# Ecological and Salutogenic Design for a Sustainable Healthy Global Society

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Edited by

Ken Yeang and Alan Dilani

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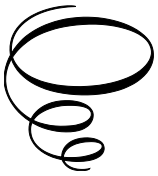

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# ACKNOWLEDGEMENTS

The Sustainable Development Goals (SDGs) outlined in the United Nations' vision are transforming our world through 17 goals and 169 targets, described within a thematic framework of the relationship between the planet, people, prosperity, peace, and partnerships.

Ecological and salutogenic design principles have been addressed as a recurring theme for decades but have not been well integrated into design practice and public health policies in our society. As editors of this book, we (Alan Dilani and Ken Yeang) support the United Nations' SDGs, especially Goal 3 i.e., the promotion of health and wellbeing for all. Together with several leading scientists and practitioners from around the world, we have discussed the benefits of this progressive approach to human development; it offers valuable insights for governments and the public and private sectors to seize the opportunity to develop a healthy built environment. These principles and their applications provide the foundation for a sustainable and healthy global society.

For the design profession (architects, planners, designers, etc.), concern around designing a healthy and sustainable society constitutes the most compelling task to be addressed and implemented across all sectors where human beings live, work and play. The challenge for ecological design is to provide a green context for a healthy society, dealing with built infrastructure that creates clean air, clean water, clean food, and clean land. This is achieved through water management and retention, natural heating and cooling, and renewable energy which, in turn, are necessary for human health and wellbeing. These principles are intertwined with those of salutogenic design, which supports human health in daily life.

This book contains a unique selection of papers written by some of the most respected scientists, architects, designers and practitioners, economists, and landscape planners. We appreciate and are most grateful for the efforts of all participating authors, who have shared their unique experiences, knowledge and wisdom in contributing to the enrichment of the discussion in this book. We thank architect and psychologist, Ms. Aishwarya Narayana; and Mr. Derek Parker, FAIA, former director of Anshen + Allen Architects, San Francisco, and lifetime leadership awards winner, for proofreading some of the chapters. We deeply appreciate the support of our colleagues and friends who have helped us create this book, especially our colleague and co-author, the architect Avani Parikh, from New York, for sponsoring the final proofreading of the book.

*Alan Dilani, Stockholm, June 2021.* *Ken Yeang, Kuala Lumpur, June 2021.*

# NOTE ON EDITORS

**Dr. Ken Yeang, Ph.D.** is an architect, planner and ecologist who is best known for his signature green architecture and master planning, differentiated from other green architects by his authentic ecology-based approach, distinctive green aesthetic, and performance beyond conventional rating systems. He is the world's leading green skyscraper architect. In the tropics, especially, high-rises are traditionally the most un-ecological of all buildings, often wasting up to 30% more energy than lower structures built with the same materials. Yeang uses walls of plants: photovoltaics, scallop-shaped sunshades, advanced ventilation, and whatever he can to collect water and breezes. The idea is to make buildings run as complete ecosystems with little external energy supply. He is not there yet, but the possibility of the green skyscraper is developing fast, as ecological imperatives filter into the consciousness of the startlingly backward world of international architecture. He trained at the AA (Architectural Association, UK) and received his doctorate from Cambridge University (UK) on ecological design and planning. His key buildings include Solaris (Singapore), Menara Mesiniaga (Malaysia), Spire Edge Tower (India), Genome Research Building (Hong Kong), and Great Ormond Street Children's Hospital Extension (UK). He is the Principal of T. R. Hamzah & Yeang, with offices in Malaysia, UK and China. He is a recipient of the Malaysian Institute of Architects Gold Medal, the Government of Malaysia Merdeka Award, and the Architectural Society of China Liang Sicheng Award, 2016. The UK Guardian newspaper named him as one of 50 individuals who could save the planet and he was named by CNN as the leading architect in ecological design.

**Professor Alan Dilani**, Ph.D. is a founder of the International Academy for Design and Health (IADH) and the journal, *World Health Design*. Dr Dilani has been engaged worldwide in several universities in the field of design and health, developing "salutogenic design", in both medical and design institutions across the globe. He holds a Master of Architecture in environmental design from the Polytechnic of Turin, Italy, and a Ph.D. in health facility design from the Royal Institute of Technology, Stockholm. His research at the Karolinska Institute, Medical University, which developed a multidisciplinary research approach, led to a new design theory called salutogenic design. Dr. Dilani's design theory reflects Aaron Antonovsky's salutogenesis health theory, which posits that life's experiences – understood as more or less comprehensible, manageable, and meaningful – shape one's sense of coherence which, in turn, helps each person to successfully mobilise resources to cope with life's stressors and manage life's tensions – leading to health. Dilani asserts that this definition of health, and the "theory of health" that underlies it, lead to a coherent design method and approach. He describes how design uninformed by salutogenic theory causes unnecessary stress, while emphasising the importance of a stress-prevention design approach to the built environment. He has brought together scientists, policy-makers, and industry experts, as well as designers and building owners from across the globe to discuss the principles and application of ecological and salutogenic design approaches, in support of sustainable development in a healthy, urban, post-corona society. Dr. Dilani was awarded in 2010 by the American Institute of Architect's Academy of Architecture for Health, for his promotion of high-quality design research.

# NOTE ON CONTRIBUTORS

**Gunther De Graeve**
Managing Director of the Destravis Group and CEO of the International Academy for Design and Health, Gunther De Graeve is an international health architect and strategist with a reputation for delivering quality solutions for the complex issues facing health service providers. He is recognised as a thought-leader within the industry for his innovation in operational models and infrastructure solutions, his sustainable approach to planning, and for his attention to detail, promoting and enabling flexibility and future trends. He has planned, designed and/or delivered major hospital developments in Europe, Australia, and New Zealand. He values the translation of research and frequently engages in research studies which realise system improvements. Gunther is a proactive member of the health facility community, participating in and speaking at international conferences and study tours. He actively promotes new achievements in the industry.

**Richard Ashby**
Dr. Ashby is one of Australia's most experienced clinician executives. He is a Senior Executive in Digital Health at the Destravis Group. For two decades, he occupied several senior health executive roles including Executive Director of Medical Services at both the Royal Brisbane and Women's Hospital and the Princess Alexandra Hospital; Executive Director of the Princess Alexandra Hospital; and Chief Executive of the Metro South Hospital and Health Service, the latter serving a population of 1.3 million with an operating budget of $2.3 billion. In 2017, the Minister for Health appointed Dr Ashby to the position of Chief Executive of eHealth Queensland, responsible for an operating budget of over $400 million and a capital portfolio of over 100 IT projects with a combined value of over $1 billion.

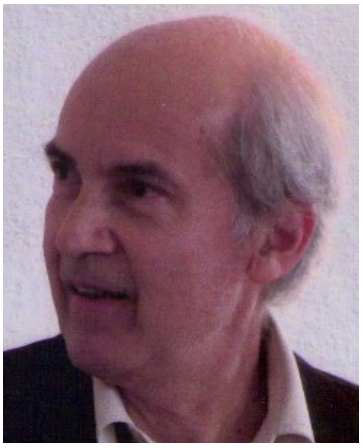
**Paul Barach,** BSc, MD, MPH, Maj (ret.) is a board-certified anaesthesiologist and intensive care physician working at Jefferson College of Population Health, Philadelphia. He trained at the Massachusetts General Hospital, affiliated with Harvard Medical School. He has been involved in advising on the design of many healthcare facilities in the US, Canada, Europe and Australia. He is a passionate believer in advancing the quadruple aim, focused on patient safety, value-based care, healthcare worker support, and using fit-for-design buildings to deliver optimal healthcare. He has faculty positions at numerous universities and has been invited to consult on numerous hospital designs. He was Chair of Research at the Center for Health Design, is a board member of the International Academy for Design and Health, and a member of the US FGI.

Paul's work has led to over $16,000,000 in federal competitive grant funding. He has published more than 300 scientific papers and five books.

**Derek Parker**, FAIA, RIBA, FACHA, FIADH, is an architect. He designed all kinds of healthcare facilities in 15 countries and received more than 75 awards for design, distinguished practice, and lifetime leadership achievement. He has published numerous papers and presentations on healthcare worldwide. He was a board member and the Vice-Chair of Laguna Honda Hospital Foundation, 2008-2013; and a board member of Marin General Hospital, 2010-2014. He is Co-Founder and Chair of The Medica Power Corporation, developing a technology to safely convert medical waste to energy. He is also a senior advisor for Aditazz and the Co-founder of the Center for Health Design (C4HD). He is Director Emeritus and a member of the scientific committee at the International Academy of Design and Health in Stockholm. He is a founding member of the editorial board at Health Environments Research and Design; and was a board member of The National Academy of Engineering (2002-2008). He's a Fellow of the American Institute of Architects; and a Fellow of the American Academy of Healthcare Architects. He is a member of the Royal Institute of British Architects; and a Lifetime Fellow of the International Academy of Design & Health. He is a board member and the treasurer of the 2112 Foundation, San Francisco; and a member of the advisory board at Care for Peace, Myanmar.

**Tye S. Farrow.**
A Senior Partner at Farrow Partners Architects**,** FRAIC, B.Arch., M.Arch.U.D., M.Neuro.Appl.Arch.Des., OAA, MAIBC, AIA Assoc, LEED AP, Tye Farrow has gained international recognition for designing places that enhance our capacity to thrive — culturally, economically, mentally, and physically. He has initiated a global "cause health" movement aimed at raising expectations for design as the basis for total health, which extends beyond environmental sustainability and physical health to encompass our mind-health, connecting the dots between neuroscience and architecture. Tye's projects across North America, Asia, Africa, and the Middle East demonstrate leadership in this visionary quest. He has been invited to present his ideas at leading institutions, including the Mayo Clinic and the Cleveland Clinic, as well as at venues from Finland to New Zealand. His portfolio includes multiple international awards for designing some of the most technically advanced facilities in the world.

**Rossano Albatici**,
A civil engineer and PhD in “building restoration and technological innovation”, Dr. Albatici is full Professor of Building Construction at the University of Trento, Italy. His main research interests are indoor environmental comfort; architecture and salutogenesis; zero energy and solar passive building design; and building automation. He leads research groups within several national and international projects. He is also a teacher on courses organised by professional associations and public and private bodies, concerning energy and environmental sustainability in the building sector. He is author of more than 140 publications including books, articles in scientific journals, and conference proceedings.



**Stefano Andi,**
Having graduated in architecture at the Politecnico di Milano, Stefano Andi is a self-employed professional at the FormaeFlusso living organic architecture studio in Milan, Italy. He studied Rudolf Steiner's architecture in depth at Alexander Tschakalow's studio in Dornach, and has taught at the Rudolf Steiner School in Milan. Since 1990 he has been the Italian representative of the International Forum of Man and Architecture (IFMA) in Amsterdam and was president of the Milanese Anthroposophical Association, 2010-2012. He is active in the field of design, teaching and disseminating themes related to the promotion of organic movement in architecture.

**Mark W. Johnson**
Mark Johnson is a designer for the regeneration of inner cities. He is known for complex projects involving green infrastructure as a catalyst to economic, environmental, and social change. He has received many awards for planning, design, and service. In 2016, *Curbed* magazine named his Larimer Square as "one of the 11 best streets in America," and the Canadian Institute of Planners named his St. Patrick's Island the "Greatest Public Space 2016" in Canada. Mark is a frequent lecturer at universities and other institutes on the role of urban design in public health, and he is a board member of the Van Alen Institute in New York.

**Ihab M.K. Elzeyadi,**
Dr. Ihab Elzeyadi is an architect, building scientist, and design educator. He has been engaged in the design, construction, and research of high-performance buildings for more than 30 years. Professor Elzeyadi joined the University of Oregon from private practice where he was a senior architect and project manager at various top 10 ENR professional firms for eight years. His research and consulting focus on indoor environmental quality (IEQ) and occupant wellbeing in sustainable buildings. Dr. Elzeyadi has published more than 95 peer-reviewed papers, 8 chapters in peer-reviewed edited books, 2 books, and 1 pending US patent. Various grants and awards exceeding $5.6 M in funding supported his research projects.

**Mardelle McCuskey Shepley**
Mardelle is a professor and Chair of the Department of Design and Environmental Analysis. She is the Associate Director of the Institute for Healthy Futures at Cornell University and serves on the graduate faculty in the Department of Architecture. A Fellow of the American Institute of Architects, she has LEED AP and EDAC credentials. Dr. Shepley has authored/co-authored six books, including Healthcare Environments for Children & their Families, Health Facility Evaluation for Design Practitioners, Design for Pediatric and Neonatal Critical Care, and Design for Mental and Behavioral Health. Dr. Shepley has worked full and part-time in professional practice for 25 years.

**Mane Mehrabyan**
While completing her undergraduate degree at Cornell University, Mané Mehrabyan discovered the importance of healing, both through the physical environment and through liberation from institutional and systemic oppression. After working as a UX researcher in a global tech company and an engaged leadership program, Mané now works in Armenia with organisations and individuals to co-facilitate and co-create workshops and programs to create more humane systems. She uses diverse methods, including those from applied theatre, storytelling, and participatory design.

**Naomi A. Sachs**
Naomi A. Sachs is Assistant Professor at the University of Maryland in the Department of Plant Science and Landscape Architecture. She is Founding Director of the Therapeutic Landscapes Network, a non-profit knowledge base and online interactive space for information about landscapes that promote health and wellbeing. She has published and presented nationally and internationally on the positive role of nature in human health. Among other publications, Naomi is co-author (with Clare Cooper Marcus) of the book, Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. She is Co-Editor of the peer-reviewed journal, Health Environments Research & Design.

