' in order to engage the patient in decisions, the architect has an opportunity to enlarge the role of the building's users and



EBD principles employed in the street design at the new Royal Children's Hospital, Melbourne (pp 20-23)

to incorporate their previous experience into key design decisions.

In order to realise its full potential, EBD research incorporates evidence from and about users to make specific design decisions. Moreover, the availability of objective information shifts the balance of decision-making power, thereby affecting the outcome of a design and construction project. Professionals who want to continue doing things the same old way will find it difficult to defend this stance with up-to-date research results. Just as doctors take the Hippocratic oath to do no harm, designers and builders who create our environment have a new opportunity to use EBD research not only to protect building users and to do them no harm, but in fact to improve and enhance their environmental experience.

The relationship with POE

This emphasis on the building users' experience raises the question of whether or not the evidence-based approach to design has supplanted or replaced post-occupancy evaluation (POE) as the way of using data on or about users to inform design. We would argue that EBD and POE remain two related, but distinct, pre-design activities. First, responsibility for EBD is located in the design process, whereas POEs are considered to be research. Whereas an EBD approach seems by definition to support a high-quality design outcome, POE has

tended to focus on questioning the design quality of existing projects. The term post-occupancy evaluation has always suffered from the judgemental approach implied by the term 'evaluation': the performance of all professionals in a design and construction project risks being 'evaluated' by POE. This possibility discourages stakeholders from engaging in POE – not simply an evidence-gathering exercise aimed at increasing knowledge about what works and what does not work, but also a judgement on how well the building delivery team performed.

In contrast, EBD contains no mention of evaluation or judgements. It is by definition scientific; it employs approved scientific methods of gathering data. According to labelling theory in social science, something's name affects how it is viewed and used. Even if EBD were merely a semantic shift, it may turn out to be an important one, because it changes how designers, owners, and users view and use POE.

As mentioned above, post-occupancy studies tend to limit their data-gathering to the opinions of building occupants – a limited definition of building users – and to whether occupants like or dislike ("are satisfied with") identified features of a building – a limited definition of how the built environment affects people. Evidence-based research draws on a broader base of stakeholders than simply the occupants of the building at a specific time, and focuses on a range of



Spacious, curved corridors at the Intermountain Medical Centre, Utah (Pic: John Linden and Cesar Rubio)

in a form that makes it relevant to the decisions that are facing them. This shift in EBD decision-making itself 'bridges the gap'.

Conflict with creativity

As the building design professions shift to a more rational and research-based approach to design, professionals are likely to be less prone to avoid acquiring knowledge that could inform design decisions than they have been in the past. Architects in particular have tended to express concern that taking a rational approach to design may limit their creativity and ability to have new ideas, that having 'too much information' could reduce or even eliminate their ability to find 'artistic' solutions to design problems. (In a question-and-answer session at the 2006 Annual General Meeting of the Society for Neuroscience, architect Frank Gehry stated that too much neuroscientific knowledge about people and their responses to buildings would limit his creativity.)

One of the positive impacts of the EBD approach is that it is based on the assumption that more and better information and knowledge will *ipso facto* improve the design of buildings, and that the value of informed design decision-making not only supports design creativity but – with so much more information available – trying to do without it is both foolish and dangerous. It is no longer considered the action of a responsible professional to embark on a building design project without paying attention to what is known about the impact of previous, related design decisions on human behaviour. As building-related research expands, building clients, regulatory bodies, and building users will increasingly expect design professionals to access the growing multidisciplinary knowledge base not only on how building users are affected by features of their environment, but also how to combine what we know about building user psychology and behaviour with the innovative features of buildings that have been certified by green ratings systems such as LEED, Green Star and BREAM.

Recent research

At a recent conference in North America, the range of EBD research reported included a study focusing on systemic problems in how emergency healthcare facilities are designed and operated, in order to identify ways of enabling hospital staff to avoid mistakes and

measurable performance outcomes (such as energy use, health-enhancing qualities and functionality) that supports user activities. EBD can add to and enhance traditional POE activities, and make pre-design programming a more precise science.

A well-documented problem in POE research is the difficulty of finding a simple way to communicate POE results to building professionals in a form that they can use. Making research results relevant to design is fraught with both logical and practical pitfalls. The language of research – more or less support for a hypothesis, probability of a significant relationship, strengths and weaknesses of the methodology selected – is foreign to the world of building design and construction. Furthermore, all building decisions are made under pressure (time, money, politics, or all three), so it is not possible to make a tentative decision based on the probability of a desired outcome. A decision is a commitment, and it ends up in three-dimensional form: it is built. Techniques and tools for knowledge transfer – from the theory-based, exploratory and analytic world of research to the practical, deterministic and real-time world of constructing buildings – still need to be developed.

Bridging the gap

A significant advantage of the EBD approach is that building industry professionals can focus and direct research to the issues that

they have identified as needing evidence. In other words, each design team is in theory responsible for identifying one or more project-related research topics. Designers need access to databanks of research results that cover issues likely to arise during project design and construction, much as the medical professional will review published evidence on their current patients' conditions. These data repositories are not limited to feedback from building occupants, but ideally should include information about materials selection and performance, construction technology and management, cost containment and risk control, and other areas of knowledge that are key to building successful buildings.