**Kati Peditto**

Kati Peditto, PhD, EDAC, is an environmental psychologist and Postdoctoral Sssociate in the Department of Design and Environmental Analysis at Cornell University. She received her PhD in Human Behavior and Design from Cornell University, where her research focuses on providing equitable health environments for vulnerable populations, including adolescents and young adults with cancer. She is the recipient of the 2018 New Investigator Award from the Center for Health Design, and a 2018 AIA-AAH Tuttle Fellow in Health Facility Planning and Design.

**Angela Lee**

As Regional Managing Director of HKS Asia Pacific, Angela Lee has 27 years of architecture and medical-planning experience for over 1.4 million square-meters of healthcare projects worldwide. She has been honoured and recognised by international institutes and publications such as AIA, Modern Healthcare, Health Facilities Management and Medical Construction and Design. Angela believes that successful design is the result of a harmonious relationship and balance between patient and user experience, form and function, budget and schedule, sustainability, and sound business principles.

**Brinda Sengupta**

With over 15 years of international design experience as an architect and urban designer, Brinda Sengupta believes the key to a successful project is great teamwork coupled with the pursuit of creativity and excellence at every step of the design process. At HKS she leads teams designing and planning healthcare environments across Asia and the Middle East, striving to integrate urban design principles into public-health strategies. Her keen interest in healthcare design, sustainability and urban design has led to numerous international publications and research projects.

**Stefano Capolongo**

Architect, PhD, and Professor in Hospital Design and Urban Health; and Director of the Department of Architecture, Built Environment and Construction engineering (ABC) at Politecnico di Milano, Dr. Capolongo is also the coordinator of the Lab Design & Health Department ABC of Politecnico di Milano. He is President of the Urban Public Health Section of the European Public Health Association (EUPHA), and coordinator of the European chapter of the International Academy for Design and Health (IADH). He has authored several scientific publications and carries out research concerning hospital design and urban health.

**Marco Gola**

Marco Gola is an architect with a PhD in architecture, the built environment and construction engineering (DABC). He is Postdoctoral Research Fellow at the Design & Health Lab and is currently specialising in hospital design, working at the healthcare department of Techint S.p.a Engineering & Construction. He teaches on the environmental hygiene courses at Politecnico di Milano, and hospital design in various training activities for professionals and postgraduate students. In addition, he has taken part in numerous research projects related to healthcare design, the analysis of hospital performance data, hospital functional and layout design, and furniture design.

**Parul Minhas**

Parul is a research scholar in the Department of Architecture, Guru Nanak Dev University, Amritsar, India. She holds a Bachelor's degree in architecture and a Master's degree in urban design from the same institute, along with teaching experience of 8 years. Her desire to be a better parent inspired her to take up this research concerned with the holistic health of children. This exploration has opened her mind towards the interdisciplinary nature of architecture. She is deeply influenced by salutogenic design and looks forward to excelling in the same field with an intention to promote holistic health as the primary consideration for all architecture and planning interventions.

**Karamjit Singh Chahal**

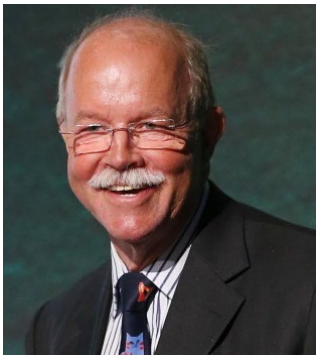
Chahal is professor of Architecture at Guru Nanak Dev University, Amritsar, India. He holds B.Arch and Ph.D degrees from Guru Nanak Dev University, Amritsar, and an M.E. (Const. Tech. & Mgt) degree from Thapar University Patiala. Chahal is a life member of INTACH and fellow member of the Indian Institute of Architects. He has more than 27 years of teaching and professional experience in the field of architecture. He has authored more than fifty research papers and technical reports in various journals and for various agencies. He is actively involved in research and institutional consultancy. His area of interest is Sikh architecture and sustainability.

**Avani Parikh**

Avani Parikh is an architect and planner with 30 years of experience and a consulting practice primarily in healthcare. Having worked with LSG, New York Presbyterian Hospital, and HOK, her portfolio includes numerous health-related projects. In 1987, as a member of India's government-appointed D'Souza Committee, she formulated a new Transfer of Development Rights scheme for Bombay's Development Plan. She was Co-Chair of the AIANY Health Facilities Committee, a member of the Fit City 5 Initiative, NYSHP, and other non-profits. She is the co-author of "Choice Architecture: A New Approach to Behavior, Design, and Wellness," and the recipient of a Nautilus Book Award.

**Debajyoti Pati**

Dr. Debajyoti Pati is Professor and Rockwell Endowment Chair in the Department of Design, Texas Tech University. He has published over 100 articles on the interactions between healthcare, physical design, operations, people, and processes. He was twice voted among the 25 most influential people in healthcare design. He is currently serving as Chair of the Building Research Council at the National Institute of Building Sciences; and is the Director of the North America Chapter of the International Academy for Design and Health. He is on the International Advisory Board of the Swiss Center for Design and Health; and on the editorial board of the HERD Journal.



**Leif Edvinsson**

Professor Leif Edvinsson is a key pioneering contributor to the theory and practice of intellectual capital (IC). He was the world's first director of IC in 1991 and the world's first professor of IC at Lund University, prototyping the Skandia Future Center as a lab for organizational design in 1996. In 1998, he was awarded "Brain of the Year" by the Brain Trust, UK and listed in Who's Who in the world. An associate member of The Club of Rome, and the Co-Founder and Founding Chairman of The New Club of Paris, in 2013 he was awarded the Thought Leader Award by the European Commission, Intel, and the Peter Drucker Association. In 2017 he was awarded the KM Award at the UN in Geneva, by www.km-a.net.

**Innocent Okpanum**

Dr. Innocent is an architect, researcher, urban designer, healthcare design specialist, and the managing director and owner of the architectural firm, Ngonyama Okpanum & Associates, which has offices in eight cities in South Africa; Abuja, Nigeria; Accra, Ghana; and in Ho Chi Minh City, Vietnam. He studied in Genoa, Italy, where he obtained a doctorate degree in architecture. He also holds a Ph.D. in architecture for healthcare facilities design from the University of Newcastle in the United Kingdom. He has gained extensive professional experience spanning over 35 years of practice; and has designed a wide range of buildings.

# INTRODUCTION AND CHAPTER SUMMARY

## Theme 1: Ecological and Salutogenic Design

### Chapter I: Ecological and Salutogenic Design for a Sustainable and Healthy Global Society

*Ken Yeang (UK/Malaysia) and Alan Dilani (Sweden).*

The authors Ken Yeang, the founder of ecological design; and Alan Dilani, the founder of salutogenic design principles, discuss the benefits of these progressive approaches to human development that have far-reaching consequences. Furthermore, they provide governments and the leaders of the public and private sectors with the opportunity to develop healthy built environments through the application of ecological and salutogenic design principles. These principles and their applications are the most important scientific domain of health promotion, setting the foundation for a sustainable and healthy society.

The authors discuss the principles and ideas for an ecological and salutogenic approach to sustainable design and the planning of our built environment, supporting the foundations of a healthy society. Several studies explicate the relationship between the design of our built environment and our health. We understand the link between access to natural light and blood pressure, between overcrowding or chronic noise and psychological stress, and the direct link between healing and nature. For the design profession (architects, planners, designers, etc.), concern around designing a sustainable and healthy future society is the most compelling task to be addressed and implemented in all sectors where human beings live, work, and play. The challenge for ecological design is to provide a green context for a healthy society dealing with built infrastructure that creates clean air, clean water, clean food, and clean land. This is achieved through water management and retention, natural heating and cooling, and renewable energy which, in turn, is necessary for human health and wellbeing. These principles are intertwined with those of salutogenic design, which support human health in daily life.

## Theme 2: Salutogenic Health Systems and the Healthcare Environment

### Chapter II: A Salutogenic Redesign of the Health System

*Gunther De Graeve and Richard Ashby (Australia)*

Hospitals and health systems globally have focused on a pathogenic (disease) approach which, in turn, has contributed to the worldwide burden of disease. In combination with inequities in the social determinants of health and wellbeing, factors such as an ageing population, significant comorbidities, and changing patient expectations are contributing to demands on healthcare services which are outstripping the supply and its affordability. The solution to these health challenges is to work towards a salutogenic health system that transforms and optimises the current system, to establish a sustainable service and infrastructure capacity that can provide equitable and safe access. The current over-reliance on acute facilities to deliver care has led to infrastructure need growing beyond what is sustainable. This is the result of infrastructure solutions being planned from historical activity and a focus on traditional models of acute care delivery. This has often led to infrastructure investment which does not meet the service need and is not able to adapt. Changes to technology, with respect to digital health, are driving changes in models of care that prioritise the long-term health of the community, focusing on out-of-hospital and preventative care. A salutogenic approach, including preventive care, has long been seen as the direction health services should take, on the basis it will be better for patients, will reduce acute health needs, and will ultimately be more

financially sustainable. Digital technologies and an alignment of patient demands are making these shifts a reality.

**Chapter III: Designing Salutogenic Healthcare Facilities for Safety and Quality**

*Paul Barach (USA) and Derek Parker (UK/USA)*

The hospitals of the future will require disruptive and opportunistic changes in culture, systems, processes, technology and behaviours. The coronavirus disruption to our day-to-day lives has provided a rare opportunity to reflect on all things health, and to reconsider what we do, how we do it, and why we do it. New buildings can help to unlock and catalyse this, but only as part of a wider vision. The hospital must address the holistic needs of patients to actively promote their recovery and agency, and better outcomes. Carers, visitors and other users also need environments that help them during what can be difficult times while facing existential threats. The needs of staff must be comprehensively met in a transparent manner, so that they too feel cared for and valued. A change in outcomes – clinical or experiential – requires a major shift in the culture of healthcare and the underpinning public discourse. Creating salutogenic environments that promote health and wellbeing and a supportive culture can help promote healing for the patient and nurture the staff, while being sustainable and equitable. Salutogenesis is now a respected and encouraged design goal. The downside is that the term 'salutogenic' is often overused by architects, most of whom may not know how to drive their schemes with a salutogenic methodology, and may have a tenuous grasp of the scientific underpinnings of salutogenesis.

**Chapter IV: Enriched Elements of Salutogenic Environments**

*Tye Farrow (Canada)*

A core dimension of wellness and the pursuit of holistic health is "place" and our designed environment. More specifically, the elements of our physical space. Research has confirmed that where one lives has more impact on one's health and wellbeing than the medical system, beyond those episodes of serious disease, of course. The elements of our environments — *enriched* environments — in which we can thrive ecologically, physically, economically, culturally, and socially, can be consciously created. As a society, we can create environments that meet deeply-rooted biological, physiological, and psychological needs. We can create environments that reverse the surge of lifestyle-related diseases and alleviate the drowning of the human spirit. We can create sustainable and holistic living conditions where we can flourish and prosper, instead of merely survive. The full range of design factors that influence our total health extend beyond the state of our physical wellbeing and ecological health, to include qualities of place that affect our state of mind and thereby enrich and accelerate optimal health. The design of every public space, building, campus, community, and every home must be judged in terms of its capacity to activate optimal health. Over the past century, people have become numbed to the harmful effects of denatured, disconnected, and dismal design. Numbed as we may be, we are nonetheless affected by the design of our physical environments. The main problem of our surrounding designed environments and habitations is that they are not intentionally designed for active health promotion – to *cause health*.

**Chapter V: Designing Salutogenic Spaces to Promote Health**

*Rossano Albatici and Stefano Andi (Italy).*

At the time of writing this, a year has passed since the declaration of a global health emergency following the outbreak of the Covid-19 pandemic, triggered by the SARS-CoV-2 virus. Much has been written about the causes at one level or another, and many ideas have been put forward on how best to tackle the problem in the short term, especially through health measures, and a new organisation of society, reflected in numerous restrictions imposed by national governments. Some researchers have explored the connection between sickness and the environment, and it has been

stressed that there is a need for "transformative change, using the evidence from science to re-assess the relationship between people and nature, and to reduce global environmental changes that are caused by unsustainable consumption, and which drive biodiversity loss, climate change and pandemic emergence" [2]. It is a vision that moves towards a bio-psycho-social approach to human health, whereby attention is shifted from the diseased organ to the human being as a complete whole, not least considering the environment in which the person lives, in all senses: physical and biological, relational, psychological, social, and ecological. In this scenario, the built environment plays a role of primary importance regarding both the impact of the construction industry (environmental and economic) and pollution created by the energy management of an often outdated and power-hungry stock of buildings and, crucially, guaranteeing conditions of hygiene such as will make it possible to prevent the onset of illnesses.

## Theme 3: Salutogenic Outdoor and Indoor Environments

### Chapter VI: Health-Promoting Urban Design in a Post-Pandemic Society

*Mark W Johnson (USA)*

The design of the urban environment plays a key role in and has a great impact on the health and wellbeing of people. However, urban planning of the 19$^{th}$ and 20$^{th}$ centuries created a harmful impact on health in the US, although some Victorian ideas hold promise for sophisticated community design in pandemic times. As we retrofit our cities for the future, old and new thinking could lead to shifts in policy and planning norms to better prepare us for the future challenges of healthy urban environments. The author, as an expert in the field of urban design with decades of practice and experience worldwide, highlights the trends and issues of healthy urban design that have been developed over time. I want to urge urban policy-makers and the academic world and colleagues to pay more attention to this crucial design thinking that should be considered a foundation of a healthy society. Why does urban design matter? Most people today, at least in developed countries, pay more attention to some of the more complex relationships between personal health, public health, and urban design. Most planning professionals are aware of the dangers of over-consumption and of the damage to our health caused by polluted air, water, and soils. We could clearly see the consequences of unhealthy lifestyle choices that are often linked to urban design. However, we have become aware of a variety of environmental issues such as climate change and the impact of energy consumption, as well as the need to address sustainability in almost all of our choices.

### Chapter VII: The Salutogenic Office: The Environmental Quality of Indoor Architecture and Occupant Health and Wellbeing

*Ihab M. K. Elzeyadi (USA).*

How does a state-of-the-art high-performance building impact indoor environmental quality, occupant comfort, productivity, health, and wellbeing? This question highlights an important, yet under-studied objective of high performance and LEED™ certified green buildings. Not only do green buildings propose a solution to combat the building industry's energy addiction, but they also promise better indoor environmental quality and, more recently, a value proposition that they provide better health and wellbeing for their occupants. Despite the favourability of this hypothesis, most recent studies have failed to prove these linkages leading to inconclusive evidence of green building performance. This chapter presents a case study of a 36-month comparative indoor environmental quality (IEQ) assessment and a pre/post-occupancy evaluation of a new LEED™ double-platinum certified building and compares it to a traditional office complex which the LEED building employees occupied previously. The longitudinal study was conducted for 36 months, employing long-term data collection monitoring of IEQ parameters and occupant satisfaction and health in the before and after. The Space Performance Evaluation Questionnaire (SPEQ™) was administered over the 36-month study to gain further insights on the occupants' perspectives related to their perceptions of the building's indoor comfort, productivity and health benefits. Results show

strong relationships between green design strategies, salutogenic building practices, and occupants' health and wellbeing, proving that a well-designed salutogenic environment can provide long-term impacts on the triple bottom-line approach of people, planet, and profit.

## Theme 4: Salutogenic Healthcare Design

### Chapter VIII: The Role of Salutogenic Design in Mental and Medical Health-Integrated University Clinics

*Mardelle McCuskey Shepley, Mane Mehrabyan, Kathryn Sandra Peditto, and Naomi A. Sachs (USA)*

A university healthcare clinic is an integral part of its academic community and can contribute to the salutogenesis, or health promotion, of the students, staff and faculty in two ways: 1) through its philosophy and protocols as a contributor to the broader campus culture; and 2) through the physical environment of the clinic itself. The notion that a clinic can play a role in supporting health and wellbeing has been explored by previous researchers (e.g., Lindmark, et al., 2018; Rakel, 2008). By facilitating a sense of coherence, a renovated university health clinic can be a salutogenic resource to both students and staff. The research described here addresses a new medical and mental health-integrated university clinic facility, the design of which includes salutogenic components at both levels. In this study, researchers used interviews and surveys to evaluate the following six primary design goals, established for the clinic during programming: transparency, accessibility, privacy, integration, collaboration and welcoming. Regarding the physical environment, the new clinic addresses many of the goals suggested by previous authors (e.g., Abdelaal & Soebarto, 2019; Mazuch, 2017; Wister, 2005). According to Antonovsky (1996), the primary objective of salutogenesis is to provide a sense of coherence (SOC) through comprehensibility, manageability and meaningfulness. A study of the salutogenic model among university students suggests the importance of the college environment in affording SOC (Heiman, 2010).

### Chapter IX: Healthcare Design for a Healthy Post-Pandemic Society

*Angela Lee and Brinda Sengupta (USA).*

In the last ten years there has been a great focus on sustainability within the building industry. Green building technologies and green materials have become the buzzwords in every project. Designing for wellness has also come to the forefront with the recent WELL accreditation but is at a relatively nascent stage for healthcare. COVID-19 and some of the other recent pandemics and natural disasters have forced us to think about health and salutogenic design in a more holistic and sustainable way. The future state of healthcare should cater to our full spectrum of needs. Health must be embedded in how we live, work and play, and go beyond the hospital or clinic. The design of healthcare environments needs to leverage technology and big data to inform design to help shape healthy behaviours and lifestyles. The vision for salutogenic design needs to builds community and enhance our resilience at all scales of the urban environment. Here, we outline some of the strategies that can be adopted to achieve this vision using case studies and best practices from research and practice around the world. Architects, medical planners, and designers need to understand the impact of their design even beyond the building envelope. Healthcare buildings need to be viewed in the overall urban context, plugging into the larger urban infrastructure, and giving back to its immediate environment.

### Chapter X: Finishing Materials as Health-Promoters in Healing Spaces

*Stefano Capolongo and Marco Gola (Italy).*

According to the World Health Organization, every year in the European Union, four million patients acquire a healthcare associated infection. The risk mainly affects patients, being more vulnerable than staff due to their precarious health conditions. Implementing control and prevention

measures is essential to mitigate an increasingly growing phenomenon. In addition to the contact between people, transmission can take place through surfaces, which play an important role in the propagation of microorganisms, but they are very often neglected with few guidelines on microbiological evaluations. In general, the analysis of the regulatory framework shows a great lack of strategies in the selection of finishes. It is clear that designers have a great responsibility in creating healthy spaces, particularly in the important part finishing materials play within healthcare facilities, although they are often considered the final application of a surface layer on the spaces. However, they should gain greater attention, especially with respect to the activities carried out within healing environments. They can influence the transmission of hospital infections; they have a strategic role in a space more hospitable for the wellbeing of users; and they can also affect indoor air quality. This chapter investigates several finishing materials and several studies taken from the scientific literature, investigating how they can be health promoters.

## Theme 5: Salutogenic Learning Environments

### Chapter XI: Salutogenic Design Guidelines for School Environments and Health Outcomes

*Parul Minhas and Karamjit Singh Chahal (India).*

*"The function of protecting and developing health must rank above that of restoring it when it is impaired."* Hippocrates.

Schools are known to be temples of knowledge and places of learning but the fact that children spend most of their waking hours in school makes these environments much more significant than they may at first seem. According to C.K. Tanner, most people believe that school buildings are just big boxes in which learning occurs and they are places to store students until they drop out or graduate. Current approaches to school design focus either on aesthetics or on the academic achievement of children, often ignoring the health-promoting aspects of the built environment. A salutogenic approach to school design aims to protect and promote the holistic health of children by considering the physical, mental, emotional, and spiritual aspects of children's health. This chapter not only explores the relationship between the built school environment and the holistic health of children, but also proposes a set of salutogenic guidelines for the design of school environments to achieve the desired health outcomes. The inter-disciplinary nature of salutogenic theory integrating architecture, neuroscience and psychology imparts the much-needed complexity to conceptualise and design school environments.

## Theme 6: Choice Architecture and Salutogenic Value for Society

### Chapter XII: Choice Architecture and Salutogenesis

*Avani Parikh and Debajyoti Pati (USA).*

The mainstream theoretical approach to choose in consumer economics since the 18$^{th}$ century has been rational choice based on costs and benefits. But, as it turns out, people do not always choose rationally. The foundations of a broader behavioural approach to human decision-making were laid by Amos Tversky and Daniel Kahneman in the 1970s, for which the latter won the Nobel Prize in Economics. Rational choice sometimes involves deliberation — an explicit analysis of net benefits — and is context-free, whereas behavioural choice is often spontaneous and contextual. In some situations, the former appropriately describes a person’s decisions regarding behaviour and action and, in others, the latter appropriately describes the response. In fact, it could be argued that other than major life decisions, very few conscious human choices follow a rational cost-benefit analysis. It is the unique strength of choice architecture to extend both sets of ideas to architectural decision-making. Choice architecture offers a tool that is measurable, cost-effective, addresses multiple issues, and is flexible. It reduces the function/outcome gap between the ideal and the actual built. Salutogenic design principles can be used to position choices to end-users that potentially create the

conditions in which people want to voluntarily adopt health-promoting behaviour-change in a variety of social and cultural settings.

### Chapter XIII: The Impact of Design on Intellectual Capital (IC) and Society 5.0: Creating an 'Aha'

*Leif Edvinsson (Sweden).*

Many years ago, on my way home after a long workday at Skandia Future Center, I realised and got an *AHA*. I was full of energy and spirit! How had this happened after so many hours of work and at the end of the day? The workplace had provided me with energy, rather than having drained it. What an impact! How? Was this the impact of salutogenic design? Where and How do we Learn to think of work design? One of my key learning aspects as a student at Berkeley University was to 'learn to think.' The Skandia Future Center in Stockholm was designed to be a workspace for 'futurising.' A space for organizational design prototyping. It opened in May 1996 as the world's first future centre. It was located in an old wooden house in the archipelago outside of Stockholm. Initially full of high-tech devices, these were gradually supplemented by older antiques, such as old mechanical typewriters. Old tech was impacting the mind rhythms positively, versus the fascination of high tech. How do we nourish salutogenic architecture and design for wise spaces? The very first step might be a deeper understanding of the above-mentioned 'Aha,' followed by extended cross-disciplinary dialogues for long-term holistic sustainability understanding. It is multidisciplinary design, from soft to hard, from object to relationship, from economics to neuroscience. The impact is, among others, in the monetizing of the multiplier effect, but is much more multi-dimensional. The salutogenic design approach should be considered as important intellectual capital in our cities and society. In the city, it creates landmarks as intellectual capital, helping to create mind maps and easy navigation, to improve the quality of life by reducing stress and promoting health and wellbeing.

## Theme 7: Implementing Salutogenic Design in Africa

### Chapter XIV: Salutogenesis Philosophy and its Influence on a Post-Covid-19 Era in Africa

*Innocent Okpanum (South Africa/ Nigeria).*

The aim of this article is to assess the role of salutogenesis philosophy in the development and provision of the physical built environment and, more specifically, to assess its role in the design of buildings in Africa. Further, recommendations can be made for improving design and project development processes. The basic assumption of this chapter is the use of salutogenesis design philosophy to improve the design of the physical built environment in Africa, which is essential to the achievement of "the right to health" for all as recognised in the Universal Declaration of Human Rights and several international human rights instruments, covenants, and consensus documents. Moreover, most state governments in Africa have committed, to varying degrees, to implementing the "right to health," including the right to access healthy lifestyle, goods and services, as provided for in their respective constitutions. The current public health emergency due to COVID-19 offers a great opportunity to change project implementation processes in Africa based on salutogenesis philosophy. The Salutogenesis perspective is a research-based project design approach that requires the development and introduction of an appropriate continuous evaluation, and monitoring tools to be used during design, construction, and operation. This process is essential to ensure that the physical built environment vision and objectives are fully met.

# THEME 1:

# ECOLOGICAL AND SALUTOGENIC DESIGN

# CHAPTER I

# ECOLOGICAL AND SALUTOGENIC DESIGN FOR A SUSTAINABLE AND HEALTHY GLOBAL SOCIETY

KEN YEANG AND ALAN DILANI

*The authors discuss the principles and ideas for an ecological and salutogenic approach to the sustainable design and planning of our built environment in order to support the foundations of a healthy society. Several studies explicate the relationship between the design of our built environment and our health. We understand the link between access to natural light and blood pressure; between overcrowding or chronic noise and psychological stress; and the direct link between healing and nature. For the design profession (architects, planners, designers, etc.), concerns around designing a sustainable healthy society for the future is the most compelling task to be addressed and implemented in all sectors where human beings live, work, and play. The challenge for ecological design is to provide a green context for a healthy society, dealing with built infrastructure that creates clean air, clean water, clean food, and clean land. This is achieved through water management and retention, natural heating and cooling, as well as renewable energy which, in turn, is necessary for human health and wellbeing. These principles are intertwined with those of salutogenic design, which support human health in daily life.*

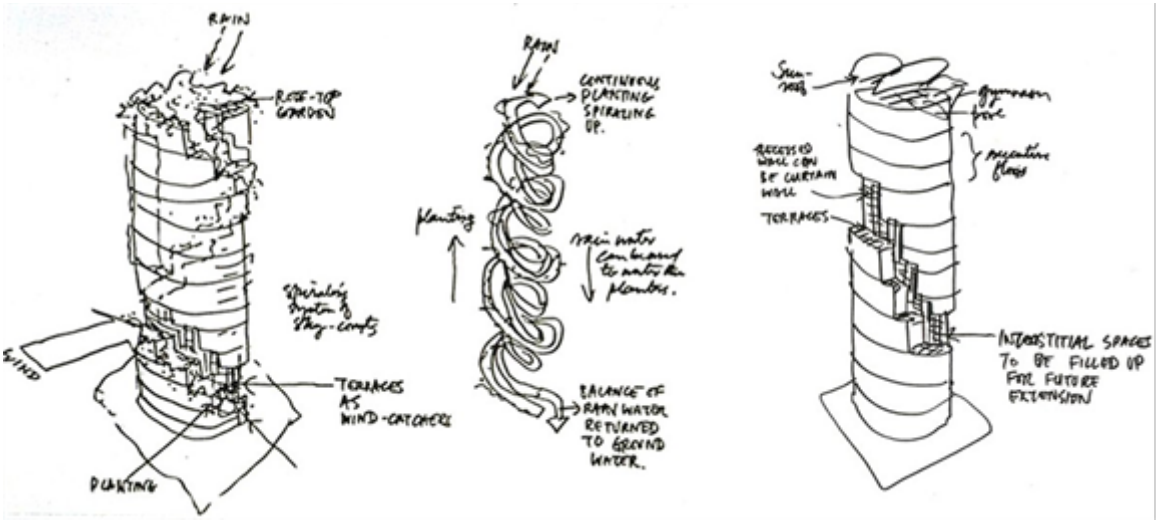
*Ken Yeang, who is the founder of ecological design, and Alan Dilani, the founder of salutogenic design principles, here discuss the benefits of these progressive approaches to human development. Furthermore, they provide governments, public and private sector leaders with the opportunity to develop a healthy built environment through the application of ecological and salutogenic design principles. These principles and their applications are currently the most important scientific domain for promoting health and they set the foundation for a sustainable and healthy society.*

## Introduction

In 1997, the World Health Organization identified "the health arena," which includes the priority settings and frequently-used spaces such as the workplace, schools, hospitals, correctional institutions, commercial offices, and public spaces within our towns, cities, and homes which should be at the centre of health promotion activities in the 21st century. During the 66th meeting of the General Assembly of the United Nations in September 2011, the socio-economic challenge of non-communicable diseases was discussed for the first time. The authors argue that the built environment has a significant impact on human health and are committed to bringing this understanding to design and health professions, in order to reduce the prevalence of lifestyle diseases, which constitute significant health problems in societies around the world.