New thinking about EBD is focusing on mechanisms and strategies that enable and facilitate this intimate relationship between research and design, obviating the need for what was a burden on the former POE researcher: to find a way of 'dressing up' research results and making them attractive to, and accessible and useable by, design professionals. This was always called 'bridging the gap' – ie, the gap that exists between design and research. The EBD approach requires the design professional to define the research in terms that are relevant to the practitioner's project. So although they may not design the research – this is the researcher's area of expertise – they drive the style of applied research projects that seem likely to yield useful new knowledge

of increasing the effectiveness and efficiency of their time⁹. In another example, studies of the impact of improperly performing ventilation systems on illness, discomfort and stress are summarised to indicate ways of improving indoor air quality in a wide variety of building types⁹. A third study examines a range of methodological approaches in order to demonstrate the close relationship between the way a research hypothesis is formulated and the selection of the appropriate data collection method to test it¹⁰. Examples given include a comparative analysis of various configurations of nursing station designs on nursing outcomes such as time with patients, amount of walking, and accessibility of medications and equipment, measuring the relative proximity of hand-washing facilities to patient care areas and the effect on staff hand-washing behaviour, and assessing the impact of available family sleeping areas and family furniture on families' perceptions of family-centred care.

Studies like these, which have informed or could inform critical healthcare design decisions, illuminate the enormous potential for implementing a programme of EBD studies that can inform hospital design decisions. A similar richness of studies awaits design researchers in other areas – workspace design, for example. Much of the research in this rapidly growing field of study has responded to critical issues that have arisen in the commercial real estate industry. These include, but are not limited to, sick building syndrome and indoor air pollution in the 1970s and 1980s, thermal comfort and

temperature control as well as ergonomic workspace and management of repetitive strain injuries in the 1990s, broadening out in the current decade to managing noise and distractions in workspace with smaller and more open workstations¹¹.

Our research on how office occupants assess a range of environmental conditions has generated a large amount of evidence on both supportive and non-supportive elements of workspace design. Part of the evidence indicates when and how these affect worker behaviour (task performance, communication with co-workers and employee retention) and worker mood (wellbeing, satisfaction and engagement)¹².

Another useful topic for EBD in workspace planning is the optimal balance between individual workspace (offices or workstations, concentration rooms, places to work alone) and shared or communal facilities (meeting rooms, workrooms, coffee rooms and lounges, places that facilitate collaboration). Studies to date indicate that systematic analysis of the tasks people are performing and the environmental requirements for the types of work they are doing provide a solid basis for this key design decision in most instances¹³.

EBD research and Alzheimer's

Our environment-behaviour model for Alzheimer's design is also based on data from multi-site studies in which the correlations between specific design characteristics and behavioural health outcomes were measured¹⁴. Outcome behaviours or

symptoms measured in residents of Alzheimer's units include social withdrawal, agitation, aggression, depression and psychotic symptoms such as hallucinations¹⁵. Research findings clearly indicate fewer symptoms in more appropriately designed environments: anxiety and aggression are reduced where there is greater privacy and personalisation of bedrooms; social withdrawal is reduced in settings with not more than four communal spaces, each of which has a unique design character that helps residents orient themselves and make choices. There is a lower incidence of depression when exits are camouflaged using less visible electronic locks instead of alarms.

Another key symptom of dementia, which takes up staff time and disrupts the community, is physical agitation. Whereas agitated behaviours do not appear to be affected by environmental design characteristics, verbal and physical agitation taken together are less present in settings that are more residential than institutional. Verbal agitation is reduced in settings where residents understand more of the sensory input they receive, and where sensory stimuli are controlled; and there were fewer psychotic symptoms in environments with more opportunities for privacy and for personalisation, and where residents could understand their sensory environment.

We conclude these outcomes are related to the neuroscience of Alzheimer's and environmental awareness¹⁶. Neuroscience and architecture is a fast-growing area of research in which links can be identified between the physical features of a building and the mental, emotional and behavioural effects on users, and is likely to have implications for future EBD research¹⁷.

Information versus evidence

One of the ways the European approach differs from the North American approach to EBD is the definition of 'evidence'. In North American design circles, 'research' for a design project such as a hospital or office typically ranges from studying examples published in the architectural magazines, to visiting a recently completed project and looking around to see how it looks, perhaps asking a few people working there what they think of it, to systematically interviewing building users and applying the results to an architectural programme or brief, to performing or commissioning a full-scale



Design decisions at The Children's Hospital, Denver were based on patient and staff consultation (pp24-25)

POE using social science research¹⁸.

The EBD approach represents an advance on this loose definition of how much knowledge is needed to gather sufficient evidence to build successful projects. At a recent seminar in the UK, specific initiatives – including government incentive programs and investment in innovation to increase urban regeneration and sustainability; a framework for acquiring, assessing and various ways of applying evidence in the workplace and schools; and managing building-related pathology such as offgassing materials that cause asthma – were all described as examples of evidence-based design research. On both sides of the Atlantic, the EBD approach emphasises that researched evidence must be reliable and acquired using rigour, certainty and validity. The evidence needed for EBD application has a hard edge to it that the casual POE approach does not.

Evidence is not knowledge: design professionals need a reflexive practice to turn information into knowledge¹⁹. But evidence from research goes beyond informed opinion – it is predicated on proof. Therefore hypotheses must be identified and tested in order for designers to claim they are using an EBD approach. Casual user feedback is not a substitute for validating a relationship between users and built space.