Growing awareness of the importance of health promotion and the need to invest in healthy and sustainable public, social, institutional, and domestic infrastructure, through the application of ecological and salutogenic design, is at the forefront of this opportunity and will lead change in our society. Embracing ecodesign and salutogenic approaches to the built environment, infrastructure investment, and the development embedded at the core of a preventative care strategy changes the focus from risk factors and the treatment of disease to a more holistic understanding of a healthy society. Research on ecodesign and salutogenic direction highlights the impact of design factors when it comes to inspiring the designer and planner to help build a healthier society.

We are all too aware of the numerous pressing global social issues that need to be addressed. These include abject poverty, the provision of clean water and adequate food, and proper sanitation to name just a few. However, ultimately, if we do not have a clean environment comprising of clean air, clean water, and clean land, then the other pressing issues become even more difficult and expensive to resolve. Thus, saving our environment has to be the most vital cause that humankind must address today.




For the designer, the compelling question is: how do we design for a sustainable future? We need to imagine and envision what such architecture might be. How will it look if it is to be sustainable? We must address these questions while seeking to understand and address designing for the environmental consequences of architecture's functions and processes. By finding new models for design, seeking new construction and production systems, materials and processes, what action must we take to realise this vision through comprehensive and ecologically benign strategies?

Globally, businesses and industries face similar concerns in terms of understanding the environmental consequences of their functions and processes, especially with changing business models, new production systems, materials, and processes.

Environmental challenges such as climate change and other impairments within natural ecosystems are also architectural problems, given the bulk of building emissions and waste in landfills. Green architecture becomes an opportunity for architects as a community of professionals to help the world with its problems and a chance to cease creating new problems. Green design must become the core value to architecture, changing the way we design, but how should we shape our future environments to respond to the new demands of society?

We are living in a post-industrial age, in the knowledge (or Google) society. Therefore, architecture should provide positive stimuli to promote creativity. This requires a new way of looking at the role of the built environment within the context of health and wellbeing. This is called salutogenic design. Salutogenic design highlights the impact of design factors on inspiring designers and planners to help create a healthy society by developing urban design that stimulates healthy behaviour, the promotion of health, and the prevention of diseases. Considering a salutogenic design approach also means favouring social innovation. Ecological design with salutogenic design requires an interdisciplinary application of psychosocial design factors within architectural design, in order to promote a healthy lifestyle. To reduce the global burden of disease in an efficient way, major investment needs to be made in the promotion of healthy lifestyles and the development of healthy spaces.


Research has shown that well-designed and people-friendly spaces encourage walking, cycling and the use of public transport. High levels of greenery also encourage physical activity which lowers blood pressure, decreases the risk of heart disease, stroke and diabetes, and prevents falls in the elderly. Evidence also shows that attractive and open public spaces reduce mental fatigue and stress. Such factors contribute to the reduction of the burden of disease which may eventually reduce the costs of healthcare.

> "Global health means making major investments in the promotion of healthy lifestyles and the development of healthy spaces to reduce the burden of disease" (*Julio Frenk, the* former Minister of Health, Mexico, and the Dean of Public Health at Harvard University, talking to *Alan Dilani* in an interview for *World Health Design*, October 2010).

Promoting a healthy lifestyle and healthy spaces depends on ecological design that primarily deals with infrastructure by creating clean air, clean water, clean food and clean land. This is achieved through water management and retention, natural heating and cooling, and renewable energy, which are necessary for human health. These principles are intertwined with those of salutogenic design, which supports good human health in everyday life. Improving population health as the foundation for social and economic development will be achieved through salutogenic and ecological design principles: salutogenic design can provide social organisation, structure, and function in society; while ecological design can work to continually restore the natural environment.

Largely informed by the global recognition of the urgency of the need to reshape our built environment to tackle the 21$^{st}$ century challenges of chronic and non-communicable diseases, we have synthesized nearly two decades of dialogue and interdisciplinary research for design. While significant progress has been achieved to understand the value of salutogenic and eco-design, there are still some inadequacies when it comes to their implementation. One of the most pressing areas

is the rehabilitation of our existing cities into eco-cities. We need the new generation of designers, architects, and engineers to learn how to apply ecological and salutogenic design principles in their work. In the meantime, we also need the support of governments around the world to understand the value of healthy and sustainable societies.

The world needs a new paradigm with ecological design in interaction with the built and natural environments, where buildings are not add-ons to the ecosystem, but an active part of it. According to Yeang, the relationship between an ideal building and its environment is that of a prosthetic device and a person wearing it; only if the device is completely in harmony with the body will it function optimally and, in the same way, nature can be considered as the "host organism" to man-made infrastructure, with the same level of bio-integration required if the whole system is to succeed.

## What is Green Design?

Green design must be an integral part of human life. Human beings are the most powerful species in nature, with the immense ability to use non-renewable resources to radically change landscapes. This affects the global climate and has resulted in the large-scale destruction of natural habitats along with the extensive loss of biodiversity. We must start by reducing the demands made by humans on the environment and natural resources, and reduce the exorbitant levels of consumption and move away from society's present consumer culture. We must eliminate such a wasteful way of life and ameliorate the overly extravagant standards of living and comfort.

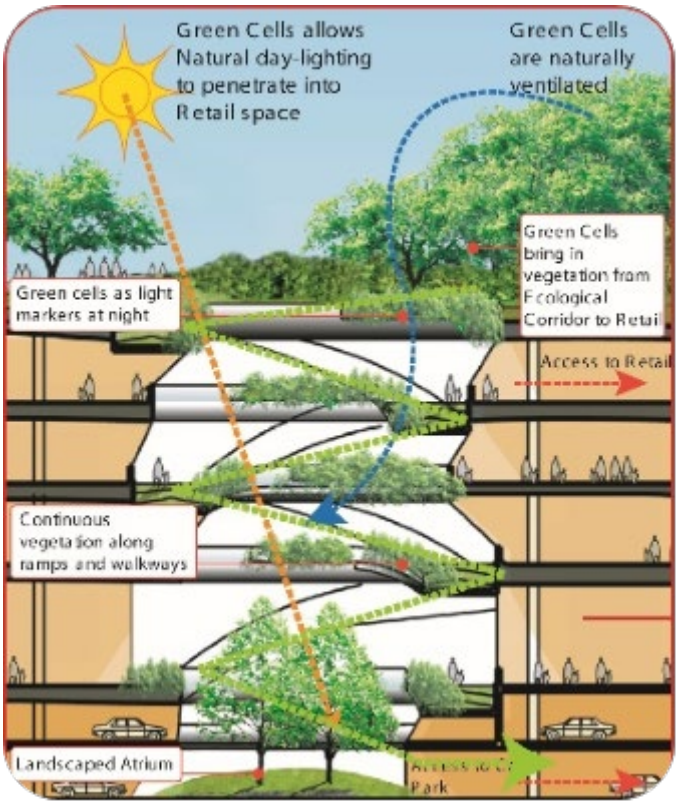



*Figure 3: Eco cell brings light and ventilation into deep spaces*

Our world has to change its existing polluting industries, unsustainable economies, commerce, and methods of production. We must also change our behaviour towards the natural environment to become more sustainable. Essentially, we need to radically change how we live, build, behave, work, make, eat, learn, buy, and move about. All of this falls within a building's utility and extended function. The less we need, the less we build, and the less we'll exploit the environment (see 'red eco-infrastructure' below).

Green design isn't just simply about engineering. Engineering systems, whether eco-engineering or clean tech engineering, are important components of green design (see 'grey eco-infrastructure' below), providing expediency in supporting society's habitation, environmental enclosure and comfort, as well as other desires that make our lives enjoyable.

While engineering technologies are rapidly advancing towards ever greener and cleaner solutions for our built environment, it must be clear that eco-engineering is not the only consideration in green design. Neither is green design just about rating and accreditation systems such as LEED, BREEAM, carbon profiling, etc. These are certainly useful checklists and guidelines but, again, these are not ecologically comprehensive. They are useful as a partial list of reminders and are some of the key items to be considered in green design. They are also useful for comparing buildings and master plans by a common standard and have been helpful in proselytizing green design to a wider audience. But by not being comprehensive and ecologically holistic (a crucial aspect of eco-design), many designers (after achieving the highest level of ratings such as platinum) then ask, what next? Where do we go from here? And how do we go beyond accreditation?

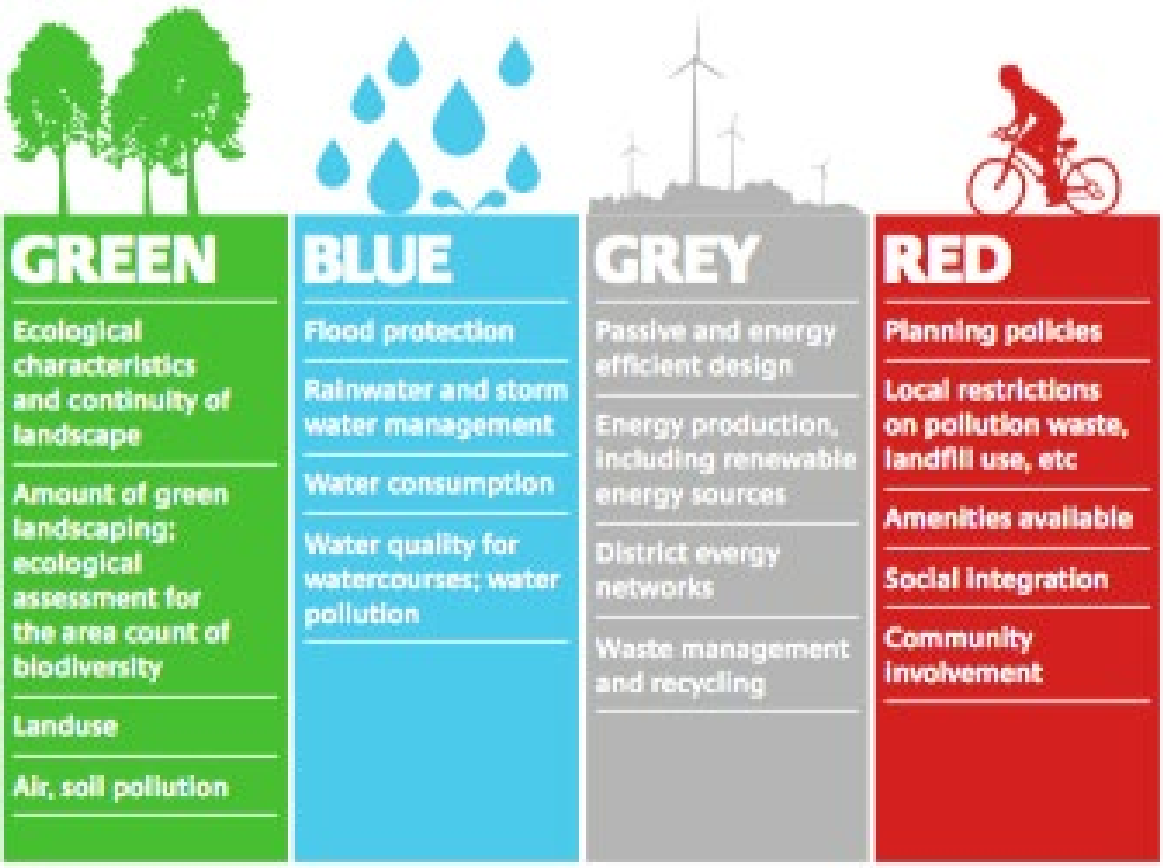
Clearly, green design has now entered the mainstream of architecture. Virtually every architect, planner, and designer today lays claim over their calling towards green design. However, some are greener by a greater margin of authenticity than others. In effect, there are 'shades of green' in design but the public is unable to tell the difference. For example, the architect who puts extensive solar photovoltaic collectors on his building would claim that it is green architecture. Architects who have achieved a high green accreditation rating, such as LEED platinum, would conclude that they have reached the pinnacle of green design. Today, many have begun to question whether achieving ratings is all there is to green design.

The contention here is that achieving complete green design is much more than the above; that green design is not as easy as it had been contended and that it is complex; that our sphere of knowledge must increase; that green design has to be the core underlying all our design endeavours for which we need new methods and design models.

## Design Strategy for Eco-Design

While still incomplete, described here are four design strategies that can be adopted in combination to arrive as close as we can towards the goal of achieving equilibrium between the built and natural environment.

**1) The first design strategy** is to view green design in terms of the bio-integration of four essential strands of eco-infrastructures, which are colour-coded here as follows:




Green design is the continual combination of all four of these sets of eco-infrastructures into a system, as a 'constructed ecosystem'. This concept provides a flexible platform for green design. Like the factors in DNA (by Crick and Watson) which reduce a complex concept into four simple sets of instructions, these four sets of eco-infrastructures and their integration provide a comprehensive base for green design and planning (i.e., being the blending of these four sets of infrastructures into a cohesive system).

Green Eco-Infrastructure

Green eco-infrastructure is vital to every design and master plan. It parallels the usual grey urban infrastructure of roads, drainage systems, and utilities. This green eco-infrastructure is nature's utilities and common services. These are the interconnected networks of natural areas and other open green spaces within the biome that conserve the natural ecosystem's values, clean air, and water. It also enables the area to flourish as a natural habitat for a wide range of wildlife, as well as delivering a wide array of benefits to humans and the natural world alike. This green eco-infrastructure is nature's functioning infrastructure (equivalent to our human-made engineering infrastructure and utilities, designated here as grey, blue, and red eco-infrastructures). In addition to providing cleaner

water and enhancing water supplies, it can also result in some instances, if not all, in the following outcomes: cleaner air; a reduction in the heat-island effect in urban areas; a moderation in the impact of climate change; increased energy efficiency; the protection of source water; other potential benefits.

Incorporating a green eco-infrastructure into a systematic way is thus vital to any design and eco master planning endeavour. Without it, no matter how clever or advanced the eco-engineering systems, the design or the master plan remains simply a work of inorganic engineering. They can neither be deemed ecological architecture/master plans nor an eco-city, in the case of larger developments.

These linear flora and fauna corridors connect existing green spaces and larger green areas within the locality to the landscape of the hinterland, and can create new larger habitats in their own right. They may even take the form of new links amongst existing woodland belts or wetlands, or existing landscape features, such as overgrown railway lines, hedges and waterways. Any new green infrastructure must clearly also complement and enhance the natural functions of what is already present in the landscape.

In the master planning process, the designer identifies existing green corridors, routes, and green areas, and possibly new routes and linkages for creating connections in the landscape. It is at this point that additional green functional landscape elements or zones can also be integrated by, for example, linking to existing waterways that provide ecological services, such as drainage to attenuate flooding.

This green eco-infrastructure takes precedence over the engineering eco-infrastructure in the design and master plan. By creating, improving and rehabilitating the ecological connectivity of the immediate environment, the eco-infrastructure turns human intervention in the landscape from a negative into a positive act. Its environmental benefits and values are as a green armature and framework for natural systems and functions — elements that are ecologically fundamental to the viability of the local flora, fauna, and their habitats, healthy soils, water, and air. It reverses the fragmentation of natural habitats (because of urban sprawl and transportation routes, etc.) and encourages biodiversity to bloom, restoring functioning ecosystems while providing the fabric for sustainable living, alongside safeguarding and enhancing natural features.

This endeavour by design to connect the landscape must extend to shape buildings both horizontally and vertically. An obvious demonstration of horizontal connectivity is the provision of ecological corridors and links in regional and local planning that are crucial for making urban patterns more biologically viable. Connectivity over impervious surfaces and roads can be achieved by using ecological bridges, undercrofts, and ramps. Besides improved horizontal connectivity and ecological nexus, vertical connectivity within buildings is also necessary, as most buildings are multi-storey. Design must extend the ecological corridors vertically, with the eco-infrastructure traversing a building from the foundations and landscape at the ground to create habitats on the walls, terraces, and rooftops.

➡ Blue Eco-Infrastructure

The eco-infrastructure that parallels green ecological infrastructure is water infrastructure (the blue eco-infrastructure), where we need to manage the water cycle to ‘close the loop’ as much as possible, although this is not always possible with evaporation, in locations with low rainfall, and wastage, etc. Rainfall needs to be harvested and grey water needs to be treated, reused, and recycled. Surface water from rain needs to be retained within the site to be returned to the land for recharging groundwater and aquifers by means of filtration beds, pervious roadways, as well as built surfaces, retention ponds and bioswales. Water reused within the built environment (both grey and black water) should be treated using natural and sustainable processes.

Site planning must take into consideration the site's natural drainage patterns and provide surface-water management such that rainfall remains within the locality and is not drained away in vain into water bodies. Combined with green eco-infrastructure, storm-water management enables natural processes to infiltrate and evapotranspirate; or the capture and use of storm water on or near the site where it falls while potentially generating other environmental benefits.

Waterways should not be culverted or deculverted as engineered waterways, but should be replaced with the introduction of wetlands and buffer strips of ecologically functional meadows and woodland habitats. Sealed surfaces can reduce soil moisture and leave low-lying areas susceptible to flooding from excessive run-off. Wetland greenways need to be designed as sustainable drainage systems to provide ecological services. Green buffers can be used together with linear green spaces to maximise their habitat potential.

Eco-design must create sustainable urban drainage systems that can function as wetland habitats. This is not only to alleviate flooding but also to create buffer strips for habitat creation. While the widths of the buffer may be constrained by existing land uses, its integration through linear green spaces can allow for wider corridors. Surface-water management maximises habitat potential. Intermittent waterway tributaries can be linked up using swales. Blue eco-infrastructure thus supports and celebrates the water cycle through design.

⇨ Grey Eco-Infrastructure

Grey infrastructure is the usual urban and engineered infrastructure and utilities such as roads, drains, sewerage, water reticulation, telecommunications, IT, energy and electric power-distribution systems. We need not be prescriptive of any specific engineering system, in order to avoid obsolescence, but require that these systems be clean technologies, of low embodied energy, and be as close to being carbon neutral as possible, while at the same time being integrated with green infrastructure, as opposed to allowing grey infrastructure dominance over green eco-infrastructure.

➥ Red (or Human) Eco-Infrastructure

Human eco-infrastructure comprises people and communities as well as built spaces and enclosures like buildings, semi-open structures, hardscapes, and our regulatory systems including but not limited to laws, regulations, penalties, incentives, legislation, and ethics. This is the social and human dimension that is often missing in the work of many green designers. It is evidently clear that our present profligate lifestyles, our economies, industries, means of mobility, our diet and food production all need to be transformed to be sustainable. This is a major undertaking that requires global leadership.

**2) Seamless & Benign Bio-Integration**

**The second design strategy** is to regard green design as a seamless and benign bio-integration of the synthetic and the artificial (human made) into the natural environment. We contend that it is this failure to successfully bio-integrate that is the root cause of all our environmental problems. In effect, if we are able to bio-integrate all our business and industrial processes, functions, built systems and built environment into the natural environment in a seamless and benign way, there will in principle, be no environmental problems at all. Successfully achieving this is, of course, easier said than done, but herein lies the challenge.

We can draw an analogy here between eco-design and prosthetic design in surgery. A medical prosthetic must integrate with its organic host (i.e., the human body). Failure to integrate successfully results in dislocation in one or in both. By analogy, this is what eco-design should achieve: a total physical, systemic, and temporal integration of our human-made built environment and our activities with our organic host, the natural environment, in a benign way. Thus, eco-design successfully bio-integrates our artificial systems both mechanically and organically with its host system in terms of ecosystems in the biosphere.

Design for bio-integration can be considered across three aspects: physical, systemic and temporal integration. Physical and systemic integration requires discerning the site's ecology. Any activity arising from design intervention or business/industries must physically integrate benignly with existing ecosystems. To achieve this, we must first understand the locality's ecosystem before imposing any human activity or built system upon it. Every site has an ecology with a limited capacity to withstand the stresses imposed upon it; if stressed beyond that limit, it becomes irrevocably damaged. Consequences can range from minimal localised impact, such as the clearing of a small land area for access, to total devastation of the entire land area, such as clearing away all trees and vegetation, levelling the topography, and diverting existing waterways, to name a few.


*Figure 2: Solaris. Rooftop gardens increase the planting areas on the site for the benefit of its users.*

We need to establish the locality's ecosystem structure, energy flow, its species' diversity, and other ecological properties and processes. Then we must identify which parts of the site (if any) can permit different types of structures and activities, and which parts are particularly sensitive. Finally, we must consider the likely impact of the intended construction and use over time. This, of course, is a major undertaking. It needs to be done diurnally over the year and, in some instances, over several years. To reduce this lengthy effort, landscape architects have developed the 'sieve-mapping' technique for landscape mapping. However, this method is an abbreviated approach and generally treats the site's ecosystem statically, potentially ignoring the dynamic forces taking place between the layers and within the ecosystem. Between each of these layers are complex interactions.

Another major design issue is the systemic integration of our built forms, their operational systems, and internal processes with the natural ecosystems. This integration is crucial because if our built systems and processes do not integrate with the natural systems, they will remain distinct, artificial items, and potentially become pollutants destructive to the local ecology. And the eventual integration post-manufacture and use can only be through biodegradation. Often, this requires a long-term natural process of decomposition.

Finally, temporal integration involves the conservation of renewable and non-renewable resources to ensure that these are sustainable for future generations. This includes designing for low energy-built systems that are almost independent from the use of non-renewable sources of energy.

### 3) Eco-mimesis

**The third design strategy** is to regard green design as eco-mimesis, as in imitating the attributes and properties of ecosystems, their processes, structure, features and functions. This is one of the fundamental premises of eco-design. Our built environment must imitate ecosystems in all respects (such as recycling using energy from the sun through photosynthesis), and become systems that head towards increasing energy efficiency, and achieve a holistic balance of biotic and abiotic constituents, etc.

Nature without humans exists in stasis. Can our businesses and built environment imitate nature's processes, structure, and functions? Can is particularly do this in terms of its ecosystems? For instance, ecosystems have no waste; everything is recycled within. By imitating this, our built environment could dodge waste generation. All emissions and products are continuously reused, recycled, and eventually reintegrated into the natural environment, in tandem with efficient use of energy and material resources.

*Figure 3: Neom Elevated Golf Course, designed to minimise the impact on the existing environment.*

Ecosystems in a biosphere are definable units containing both biotic and abiotic constituents acting together as a whole. From this concept, our businesses/industries and built environment should be designed analogous to the ecosystem's physical content, composition, and processes. For instance, rather than regarding architecture as just the creation of artistic objects or engineered enclosures, we should regard it as the deliverance of artefacts that need to be operationally (even if only eventually) integrated with nature.

As is self-evident, the material composition of our built environment is almost entirely inorganic, whereas ecosystems contain a complement of both biotic and abiotic constituents, or of inorganic and organic components which need to be reversed.

A myriad of construction, manufacturing and other activities are, in effect, making the biosphere less and less organic, artificial, and increasingly biologically simplified. To continue without balancing the biotic content means simply adding to the biosphere's artificiality, thereby making it increasingly less organic and more synthetic. This results in biological simplification of the biosphere and the reduction of its complexity and diversity. We must reverse this trend and balance our built environment with greater integral levels of biomass, ameliorating biodiversity and ecological connectivity in the shape of the built environment.

Eco-design also requires the designer to use green materials and assemblies of materials, and components that facilitate reuse, recycling, and reintegration over time (temporal integration) within ecological systems. We need to be eco-mimetic in our use of materials in the built environment. In ecosystems, all living organisms feed on continual flows of matter and energy from their environment to stay alive, and all living organisms continually produce outputs. Here, an ecosystem generates no waste and one specie's waste ends up as another specie's food. Thus, matter cycles continue through the web of life. It is this closing of the loop in reuse and recycling that our human-made environment must imitate.

**4) Eco-design as Restoring Impaired Environments**

**Fourthly, eco-design strategy** can be regarded not only as the creation of new artificial 'living' urban ecosystems or the rehabilitation of existing built environments and cities, but also as the restoration of existing impaired and devastated regional ecosystems within the wider landscape of our designed systems. Eco-design must look beyond the limitations of the project site to the larger context of the locality. We should improve the ecological linkages between our designed systems and our business models and strategies with the surrounding landscape and hardscapes, not just horizontally but also vertically.

*Figure 4: Solaris. A green path between structural columns.*

Achieving these linkages ensures a wider level of species connectivity, interaction, mobility, and a greater sharing of resources across boundaries. Such real improvements in the ecological nexus enhances biodiversity and further increases habitat resilience and species survival. Providing new ecological corridors and linkages in regional planning is crucial to making urban patterns more biologically viable.

Crucially we need to apply these concepts to retrofit our existing cities and urban development. We must bio-integrate the existing inorganic aspects of our built environment and its processes within the landscape to support them in becoming mutually eco-systemic. We must create human-made ecosystems compatible with natural ecosystems. By doing so, we enhance the ability of human-made ecosystems to sustain life in the biosphere.

### 5) Eco-design as a self-monitoring system

**The fifth eco-design strategy** is to regard our designed system as a series of interdependent environmental interactions that need to be monitored globally and locally (e.g., through GPS and biosensors, etc.), to ensure global environmental equilibrium. This enables an anticipatory approach to and the immediate repair and restoration of the environmental devastation caused by humans, natural disasters, and the inadvertent negative impacts of our human-built environment, activities and industries. These sets of environmental interactions need to be monitored for appropriate corrective actions to be taken immediately to maintain global, ecological stability.

*Figure 5: VADS. Sensors integrated into the facade system for irrigation from the rainwater harvesting system.*

The strategies mentioned above can be adopted singularly or in a composite manner to approach green design. Green design must go beyond the conventional rating systems such as LEED or BREEAM, etc. While they are indeed useful indices for providing standards to compare the 'greenness' of building design, they are not effective design tools by themselves. They are not comprehensive enough in approaching the issues of environmental design at local, regional, and global levels.

Science, research and innovation in eco-design and the development of the built environment typologies, including hospitals, schools, workplaces, public places and urban spaces must drive the policy and practice of national governments. It should strive to embody the discussed eco-design strategies, as well as salutogenic design principles, to shape our built environment with psychosocial design factors in order to promote health and wellbeing. The authors continue the search for a common strategy based on eco-design with salutogenic principles, to create a healthy global society.