Progressing from POE to EBD is a natural evolution of those professions concerned with creating the built environment. Basing design decisions on research evidence lends a scientific case to professional design, eventually having a positive effect on clients' opinions of their designers (and on clients' willingness to pay for professional design services) in much the same way as other professions such as medicine and law are



Human-centric patient environments: St Mary's Medical Centre in Tennessee, designed by HDR Architects

respected in our culture. As this proof – or evidence – accumulates, it must be stored and maintained for easy access and retrieval in the context of project applications, much as legal decisions and opinions are stored for legal practice and as medical practitioners in clinical practice now have EBM data electronically available.

EBD alters the definition of design from a function of individual creativity to a process of creatively applying rules of evidence to building decision-making. This increase in respectability goes hand-in-hand with greater responsibility – for example, to demonstrate conclusively that the physical environment of hospitals and seniors' residences is a form of treatment in healthcare, or that the physical environment of the workplace is a tool for performing work.

As designers employing EBD increasingly are able to influence such outcomes, they take on an even greater responsibility: the responsibility not to look the other way

when evidence relevant to a design decision is presented, and not to make purely intuitive design decisions when EBD data are available. Designers, design researchers and their clients can now make all their decisions count. We should not miss this opportunity.

Author biography

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John Zeisel is president of Hearthstone Alzheimer Care and visiting professor at the University of Salford. He lectures internationally on non-pharmacological approaches to treating Alzheimer's disease, and his new book *I'm Still Here: a Breakthrough Approach to Understanding Someone Living with Alzheimer's* is scheduled for publication in late 2008.

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The cardiovascular room at Catharina Hospital in Eindhoven – the first one in the world designed using Ambient Experience

Lighting Design: Creating a Less Intimidating Hospital Experience

Light isn't just for seeing what's in front of us – it provokes an emotional response, too. Research from the Netherlands explores how lighting can reduce patient anxiety and increase staff wellbeing.

Sjef Cornelissen; Martine Knoop

In the design of healthcare facilities, medical professionals and architects are increasingly realising the importance of creating a 'healing environment' that addresses the totality of patient and staff needs. This more holistic approach is driven by the recognition that a patient's perception of the physical environment in a hospital can affect his or her sense of wellbeing and, potentially, health. In an effort to create this environment in modern hospitals, considerable attention is paid to detail, colour, form, light and shade. Factors such as fresh air, light and peaceful surroundings are key design drivers. From a lighting design point of view, two developments offer new possibilities for using lighting to address wellbeing in hospital areas: the advent of LED technology, and new advances in the understanding of the non-image-forming

(NIF), or biological, effects of light.

In the past, lighting designs focused primarily on the visual aspects of light. The main purpose of lighting was to enable people to see. A large number of lighting parameters played an important role and requirements were application- and task-dependent. The visual aspects of light have a significant effect on our performance in a given environment. For example, light must be bright enough to facilitate performance of the visual tasks, but if the brightness is too high, it can cause glare. The colour-rendering of the light is also important, especially for the purpose of examining patients. Light can increase visual performance, and with that, enhance work performance^{1,2}.

In the early 1980s, designers started to realise the importance of the emotional component of light, and this knowledge was applied in shops and offices as well as healthcare premises. Light affects how

a person feels, and so artificial lighting has a role to play in improving healthcare by creating a relaxed or uplifting ambience.

The biological effects of light

Over the last two decades, it has become clear that light has a non-image-forming, or biological, effect as well. Light that reaches the retina is not solely processed by the cones and rods, but also by intrinsically photosensitive retinal ganglion cells. From these cells, signals are sent to the suprachiasmatic nucleus (SCN) of the hypothalamus, our main body clock. From the SCN, information is sent to the pineal gland, where the information is used for the production of hormones and the regulation of body temperature. An increase in alertness due to higher colour temperatures or higher light levels is a typical example of these biological effects: the reduction of sleepiness helps, for example, to combat the 'morning blues' or

Office

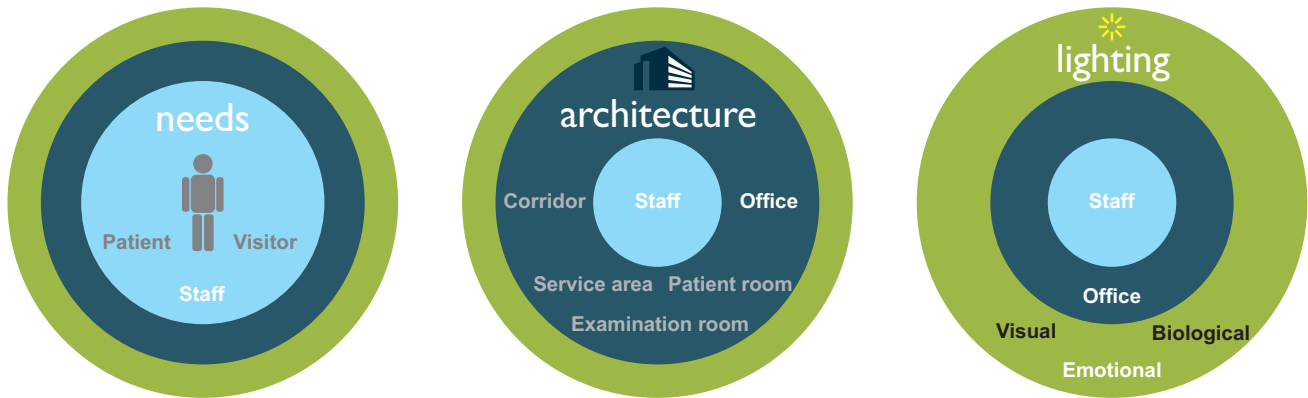


Figure 1: Office lighting is staff-centric, with an emphasis on the visual and biological aspects of light...

the 'after-lunch dip'. Lighting can also be used to suppress melatonin at night and cause a phase shift of the circadian rhythm, which is of particular interest to people working night-shifts. Consequently, light can support our wellbeing from a non-visual, biological, point of view^{3,4}.