*Figure 6: Solaris. Green corridors encourage walking and activities.*

## Introduction of Salutogenic Design

Despite improvements in the health and life expectancy of people living in developed countries in the 21st century, global healthcare systems face new challenges characterised by increasing healthcare costs, an ageing population, and a rise in the level of lifestyle diseases, most notably diabetes and obesity.

We are living in a post-industrial and post-pandemic global society, known as the knowledge or 'Google society', where health policy should focus on providing wellness and safety, along with the prevention and treatment of illness. We want to design healthcare infrastructure and a city master plan that is safe for social interaction, with the capacity to prevent diseases and pandemics. We must shift our focus beyond merely treating sickness. This requires a new way of looking at the impact of architecture and design to promote, support, and maintain safety, human health, and wellbeing.

We call this a health-promoting or salutogenic design approach to architecture and urban planning. It is an approach that is compatible with eco-design and sustainability. Greater consideration of salutogenic architecture leads to social innovation and economic growth, through the interdisciplinary application of sciences such as architecture, medicine, public health, psychology, design, and engineering along with culture, art, and music. In the following section, we will discuss some of the latest research findings that can be further developed.

Colleagues from government municipal and health departments, universities, health providers, and the industry also share the responsibility of connecting science, research, and innovation in eco-design and salutogenic principles with designers, architects, planners, and engineers, to drive the development of built environments and city infrastructures.

We will explore the principles of salutogenic design across the following topics:

- How do we embed health science and innovation into the creation of healthy built environments?
- How do we plan our cities, workplaces, healthcare facilities, schools, and public institutions to support human health and wellbeing?
- How do we implement ecological and salutogenic design to promote health and wellbeing?

## Theories and Perspectives on Health

According to Ewles and Simnett (1994), health is difficult to define, since it is a subjective experience. It is affected by norms and expectations and is also formed by previous experiences. There are a few different definitions of health.

- Lawrence has defined health as a condition where resources are developed in the relationship between humans and their biological, chemical, physical and social environment (Lawrence, R.J. 2002).
- According to WHO, 'Health is a state of *complete physical, mental and social well-being* and not merely the absence of disease or infirmity.'
- 'The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being, without distinction of race, religion, political belief, economic or social condition' (Preamble of the World Health Organization Constitution, 1948).

Health is considered a process composed of psychosocial factors, lifestyle, emotions, and experiences that lead to either disease or health. But there are also biological and measurable factors between them that determine the status of health or disease. The state of health for each of us is a matter of balance between the two processes. A salutogenic approach strengthens health processes, whereas a pathogenic approach highlights the processes of disease. For the latter, medical scientists have found 8,000 diagnoses or symptoms of diseases, but why has medical science ignored the search for the causes of health and what makes people healthy? They could just as well identify 8,000 *causes of health* or wellness factors that could lead to a healthier society.

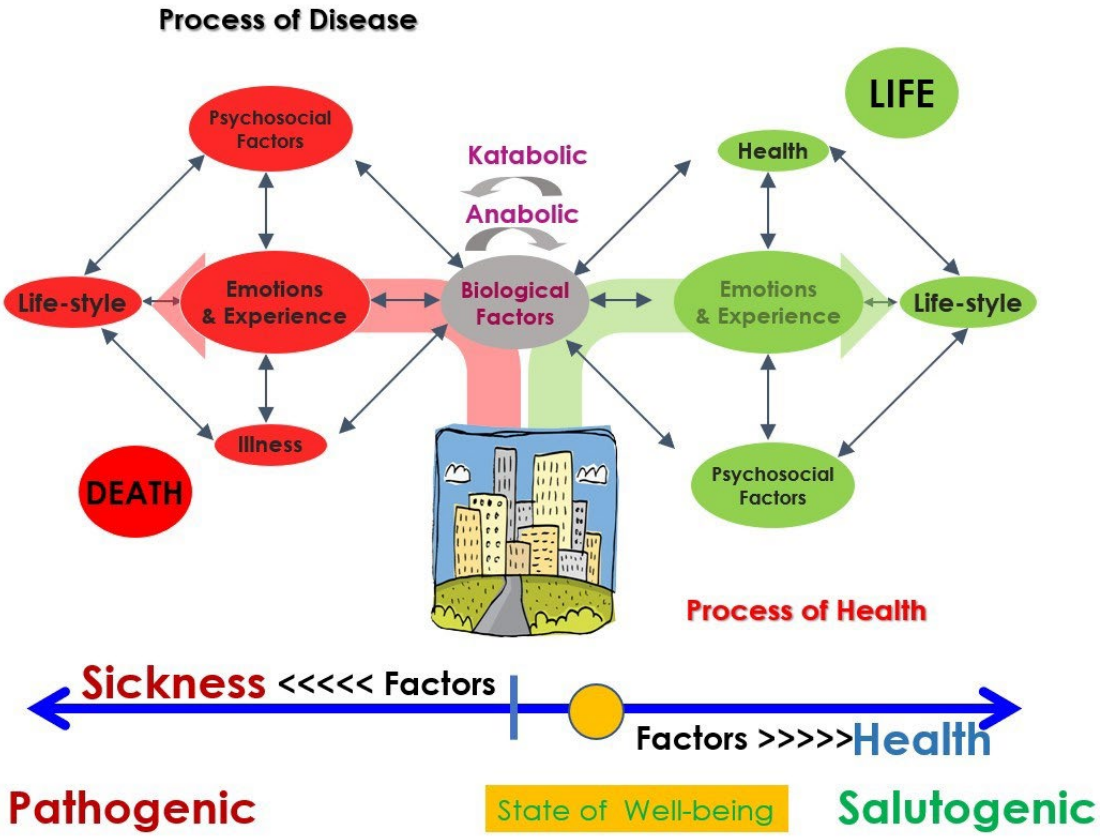



*Figure 9: The processes of health and disease, by Kristoffer Konarski and Alan Dilani.*

Emotions and experiences are central parts of the health process and can be strengthened by exposure to positive stimuli from the environments where we live, work, and play. The places where we live and work as well as the way we interact, alongside our exposure to stimuli from the built environment strongly influences our moods. This, in turn, affects health processes, emotions, experiences, our state-of-mind, and behaviour.

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 diseases (Andersen, Göransson & Petersson, 2004). In the Western world, the biomedical perspective has been the leading approach and has therefore formed the medical and healthcare fields. The holistic viewpoint emphasises multiple dimensions of health, including the physical, psychological, emotional, spiritual, and social (Nordenfelt, 1991).

To begin with, health can be divided into pathogenic and salutogenic research perspectives. Pathogenic research focuses on explaining why certain etiological factors cause disease and how they are developed in the physiological organism (Antonovsky, 1979). The primary aim of pathogenic research is often to find medical treatments. Salutogenic research is based on identifying wellness factors that maintain and promote health rather than investigating factors that cause disease. Together, the salutogenic and pathogenic approaches offer a deeper knowledge and understanding of health and disease (Antonovsky, 1991). The goal is to address the salutogenic question: what makes and keeps people healthy?

Antonovsky (1991) developed the concept of 'a sense of coherence (SOC)'. It posits 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 health. A strong sense of coherence predicts good

health, and a low sense of coherence predicts poor health (Suominen, Helenius, Blomberg, Uutela & Koskenvuo, 2001).

In his study, Heiman (2004) 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. The concept of a sense of coherence has three vital components: (1) *comprehensibility;* (2) *manageability;* and (3) *meaningfulness* (Antonovsky, 1991). A person with a strong sense of coherence scores high on all three components.

**Comprehensibility**, according to Antonovsky (1991), implies that an individual perceives their 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 it could be happening has a higher sense of coherence than one who cannot. A person with a low sense of coherence perceives himself as 'unlucky.'

**Manageability** comprises all the individual experiences a person has and all the resources necessary to cope with challenges and demands. This mean the individual feels they are influencing what is happening around them and does not perceive themselves to be a victim of circumstance. Antonovsky (1991) believes that a person's sense of meaningfulness is connected to their perception that there are important and meaningful phenomena in life.

**Meaningfulness** is the component that motivates a person's sense of coherence (Antonovsky, 1991). According to salutogenic theory, a sense of coherence is fostered by a person's ability to comprehend the built environment (comprehensibility), to be effective in their behaviour (manageability), and to find meaning in stimuli through exposure to the built environment (meaningfulness).

## The Impact of Built Environment on Health and Wellbeing

There is an interaction between human health and the built environment. According to Dilani (2006), 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 therefore design factors are essential for increasing comfort and safety (Dilani, 2001). Most humans in the Western world spend most of their time in indoor environments and there is a lack of knowledge about how these environments affect health and wellbeing. There is a general belief that humans are always adapting to the environment. Often called the theory of adaptation, this belief indicates that people become less conscious of the environment the longer they reside or work in that given space (Carnvale, 1992). There is a general belief that to allow oneself to be affected by physical surroundings is a sign of weakness.

In order to create supportive physical environments, it is crucial to understand an individual's fundamental needs (Heerwagen et al., 1995). It is also necessary for different professional disciplines to willingly cooperate in creating the best conditions for humans (Heerwagen et al. 1995; Lawrence, 2002). For example, 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 animals (Heerwagen et al., 1995). 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 heeded. The aim becomes 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 and propositions when a workplace is being designed.

Heerwagen et al. (1995), created a framework and guidelines for salutogenic design, which highlights the following factors: (1) social cohesion, both in terms of formal and informal meeting points; (2) personal control over the regulation of 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. Stokols (1992) 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 ergonomic design with non-toxic environments. Mental health can be promoted by personal control and predictability as well as through aesthetic, symbolic, and spiritual elements. Social health can be promoted through access to a social support network and participation in the design process. However, within health research, it is not a new idea to view the physical environment as a health-promoting factor. In the 19th century, Florence Nightingale developed a theory of healthcare which emphasises that physical elements are vital for an individual's health (SHSTF, 1989). Noise, lighting, and daylight, for example, were considered to be vital factors affecting a person's mood.

During the 20th century, different researchers developed stress models that illustrate how the physical environment may affect human health and wellbeing (Levi, 1972; Kagan & Levi, 1975; Dilani, 2001; Dilani 2006b).

Levi (1972) founded the stress theory, which was later developed by Kagan and Levi (1975). The model describes how the physical environment is the foundation on which societal organisation, structure and function is built and is, in the long run, critical to the promotion of health or disease (Dilani, 2001). The model is based on a system that points to a deeper understanding between the physical environment and a variety of human factors (Kalimo, 2005). The model describes that the physical environment is the basis for creating social organisation, structure, and function in society. According to Dilani (2001), the model (see figure below) describes how the physical environment is the foundation upon which social organisation, structure, and function 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.

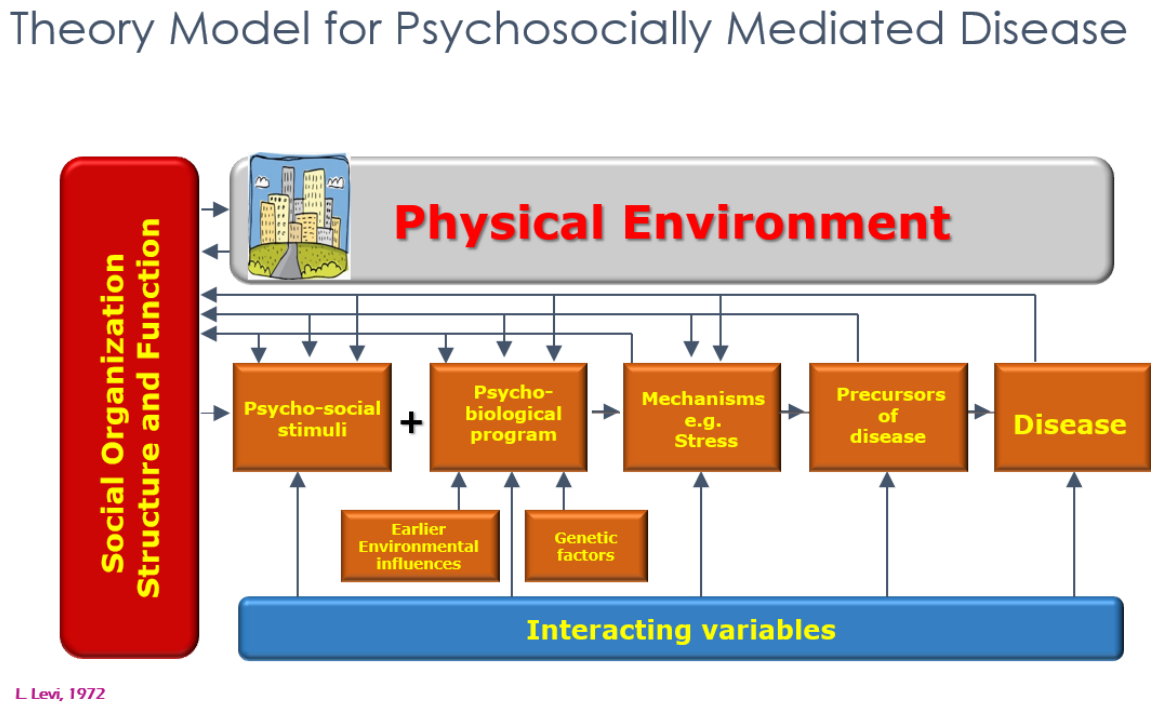



*Figure 10: Model presenting the theory for psychosocially mediated disease (Lennart Levi, 1972).*

According to Kalimo (2005), the theory has developed a deeper understanding of the effect of a physical environment on humans. Emdad (2005) has developed a model called Instability of Pyramids of Stress, where architecture and art are measurable variables. Emdad presents a new framework which, in relation to health in the workplace, has taken neuro-ergonomics 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. Furthermore, the employee will experience stress if the reward is too low or inadequate. The employee will also experience stress if they do not possess any suitable effort strategies in relation to psychosocial factors, home, and family factors or neuro-ergonomics. The model integrates all these factors and focuses on health, burnout, cardiovascular disease, and short-term memory.