Lighting solutions, and lighting installations for healing environments in particular, should take into account all three aspects of light – visual, emotional and biological. The right balance depends on the function of the space and the activities that are performed. This approach is reflected in human-centric lighting design solutions. A dynamic lighting solution for a patient room, for example, allows the colour and temperature levels to be changed according to the time of day. The lighting can be controlled (automatically or individually by staff and patients) according to their requirements at the time. This solution utilises certain characteristics of natural light, thus putting patients and visitors at ease (emotional), helping healthcare professionals to perform in a more relaxed and effective way (visual), and increasing the quality of sleep for patients (biological). Special consideration is usually given to one of the lighting aspects: visual, emotional or biological, depending on the application (Figures 1 and 2). Within a specific application, the focus of the lighting design solution may need to shift, if different tasks are being performed in the space.

The biological and visual aspects are important in functional areas, such as offices. In examination and waiting rooms, the emotional aspects may play a more important role, thereby establishing the main focus of this research: how can we create less intimidating hospital ambiances with lighting?

Responses to coloured light

Thanks to the advent of LEDs, coloured light is easier to use today, and coloured lighting solutions – fluorescent or LED – are increasingly popular. New, more sophisticated lighting control systems have made it easier to use dynamic coloured lighting. If designed well, coloured light can be used effectively to influence emotion, mood and wellbeing.

We experience colour on a conscious level, but also on a subconscious level, as categorised in Frank H. Mahnke's 'colour experience' pyramid, which describes the effects of coloured lighting on mood and wellbeing. These effects range from conscious, personal and temporary to more subconscious, biological and long-term.

If the application of colour is not based on aesthetic impressions, it is the influence of trends, styles and associations that form the basis for colour selection. Every colour has its own properties that can evoke emotions. There are, for example, some universally valid colour associations. Warm colours such as red, orange and yellow are associated with sun and fire. Red is seen as an activating colour. Cool colours such as blue and violet, are associated with air, sky and water, while green tends to be associated with nature. Blue is described as having a calming effect.

Our emotional response to colour is a response that is triggered immediately. A colour is perceived and the impression, association, response is formed. But colour has a long-term effect as well. It is a form of energy, a bandwidth of wavelengths. When it is experienced for a longer period of time – minutes, hours or days – this energy affects bodily functions, like brain activity and the production of hormones, just as it influences our mood and emotions⁵. It is assumed that pulse, heartbeat, blood pressure, EEG

or galvanic skin response are physiological indices for the level of arousal – one of the biological responses to light. Literature indicates, with anecdotal evidence, that blood pressure rises and pulse quickens in red light. Red also makes body temperature rise, and people experience a feeling of warmth. It stimulates the nervous system.

Furthermore, it has been suggested that blue rooms have a calming effect on the senses, helping people to calm down, and boosting a person's ability to concentrate. Previous research^{6,7,8} worked specifically with coloured light, and showed that light of a long wavelength generates a high level of arousal and light of a short wavelength induces a low level of arousal. In the experiments carried out by Swirnof, in which highly saturated colours were used, the red room was perceived as aggressive and the dark blue room was found to calm the senses. Other research⁹ supports the claim that blue light can be used to induce physiological rest, but it does not support the idea that red light has a stimulating effect, and still further research¹⁰ failed to reproduce any of the effects of coloured light on physiological indices. In one experiment¹¹, blood pressure increased with blue light and decreased under red light. A number of aspects could be the cause of this discrepancy¹².

Prolonged exposure to colour

At present, the results with respect to the non-visual effects are inconclusive, and exposure to a light of a specific colour over a longer time period is not advised. The following aspect backs this up. In a US Marine correctional facility in Seattle, the walls of a lock-up for men who had been arrested (and were often aggressive) were painted a precise hue of pink. After

Scanner room

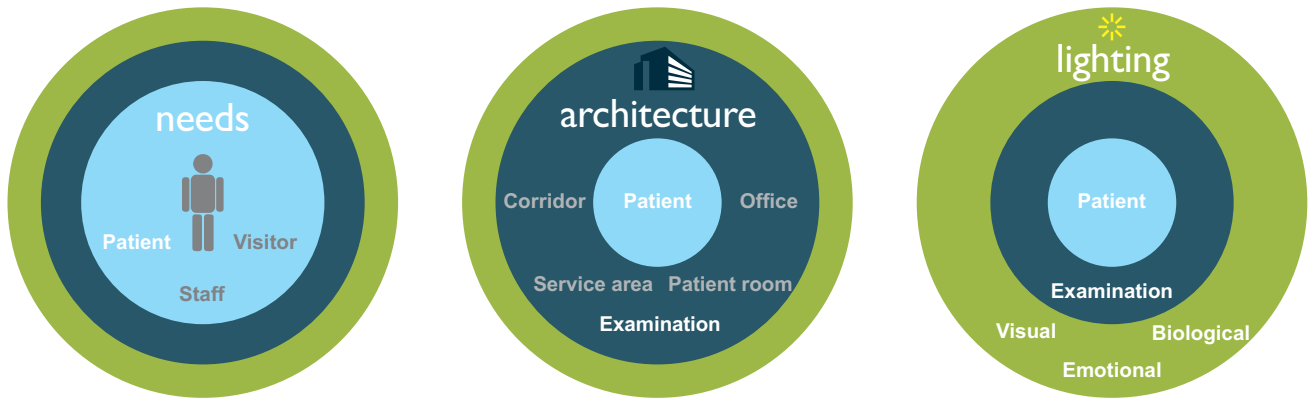


Figure 2: ...while lighting for scanner rooms is more patient-focused, with greater need for 'emotional' lighting

Lighting design focus

		Visual lighting	Emotional lighting	Biological lighting
Clinical functions	Operation room	Blue	Diagonal lines	Grey
	Intensive care	Blue	Diagonal lines	Grey
	Examination room	Blue	White	Grey
	Scanner room	Blue	White	Grey
Hotel functions	Entrance hall (Not the counters)	Diagonal lines	Blue	Grey
	Corridor	White	Blue	Grey
	Patient room	White	Blue	Grey
	Waiting room	Diagonal lines	Blue	Grey
Office functions	Staff room	White	Diagonal lines	Blue
	Staff office	White	Diagonal lines	Blue
	Meeting room	White	White	Blue
	Relax room	Grey	Diagonal lines	Blue

Main focus (first priority)
 Main focus
 Minor focus
 No focus

Above: Certain types of lighting should carry more weight, depending on the function of each area

patient. For instance, a few seconds of red light might indicate to the patient to hold their breath, and green light could tell them to continue breathing again. This reduces communication barriers, especially for those who are emotionally distressed, hard of hearing and/or speak a foreign language.

- Coloured light to underline a specific theme: if the decor of the space is based on a specific theme (summer, winter, spring or autumn, underwater, sky) they can be enhanced by choosing the right light colours. For a summer theme, bright and warm light colours such as red, orange and yellow can be used. For a winter theme, cool colours such as blue, green and purple are better.

- Coloured light for emotional association: colour can evoke emotions, and thus create an emotional state of mind. Some colour associations that are universally valid can be identified: red and orange are generally assumed to suggest warmth and cosiness; blue is considered cooler and more cheerless; a wild mixture of colours suggests cheerful and festive; and purple is thought to evoke a sad, sombre atmosphere. Other colours can trigger specific associations, so green might be associated with rest, and white with sterility.

the colour change, disturbances in the cell virtually ceased. Despite these powerful effects in the beginning, there is anecdotal evidence that these reactions are short term. Once the body returns to a state of equilibrium, a person may regress to an even more agitated state. The way an individual responds to a colour can change over time. Prolonged exposure will result in over-saturation and under-stimulation. The body will then attempt to rebalance, and the opposite effect will be achieved, in most cases with increased intensity⁵.

Using coloured light in scan rooms

Taking into consideration the ambiguity of biological responses to coloured light, the use of coloured light in scan rooms will focus on the emotional responses of the patients. We split the use of (variable) coloured light in scan rooms into the three scenarios, all based on the symbolic content of colour:

- Coloured light to communicate signals: because in an MR room the staff and the patient are in different rooms for a large percentage of the procedure, coloured light signals can be used to communicate with the

Individual experience

Any of the affective responses to coloured light are to some extent determined by our own individual experiences. It is, therefore, hard to determine in general the emotional value that is attached to a particular colour of light. Colour association can, for instance, be affected by traumatic experiences or determined by factors like education, social class, family values or cultural differences⁵.

A colour will trigger an immediate reaction, but the required effect could change from the



Above left: Ambient Experience makes hospitals seem less intimidating. Above right: a 'sea' colour theme in the scan room

required emotional effect to an undefined biological effect. Furthermore, the absence of a changing stimulus over time will lead to under-stimulation or sensory deprivation. An environment must, therefore, be neither too dull nor too stimulating. When colours are used, the levels of brightness, colour temperature, hue or saturation need to be varied. It is only with continuous variation and individual control of the lighting that the desired emotional effects can be achieved. In this case, biological responses are not addressed, sensory deprivation does not occur and personal preferences and responses can be taken into consideration. This forms the basis for strategies like AmbiScene and Ambient Experience.

AmbiScene

AmbiScene is a lighting concept that enables the creation of spaces with dynamic lighting. Lighting can change in a number of ways – in colour, contrast, tones of white light, direction or intensity. Variation in these lighting elements makes it possible to create inspiring and meaningful experiences. The scenarios used in AmbiScene focus on 'emotional associations' and 'light to communicate signals'. Variable coloured light can be used to create an ambience that relaxes patients during the medical examination. It can also help doctors and nurses to communicate with the patient: the doctor can give signals using a specific colour, to help improve communication with patients who are emotionally distressed, hard of hearing or speak a foreign language.

Ambient Experience

Ambient Experience is an interactive, human-centred healthcare environment that combines design and technology to create a more comfortable experience for patients and staff, improve workflow and increase operational effectiveness.

Integrating architecture, design and enabling technologies (dynamic coloured lighting, sound, projection, RFID), Ambient Experience creates environments that the patient can personalise, embracing them within a relaxing ambience.