## Salutogenic design principles

Salutogenic design principles serve to create healthy built environments that support users and local communities through the application of a holistic, knowledge-based approach to the delivery of healthy built environments. This approach is a systematic application of research-based knowledge with a focus on wellness design factors and exposure to positive stimuli which actively promote health, wellbeing, and quality of life. Salutogenic design environments stimulate and engage people, both mentally and socially, and support an individual's sense of coherence. The basic function of salutogenic design is to start a mental process by attracting human attention, which may reduce anxiety and promote positive psychological emotions. The principles of salutogenic design can be described as follows:

(1) *'Environmental comprehensibility'* that requires environmental orderliness, predictability, and legibility. This includes, for instance, the importance of creating visual order in the built environment with legible, intuitive wayfinding, the elimination of visual chaos, etc.

(2) '*Environmental manageability'* requires effective familiarity and social support etc.

(3) '*Environmental meaningfulness'* requires the provision of visual and aesthetic meaning, interesting positive stimuli, satisfaction, and attendant spaces for contemplation and restoration of the mind within the built environment.

According to Dilani and salutogenic design theory, a sense of coherence is fostered by people's ability to comprehend the built environment (comprehensibility), to be effective in terms of behaviour (manageability), and to find meaning from the stimuli and their exposure to the built environment (meaningfulness). A high degree of a sense of coherence supports people in managing stress.

## Translating Salutogenic Theory into Environmental Design Factors

The authors' professional experiences and research have shown that architectural parameters such as stimulation (intensity, variety, complexity, mystery, novelty, noise, light, odour, colour, crowding, visual exposure, proximity to circulation, adjacencies), coherence (legibility, organisation, thematic structure, predictability, landmark, signage, pathway configuration, distinctiveness, floor-plan complexity, circulation alignment, exterior vistas), affordances (ambiguity, sudden perceptual changes, perceptual-cue conflict, feedback), control (crowding, boundaries, climatic and light controls, spatial hierarchy, territoriality, symbolism, flexibility, responsiveness, privacy, depth, interconnectedness, functional distances, focal point, socio-fugal furniture arrangement), and restoration (minimal distraction, stimulus, shelter, fascination, solitude) are closely linked to the perception of positive and negative stress.

## Matrix of Key Design Factors as a Guide for Salutogenic Design

Today, when urbanization is rapidly increasing, especially in our post-pandemic society, people have been spending a large part of their lives at home, which has become the major place to live, rest and work. This will transform our future lifestyles. In addition, we need exposure to environmental quality that facilitates and actively supports healthy lifestyle behaviours. The Health House in Èze was developed with a salutogenic approach as an answer to today's need to prevent stress and promote health in housing environments.

Space planning in this project was based on the first 'Design Health Matrix,' co-developed by Dilani and Yeang as a tool and guide for the design of the salutogenic Health House. As a scientific development, it can be considered a model for promoting health and preventing stress in buildings. We tailored the design based on carefully identified psychosocial factors (i.e., stimuli, emotion, experiences, and the impact of a healthy lifestyle).

*Figure 11: The salutogenic Health House, designed with curvy organic form.*

*Figure 12: The Health House integrated into its natural surroundings and includes solar cells on the rooftop.*

*Figure 13: Living room with green wall and fireplace as psychosocial stimuli.*

*Figure 14: Living room in two-floor high space with infinity pool and waterfall as stimuli.*

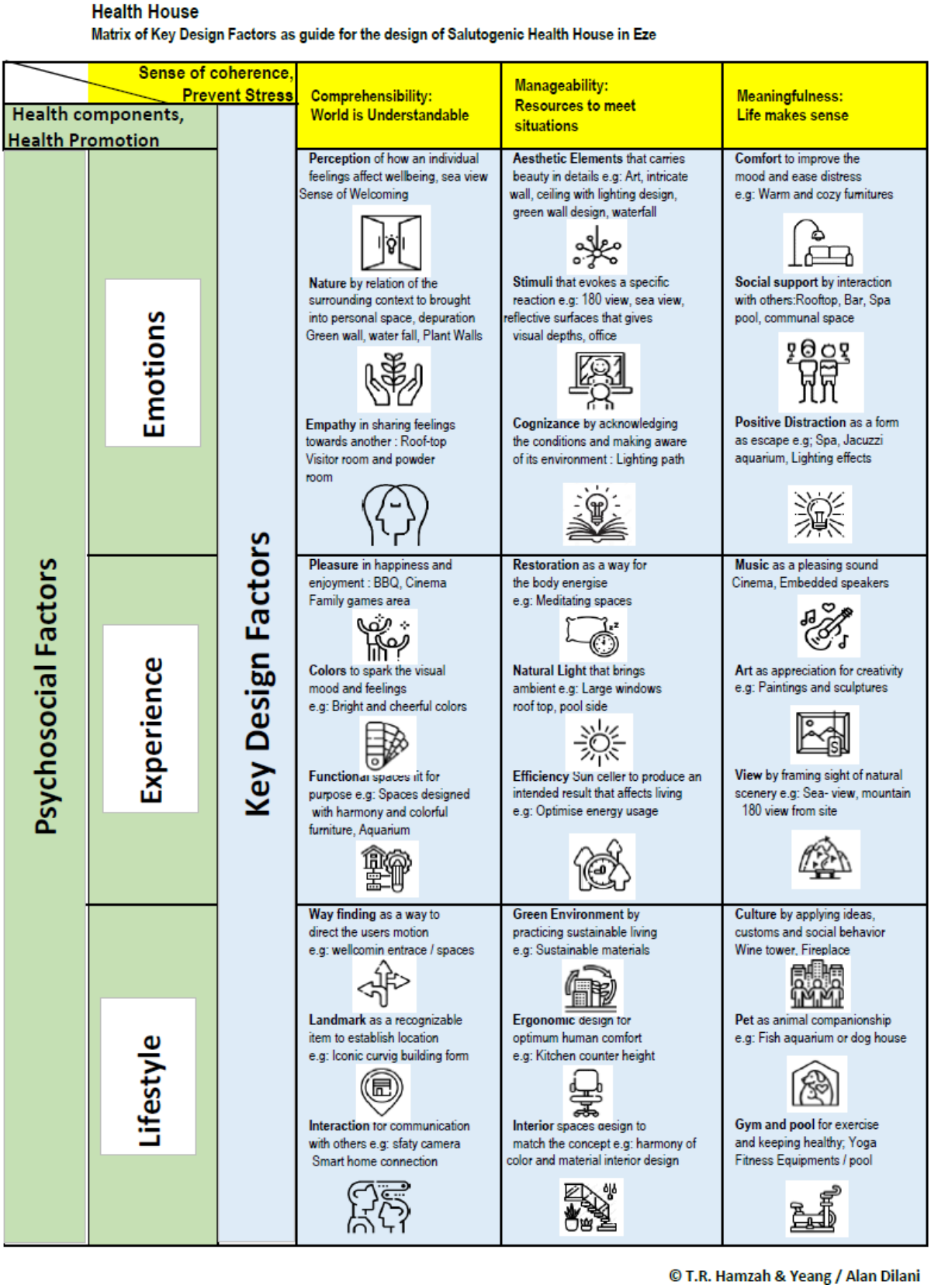



*Figure 15: Health Matrix of Key Design Factors for the Health House (Yeang & Dilani).*

## Space for Social Support

Social support is an important factor when the aim is to promote an individual's health and wellbeing (Costa, Clarke, Dobkin, Senecal, Fortin, Danoff and Esdaile, 1999; Saito, Sagawa, Kanagawa, 2005; Jacoby and Kozie-Peak, 1997; Oginska-Bulik, 2005). Knowledge and awareness of social support and its relation to health increased in the 1950s (Fleming, Baum and Singer, 1985). 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. It is therefore essential to identify design factors in the built environment and, through a salutogenic approach, create meeting points that can promote spontaneous social interaction and social support (Fleming et al. 1985; Conners, 1983).

*Figure 16: Campus concept. A large canopy shades the campus to create social spaces.*

Crowding is linked to social support and is often defined as the number of persons in a certain area or how much space every individual has in a certain area (Geas, 1994). Altman (1975) describes crowding as a condition where a person's private sphere is trespassed, such as when a person or group is exposed to more social interaction than is desirable. 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. This balance between social interaction and desired loneliness can be regulated and achieved if a person can control their own levels of social interaction (Maxwell, 2006).

## Crowding Space

Crowding can be reduced by creating buildings and spaces where the individual can control and decide if they would like to be in privacy or participate in social interactions (Altman, 1975). 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 crowding (Baum & Davis, 1980). Even a high ceiling can contribute to a reduced sense of crowding. Even though the area of the room is the same, people perceive a room with a high ceiling as lighter and more spacious.

*Figure 17: Plazas invite people to gather together and interact with others.*

*Figure 18: Before. A crowded sense of space. Ketchum Hall School before renovations.*

*Figure 19: After. Redesigned salutogenic learning environment. Ketchum School, by Tye Farrow.*

*Figure 20: Singapore Library. High ceilings create a sense of grandness.*

If design can create spaces that minimise crowding, it can reduce the experience of stress and promote social interaction (Baum & Valins, 1977). Crowding can also constrain social interaction and social support (Geas, 1994), which are closely linked to health and wellbeing (Costa, Clarke, Dobkin, Senecal, Fortin, Danoff & Esdaile, 1999; Saito, Sagawa & Kanagawa, 2005; Jacoby & Kozie-Peak, 1997; Oginska-Bulik, 2005). This illustrates the importance of identifying factors in the physical environment that promote spontaneous social interaction and social support (Fleming et al., 1985).

## 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. Many also aspire to get away from their hectic everyday lives during weekends and holidays to regain their strength in rejuvenating natural recreational areas. What 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 people?

## The Impact of Direct and Indirect Attention in Restoring Wellbeing

Kaplan and Kaplan (1989) have developed the Attentional Restorative Theory (ART), which identifies two attention systems and how they are related. The researchers have chosen to call them direct and indirect attention. 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 needs restoration, otherwise they 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.' A person who does not have the capacity to concentrate often becomes careless, less cooperative, and less competent (Kaplan & Kaplan 1989; Kaplan 1995; Herzog, Maguire, & Nebel, 2003). Therefore, in order to work efficiently, it is vital to have a well-functioning attention system and find time for restoration.

In their studies, Kaplan and Kaplan (1989; 1995) 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 routines, sounds and crowding, etc.

(2) The need for fascinating stimuli, which effortlessly stimulate the individual and reduce the risk of boredom.

(3) The need for extent (breathing space) which, at the same time, can create a feeling of being in a completely different world.

(4) The need for compatibility while performing one's tasks.

The restorative environment should be inviting and well balanced with an aesthetic beauty that allows people to reflect (Herzog, et al. 2003). Nature offers various colours, forms and scents which can encourage humans to forget about everyday life (Kaplan & Kaplan, 1989; Kaplan 1995; Herzog et al. 2003). Natural environments often offer an atmosphere where the individual's needs for harmony and compatibility are met. It is therefore very important that natural environments are accessible at the workplace. The ART has been tested and confirmed by different researchers (Herzog et al. 2003; Tennessen and Cimprich, 1995). One of the studies (Herzog et al., 2003)

showed that three of the four components (being away; extent; and compatibility) are seen as measurable indicators of how to create a restorative environment. Several studies have also confirmed that human beings perceive natural environments as more restorative than urban environments (Van den Berg, Hartig and Staats, 2007). Therefore, when human beings are tired and mentally exhausted, nature is the most appropriate place for restoration. Other studies have shown that viewing nature through a window has positive health outcomes (Moore, 1981-1982; Ulrich, 1984; Leather, Beale and Lawrence, 1998; Frumkin, 2001).

## Daylight, Sunlight, Windows, and the Effect of Lighting on Health

There is a great deal of research on the positive impact of daylight on a person's psychological wellbeing (Evans, 2003). A lack of daylight can lead to both physiological and psychological difficulties (Janssen & Laike, 2006). Another researcher studied a correctional institution in Michigan and the results proved that inmates who had their windows facing the prison yard were visiting the healthcare facility more often than inmates who had windows facing the forest and farming fields (Moore, 1981-1982). Ulrich & Lundén (1984) showed that hospital patients who were staying in rooms with windows facing nature were rehabilitated faster than patients who viewed a brick wall. Research has also shown that daylight in a classroom is necessary for pupils to maintain balanced hormone levels (Küller & Lindsten, 1992).

Windows can also have positive health outcomes on patients (Verderber, 1986; Lawson, 2001). For example, windows can contribute to improved health by allowing fresh air and daylight to enter, by providing a view and a link to the outer world, thus satisfying a patient's or prisoner's need for viewing seasonal variations (Verderber, 1986; Lawson, 2001). Another study showed that exposure to direct sunlight via windows in a workplace increased wellbeing in workers and had a positive impact on their attitudes and feelings of job satisfaction (Leather et al., 1998).

Rooms without windows can affect human health and wellbeing negatively (Janssen & Laike, 2006; Küller & Lindsten, 1992; Verderber, 1986). One of the studies showed that blue-collar workers who worked in rooms without windows experienced more tension and were more negative towards their physical working conditions than workers who had offices with windows (Heerwagen & Orians, 1986). Patients staying in rooms without windows can develop sensory deprivation and depressive reactions, exacerbating perception, cognition and attention difficulties (Verderber, 1986).