Existing projects

Experience has shown that the best colours to use are the most relaxing and cheerful ones, such as blue, green, yellow and orange. It has also shown that pastel-coloured light (light blue, soft green, yellow, orange and violet) is appreciated more by adults, while saturated colours (blue, green, yellow and orange) are appreciated more by children. A number of projects have been completed, two of which are discussed below.

In 2006, the MR scanner room of the Marien Hospital in Hamburg was totally renovated. The lighting had to provide a comforting and less stressful atmosphere for patients during their medical examination. Experience shows that medical procedures like MR examinations often frighten patients. Research indicates that up to 37% of patients may experience fear and anxiety, and 5-10% of patients cannot complete the examination due to claustrophobia.¹³

An AmbiScene lighting solution was

installed. All luminaires and other lighting equipment are invisible, hidden behind the ceiling, so that only the effects of the lighting are experienced. Functional lighting is positioned in the ceiling, next to the examination table, to create optimum working conditions. Orientation lighting is installed in the ceiling and between the entrance door and the scanner to create guidance. The functional and orientation lighting is only switched on before and after the scanning process. Incandescent lamps (300 lux, Ra=100) are used to ensure maximum quality of the light colour. The ambient lighting illuminates three walls in different colours to create the dedicated ambiances. All electrical equipment is placed outside the room to ensure that it does not have an adverse effect on the scanner images and measurements.

All lighting can be switched easily by means of a touch screen and is pre-programmed in accordance with the examination process. Each patient can choose his or her favourite colours and these colours are then used throughout the entire examination.

More than 100 patients were interviewed about this new concept. Most of them said they found the coloured light soothing. It also made children less afraid. According to patients, the narrow tunnel of the scanner seems less intimidating and the examination room looks more friendly. Colour can also be changed manually during the scan to communicate signals. Experience in the Marien Hospital shows that this enables staff to explain procedures to patients who



Coloured lighting used in the waiting room (above left) and patient room (above right) has a positive attitude on patients' sense of wellbeing

cannot speak German or who have hearing difficulties. It also shows that the number of failures in the MR room fell down to 0.5% with AmbiScene.

In another project, the first cardiovascular room in the world based on Ambient Experience was installed in the Catharina Hospital in Eindhoven. This was carried out under the responsibility of Philips Healthcare in cooperation with Philips Design, Philips Lighting and Philips Applied Technologies.

Functional lighting was installed above the treatment table in the centre of the room, behind special opal covers, to create a regular pattern on the panels. They can create lighting effects in different colour tones, from warm white light (3000K) to cool white light (5500K).

The dynamic coloured lighting supports four themes, that patients can select, allowing them to personalise the room and engaging them as a partner in the procedure. Two components have been used for the coloured ambient lighting. First of all, a

cove all around the perimeter of the room with fluorescent lamps (RGB) offers wall illumination in all colours of the rainbow, including white light. Secondly, fibre ends were fixed in panels mounted between the luminaires for functional lighting, and these illuminate the opal panels from behind as well. Response from patients and staff has been positive. Staff say it is a pleasure to work in the scan room with Ambient Experience and they prefer this room to the other three interventional rooms in the hospital, which do not have the solution. The patients perceive the interventional room as bright, cheerful and relaxing.

Conclusions

Coloured light can be used to address the symbolic content of colour and to induce responses that are beneficial to the emotional state of mind of patients and the workflow in scanner rooms. Variation of the light and the facility for individual control are required to ensure that biological

responses are not addressed, that there is no sensory deprivation and that personal preferences and responses are accounted for. Completed projects show a reduction in the failure rate and feedback from staff and patients is positive.

Dynamic coloured light can be used to create less intimidating ambiances in interventional rooms, which has a positive effect on the attitude of the patient towards the interventional procedure and on working conditions for the staff.

Author biography

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Emotional response

Stepping outside the parameters of 'normal' architecture can be good for your health, decides Veronica Simpson after a visit to the Hayward Gallery's "Psycho Buildings" exhibition in London.

How do buildings make you feel? In an ideal world, every architect should be forced to imagine, visualise and empathise with the occupants of any building they design to ensure that, in every possible, practical way, they do not wittingly create spaces that dull or disappoint the senses. Even aside from the practicalities, there are usually too many trust managers, town planners, accountants, unit managers, and clients' aesthetic sensibilities to negotiate – to the point where such a goal may end up appearing ludicrously indulgent.

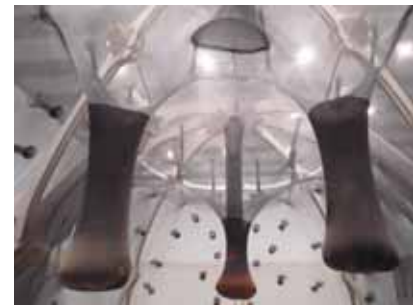
But every now and again it's worth visualising a world where budget constraints, inter-departmental pettiness, politics and even functionality have no place. It's just such a world that ten artists have conceived in "Psycho Buildings" at London's Hayward Gallery.

In this bold and visionary exhibition (commemorating the 40th anniversary of the iconic South Bank gallery space) the Hayward has asked ten international artists, whose work is architectural in tone and scale, to respond to the built environment and explore the effect on the viewer of the spaces around them.

Fantasy space

Ernesto Neto's pagoda of carved and slotted MDF 'legs' is the first exhibit you encounter, its form is sheathed in black nylon netting, like a cocoon woven by an enormous spider, or a surreal, domed and entirely un-weatherproof yurt. It evokes a sense of delight at the tactile nature of the nylon membrane, or the toy-like slotted legs – very much like the DIY plywood dinosaurs you can buy for children – and the delicious scent emanating from three huge, pendulous nylon sacs that dangle from its apex, packed with cloves, coffee beans and spices, looking very much as if the aforementioned spider had left them there to hatch.

This is a space that lends itself to play, to fantasy, or to quiet and contained contemplation – one in which you want to linger. The same cannot be said of the second gallery, a two-room installation up the spiral staircase that looks as if it has been gored by a rabid rhinoceros. The initial impact to the senses is one of horror: chunks of wood and plaster have been gouged out of the temporary plasterboard walls, at waist-height and below. With a creeping sense of desolation, the eye searches for clues as to the origins of this fearsome destruction. But the scene also conjures up an awesome neglect – not dissimilar to the communal corridors and stairways of the worst mass-housing projects or unloved institutions.



Top: Ernesto Neto's fantastical structure. Above: Gellitin's 'demented playground'



This piece, by British artist Mike Nelson, is entitled “To the Memory of HP Lovecraft” and is inspired by the works of the American science-fiction writer. It’s a place in which you are meant to feel the presence of some alien force, and as you look around, there are traces of uncanny activity: a frenzied network of scratches and scorings surrounds each of the holes, indicating much careful – or obsessive – crafting that sits oddly with the brutal and vigorous blows with which these holes were clearly made. Strange cone-shaped stacks of woodchips and splinters are piled randomly around the floor. Is it architecture, or simply interior as expressionist nightmare? Whatever your conclusion, its eerie resemblance to the kind of institutions you could conjure up in your worst nightmares – whether stinking Victorian asylum or unhygienic third-world hospital ward – lingers long after you’ve fled onto the Hayward’s terraces in search of lighter diversions.

A riverside playground

The terraces offer an abundance of entertainments. For starters, a one-and-a-half-foot-deep boating lake has been inserted into the Hayward’s sculpture court, complete with flat-bottomed boats made from wood panels that you can row to the edge of the building and back, observing the far more seaworthy vessels ploughing up and down the Thames – or be observed by bemused office workers in the surrounding glass-walled blocks. The Austrian artists’ collective that created this space, Gelitin, create ‘demented playgrounds’, we’re told, but this inversion of the natural riverside perspective – surrounded by water, looking down on the buildings below – is delicious, rather than deranged. Argentina’s Thomas Saraceno has created a plastic-bubbled geodesic dome, which is meant to offer the opportunity to walk on air – there’s a translucent mezzanine level – but was suffering structural problems on my visit. Elsewhere, Slovenian artist Tobias Putrih’s



“Pavilion of Dreams” is a rippling plywood construction cocooned within billowing plastic safety sheeting and reinforced with zig-zag scaffolding, constructed as if by a maniac with an aversion to the horizontal; inside it, documentary movies are shown about buildings as art. These three efforts are, if nothing else, a reminder that one doesn’t have to do the obvious with outdoor spaces (ie, stick a bench and a couple of pot plants on them and call them a roof garden).

Cuban collective Los Carpinteros’ “Show Room” is an exploding house, depicted as if at the moment of impact. A huge hole has been blown into one wall and the furniture – every stick of it – is suspended in mid-air on wires, tilting as if travelling from the point of impact. It’s a study in frozen momentum, but everything in the house is so shiny and new, there’s no sense of any human involvement. It’s like witnessing a completely sterile bomb blast, evoking little or no emotion, apart from awe at its painstaking assembly.

More engaging, in its ramshackle way, is German artist Michael Beutler’s shantytown construction of coloured paper and wire mesh sheets, which have been woven and clipped into arches and tunnels that lead nowhere, in a seemingly random and colourful architectural chaos.

Top: Michael Beutler creates architectural chaos in paper and mesh. Above: Rachel Whiteread’s eerie “Place (Village)”

Human handiwork

But Rachel Whiteread’s “Place (Village)” is one of the most affecting pieces, showcasing Whiteread’s painstakingly acquired collection of some 100 amateur-built dolls’ houses. Stripped of furniture, lit from within, and arranged, in the dark, around three artificial ‘hillsides’, it is like some ghostly toy village. The more you stare at these scaled-down dwellings – mimicking Victorian townhouses, 1960s ‘two-up, two-downs’, gothic mansions, follies and towers – the more the marks and personalities of the fathers, uncles, brothers or grandfathers who constructed each one emerge. Together, they create a haunting record of human ‘inhabitation’ – though it’s not the people who have inhabited these places, it’s the imaginations of their makers and owners. “It has a real feeling of pottering,” Whiteread has said, and this gives it a wonderfully intimate, human dimension. Though we may aspire to the sweeping lines and shiny hard surfaces of the newest and most impressive buildings, it is the evidence of human handiwork and character – with all the chaos, colour and craft that implies – that makes us feel cared-for or acknowledged.

“Psycho Buildings: Artists Take on Architecture,” until 25 August, The Hayward Gallery, London



A Visual Reference for Evidence-Based Design

Jain Malkin

The Center For Health Design, 2008.

Price: \$199.00

This thoughtful and comprehensive book is a valuable compendium of research results that bear on the design of the built environment for healthcare delivery. The book is lavishly illustrated with photographs of various kinds of hospital environment that have been inspired by, and have applied, the new knowledge emerging from relevant research.

The book's take on evidence-based design (EBD) is different from my own. I have written about the EBD approach as *a priori*, that is, research is defined within the context of a design project, and carried out to help make situation-relevant design decisions that can be demonstrated to have the positive effect desired. Jain Malkin – a well-known and widely respected interior architect and writer on healthcare design – develops in this book more of an *a posteriori* approach to EBD.

She sees the 'evidence' for a range of design issues and decisions as emerging from pre-existing fields of study, such as the effects of stress on patient behaviour and recovery, the impact of nature and scenes from nature on recovery and morale, studies of infection transmission and control, and studies of safety and risk management. One of the book's most interesting chapters focuses on the patient's experience, and how results from environment-behaviour studies of how people experience the built environment have a direct bearing on design decisions.

Making sense of design

The author argues that understanding how research can be used as 'evidence' to support design decisions enables design professionals to be more sensitive to how the environment affects both patients and staff, and to design healthcare environments that create a positive experience for people in stressful, uncomfortable and threatening situations.

The book provides comprehensive reviews of studies in relevant areas of research, accompanied by thoughtful discussions on what is most relevant to design of the built environment – not always a focus or even a consideration in much important health and stress research. A chapter on research methods is also included. However, the book foregoes providing clear step-by-step instructions to design professionals who are motivated to move into a more evidence-based practice in favour of providing examples of built healthcare environments that have, to a greater or lesser degree, been responsive to evidence generated by research.

One of the most interesting chapters is on patient safety and infection control. Not traditionally seen as within the building designer's purview, this chapter is a valuable primer on the current status of research on infection transmission and control in hospitals. Some minor quibbles include confusing rankings and ratings in chapter 5, some repetition regarding the effects of stress and stress management, and occasional difficulty following the author's reasoning, for example, a sudden leap into symbols of ancient geometry appears in Chapter 5. The book is avowedly focused on US healthcare and architecture, but including an international perspective would have been interesting.

I would have liked more examples of wayfinding solutions – the photos show only elevators – and of diverse types of environment for staff – limited in Chapter 6 to physician and senior executive lounges. Some of the current research on how environments for work are designed and used could have been included: hospitals are also work environments.

Already the book manages to touch on an impressive range of issues. Brief summaries of large complex topics like sacred geometry and feng shui, process redesign and managing change, the 'split' between research on hospital environments that excludes built space and research on the built environment that focuses on its effects on people and processes, and major studies such as the *Nurses' Time and Motion* study and the *TCAB (Transforming Care at the Bedside)* study give the reader the urge to know more.

Illustrated with abundant photos of innovative design examples that show that applying research results to design is not an abstract exercise but has a real impact on design outcomes, this book is a must-read for members of the design and health professions, students and teachers as well.



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As German philosopher Friedrich Hegel said, “The only thing we learn from history is that we learn nothing from history.” Is this the reason that the number of Post Project Evaluations (PPEs) carried out on healthcare buildings in the UK is so woefully low? It's no different in other countries, where despite significant investment in healthcare, there's still insufficient rigorous evaluation. Figures from the World Health Organisation for 2005 show the US spent 15% of GDP on health, Bolivia 7% and UAE 2.5%, and over the last 10 years in the UK alone, investment in healthcare buildings has been £3.2 billion.

In over 25 years in the UK's National Health Service, initially as a clinician and then in senior management, I am one of relatively few clinicians and managers who has enjoyed the challenging but rewarding process of helping deliver and evaluate a new hospital. Members of staff naturally focus on the delivery of a project, and when achieved, it's easy to see why evaluation gets overlooked.

In praise of appraisal

The best way to see how a new building is performing is to evaluate it, says *Paul Willetts*. So why do so many healthcare providers choose not to bother?

If, like Winston Churchill, you believe that “the farther backward you look, the farther forward you see,” and you agree that continuing to improve the design of healthcare facilities is essential from a clinical, environmental and financial perspective, then the challenge is to evaluate all health projects delivered.

In the US, PPEs originated during the 1960s for public housing and are now found mostly in the government sector and large businesses including the US General Services Administration, US Courts, United States Postal Services and Disney, where they are used for building portfolio management and organisational learning performance¹. The 1970s witnessed the first major collaboration between architectural and medical professionals in hospital design². During the 1990s, PPE tools were used to develop accountability measures.

Joiner³ discusses the growth of PPE in New Zealand, where government architects, until then, used accounting and engineering measures (principally time and cost) to demonstrate performance. Here, PPE has developed as a process offering social negotiation between stakeholders of a building project.

US architectural practice HKS has developed Functional Performance Evaluations – analogous to PPEs – specifically for healthcare buildings. In the UK, the Department of Health has always been clear about the hospitals' responsibilities for PPEs and states they are “an essential aid to improving project performance, achieving best value for money from public resources, improving decision-making and learning lessons,” and are “mandatory” for virtually all projects.

So how do we create incentives for health bodies to carry out evaluations? Perhaps an independent architect should take the lead, or there could be an annual award for the most clinically, architecturally and environmentally pertinent evaluation. Maybe they could be offered a financial incentive.

We're deluged with information of all kinds, but there's simply not enough on how healthcare buildings perform. It's important to share PPEs to build a global best practice knowledge bank, and given the investment in hospitals – and the fact that they deal with matters of life and death – they are crucial buildings to get right.

There's simply not enough information on how healthcare buildings perform



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