Since daylight positively impacts human physiology, it should be considered over artificial daylight, which only claims to have the same effect. According to some research, artificial daylight can positively affect cortisol levels in pupils and perhaps result in fewer sick days (Küller and Lindsten, 1992). Lack and Wright (1993) showed that exposure to lighting at certain times during a 24-hour period can prolong sleep and improve its quality. Energy consumption and costs can decrease if the individual has the ability to control lighting levels, which also has a positive impact on environmental resources (Moore, Carter and Slater, 2004). Furthermore, general feelings of satisfaction were higher in a person when they had the ability to control the lighting levels themselves. Küller's (2002) conclusion suggests that lighting will become more important in the future, especially since buildings without windows and with no access to natural daylight are becoming more common.

*Figure 21: Singapore Library. The large central atrium maximises daylight internally.*

*Figure 22: Daylight influences human physiology positively and restores the mind. Designed by Niels Torp.*

## The Impact of Colour on Health

Colours can possibly affect brain activity and create a sense of wellbeing and originality within architecture (Janssen, 2001). Colours can also have symbolic value and, in that way, contribute to the building's identity and/or cultural meaning. Colours should be of great interest to city planners, because of their aesthetic as well as symbolic value. They can also be used to reflect the organisation's philosophy. The so-called warm colours (red, yellow and orange) are considered to have an activating effect, while the so-called cold colours (blue, purple and green) are considered to have a calming effect (Küller, 1995). Küller (1995) refers to a well-known colour study from 1958 in which researchers conducted different physiological tests to investigate brain 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. Another study showed that restoration was more complete when the participants were exposed to blue light, which confirms that colours do affect brain activity (Ali, 1972).

Goldstein (1942) calls attention to an important viewpoint, which asserts that an individual's former experiences can affect their emotions, actions and behaviour, depending on what colour they are exposed to. There are geographical, cultural and historical factors that may affect a person's colour choice, and some colours have a religious meaning. Berlyne (1971) and Janssen (2001) highlight that colours should suit the contextual environment and it is important that colour activation should be well balanced to match the environment.

*Figure 23: Calvary Convention Center. Rainbow-coloured sun-shading panels create a playful visual impact.*

## The Impact of Design as a Landmark on Health and Wellbeing

Space is both what separates people from one another and bonds them together (Lawson, 2001). It is architecture, with its buildings, rooms, surfaces, dormitories, and facilities, that creates the prerequisites for individuals to cooperate, work in privacy, create relationships and fulfil their general social, psychological and physiological needs. According to Vischer (2005), an organisation's image and identity are viewed and expressed through its architectural facilities. Vischer (2005) also maintains that an 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.

Other design factors for wellbeing are landmarks in buildings (Dilani, 2004; 2006b). Landmarks are closely related to the perception of space and buildings which, in turn, are related to stress levels (Dilani, 2004), serving as reference points in the buildings for easy orientation and help in creating cognitive maps of the environment (Dilani, 2006b). These landmarks could be objects such as sculptures, paintings, aquariums, or different colours in different areas of the built environment that work as a GPS to help navigation, making way-finding much easier.

## The Impact of Noise Levels on Health and Wellbeing

*Figure 24 Concept Tower. Waterfalls from the top of the tower create a pleasant noise for the surrounding area.*

Noise is one of the most evident problems within public institutions. High noise levels can disturb sleep, increase stress and complicate communication (Janssen & Laike, 2006). Studies have shown that noise can contribute to irritation, which can lead to stress and stress-related diseases (Dijk, Souman, De Vires, 1987). Research has also shown that noise can lead to increased levels of cortisol (Brandenberger, Follenius, Wittersheim & Salame, 1980; Evans, Bullinger & Hygge, 1998). Other researchers proved that noise could increase an individual's blood pressure (Lang, Fouriaud & Jacquinet-Salord, 1992; and Evans et al., 1998). Noise can also negatively influence the healing process (Fife & Rappaport, 1976) and contribute to mental exhaustion which, in turn, may affect the amount of medication that a patient takes (Persinger, Tiller & Koren, 1999; Yoshida, Osada, Kawaguchi, Hosuhiyama, Yoshida & Yamamoto, 1997). Investigations have also established connections between noise, irritation, and lack of concentration (Dijk et al., 1987). Finally, other studies indicate that the perception of life quality decreases in a noisy environment (Evans et al., 1998) and high noise levels can also inhibit social interaction (Mathewes & Canon, 1975).

Leather, Beale and Sullivan (2003) have shown a significant relationship between noise and working demands, where a worker's perception of work stress decreases with lower noise levels. The researchers explain that workers in a less noisy environment need fewer coping strategies in order to adapt to the physical environment and 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. It is also important to realize that the experience of sound is highly individual (Staples, 1996). Kryter (1994) describes three variables that affect an individual's sound experience: volume, predictability, and possibilities for control.

## The Impact of Music on Health

There are sounds that can promote health. Lai, Chen, Chang, Hseih, Huang, Chang and Peng (2006) maintain that music is one of these factors, since it may contribute to a decreased activation in the sympathetic nervous system. Music has psychological effects and can unite people, open their senses, and help them cope with difficulties and trauma. Music may also lead to lower heart and breathing frequencies and increased body temperature. Lee, Chung, Chan and Chan (2005) conclude that music can be an effective method for decreasing negative physiological effects when people are suffering from anxiety and stress. Music, either by itself or in combination with therapeutic treatment, can improve a patient's healing process (Nilsson, 2003). For example, McCaffrey and Good (2000) 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. In her research, Spychiger (2000) showed that more music lessons in schools had positive emotional, social and cognitive effects and that the pupils with more music education cooperated better and had greater motivation for learning than pupils who had fewer lessons. Paul Robertson (2001) suggests that music is the richest language that expresses complex, emotional insight and, for a long time, has been linked to human wellbeing. Robertson also suggests how different music therapy programs are used instead of medicine, where the music rhythm and melody distracts patients' perception of pain and also reduces patients' stress hormone levels. The challenge of salutogenic design is to integrate space for musical experiences into the built environment.

## The Impact of Culture on Health

Participation in cultural activities such as dancing, singing, and visiting museums has a positive effect on human health (Koonlan, 2001). In his study, Koonlan (2001) proved the close connection between being an active cultural consumer and being able to increase an individual's health status rating. Koonlan also found support for his hypothesis in that, if a person changes their behaviour to participate in cultural activities, their perception of their own health becomes more positive. His study showed that individuals who did not participate in cultural activities had a 57% higher mortality risk compared to those who participated in cultural activities. The research showed that those who had not been participating in cultural activities, but had changed their behaviour to become active cultural consumers, had health almost as good at the end of the study as those who had been participating in cultural activities from the beginning. Another study showed that people who participate in cultural activities have the potential to live longer (Bygren, Benson & Johannson, 1996). Theorell (2000) concludes that cultural consumption is very important from a public health perspective.

Music can be a health-promoting activity in the built environment. Silber (2005) studied a choir project in an Israeli correctional institution for women, where the results indicated that participation in a choir had a positive effect. For example, the choir became a new social platform, where the participants created social bonds with one other. The inmates learned to listen to each other, receive criticism, and express themselves in a different way. Silber's (2005) research emphasises the value of choirs in prisons and explains that the choir can help the inmates improve their perceptions and relationships to others, including figures of authority. In a choir, the members must follow and trust the conductor, which can be good training for inmates, who often have difficulty with authority figures. In a prison, conflicts can arise regarding power and control between inmates and staff, the latter representing authority. With the conductor, the inmates have to cooperate and together strive for a common goal, which does not imply power or control. Furthermore, the choir generates a dynamic interrelation between its members. Every member has to control their own voice and, at the same time, listen and cooperate.

*Figure 25: Music restores the mind for medical staff after long hours of surgery.*

To achieve this, the members train their self-control, patience, intuition and trust, which can strengthen the inmates' self-esteem and give them a more positive self-image. Pratt (1990) considers that music can create a new reality, which can make it possible for an inmate to find herself/himself in another context. Music can create a sense of freedom, which can provide inmates with the inspiration and strength to change their behaviour. It can help the individual to survive, grow and create both a personal and collective identity. Pratt also explains that the space created by music reminds people about their fundamental and psychological need for freedom. Music can make a person forget about worrisome thoughts and emotions, allowing them to temporarily live in the present moment. Research on the choir's positive, social and therapeutic effects in prison environments is limited (Silber, 2005). However, there are several reasons why it is worth investigating how a choir can be a good method for helping inmates change their criminal behaviour, such as increasing self-esteem, empathy, self-control, and decreasing aggression and the need for immediate acknowledgment.

## Art, the Healing Process and Wellbeing

According to art historians, humans live today in a more aesthetic world where art, fashion and design offer countless aesthetic experiences (Leder, Belke, Oeberst and Augustin, 20004). When a person observes and appreciates different visual scenes, such as a piece of art, complex cognitive and emotional processes arise (Keith, 2001). In order to understand the meaning of a painting it is important to understand its different parts before it is possible to 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 and often lead to positive, satisfying and rewarding experiences for the viewer (Leder et al., 2004).

*Figure 26: Menara Suasana. Abstract art on the internal facade creates a sense of experience and appreciation.*

According to Kreitler and Kreitler (1972), art psychology is an empirical, scientific discipline that focuses on a person's internal and external behaviour and how they are related to art. There are several psychological theories that try to explain and describe an individual's experience of art. In summary, Kreitler and Kreitler believe that psychological models regarding art perception should be based on the homeostatic behaviour model, which suggests there is an optimal physical condition in which humans strive to reach the balance between tension and relaxation. This condition of homeostasis can explain some parts of an individual's relationship to art, and that the art experience can help an individual restore their homeostatic balance.

Art therapy (music, dance, painting, and drama therapy) has the unique potential to reach patients with psychosomatic diseases, who are otherwise difficult to reach with traditional therapeutic methods (Theorell & Konarski, 1998). For example, Argyle (2003) showed how a group of people identified as being in the risk zone for mental disease participated in different art projects, resulting in an improvement in their social and mental wellbeing. The participants testified that the project had strengthened their self-esteem and given them a sense of belonging to a social group. This health-promoting art project was also considered to be cost effective. Gardner (1994) also maintains that participation in different art processes can give individuals the tools to express feelings and experiences in a way that is non-verbal.

## Salutogenic Design and Productivity

*Figure 27: R-house. The swimming pool connects directly to the house.*

When an organisation's management wants to increase productivity, they often focus on employee competence and personal motivation rather than the physical environment and design (Heerwagen et al., 1995). In his study, Herzberg (1966) observed employee motivation and the relationship between worker behaviour and physical environment. When the physical environment is perceived as disturbing it can negatively affect employee motivation and thereby decrease productivity. Herzberg emphasised that it is necessary to have access to a physically supportive environment that can contribute to employee motivation. Maslow's (1987) theory of motivation is one of the most well-known theories related to human need and motivation. Maslow's theory was developed to analyse and explain the social environment but it can also be applicable to the physical environment (Heerwagen et al. 1995). For instance, the need for safety can be achieved through designed environments that allow people to have a good visual overview. If humans are not stimulated by their surroundings, they can easily lose interest and this can result in reduced performance (Lawson, 2001). On the other hand, too much stimulation can lead to stress, since a person may not have the capability to deal with the stimulation.

Increased knowledge and consciousness about the relationship between improved health and increased profitability would affect how designers, architects and managers design, build, and maintain buildings (Fisk, 2000). For instance, improved indoor climate can improve employee health, decrease the amount of sick days, reduce healthcare needs and increase productivity which, in turn, strengthens human capital and leads to higher levels of profitability for the company. Ergonomic improvement for employees has also been proven to increase a company's profitability. For example, IBM invested $186,000 in ergonomic education and implemented extended ergonomic changes, whereby they changed the design of the workplace and various working tools (Helander & Burris, 1995). The improvements contributed to better working positions, improved lighting, lower noise levels and better support with heavy work routines. The project decreased sick days by 19%, which generated an annual profit of $68,000. In addition, the changes contributed to higher productivity and improved quality, which led to an annual profit of $7,400,000. In other words, investments and changes within the physical environment led to profits through an increase in health conditions and productivity.

*Figure 28: An example of a healthy work environment, by BVN Australia.*


*Figure 29: Eco-design that promotes health in the workplace.*

## Discussion and Conclusion

Because of our knowledge-and-ideas-driven society, stimulated by the internet, it can be argued that diseases are becoming more psychosocial and psychosomatic in nature. Credible research is also finding that people who frequently experience positive emotions are also more likely to be healthier: they have fewer heart attacks, for example, and fewer colds. With the link between a positive outlook

and good physical health moving from hypothesis to fact, it is time to recognize that the way we live, where we work, and the way we interact with the built environment all have a tremendous impact on our emotions and experiences. These emotions and experiences are central parts of the health process that could be strengthened and supported by stimuli from salutogenic design and psychosocial design factors, including nature, with the most positive stimuli within the built environment.

The growing prevalence of non-communicable diseases (NCDs), or 'lifestyle diseases', is highly related to the quality of eco-design, built infrastructure and the design of the built environment. Suggestions about how we can reduce NCDs such as obesity are one of the primary challenges facing designers and planners. Ageing populations and urban growth are two further huge challenges to which eco-design could be applied to increase quality of life, exposure to positive stimuli, and an active lifestyle for the elderly. We must focus on the innovative design and planning of ecological, sustainable, healthy and salutogenic urban environments around the world. And it is the task of designers and planners to reconsider the value of eco-design and promote health with a knowledge-driven approach to salutogenic design.

The approach of eco-design and salutogenic architecture promotes a healthy lifestyle by creating a built environment that focuses on wellness factors that promote health, thereby contributing to the realization of a healthy society. An increase in the consideration of eco-design and salutogenic principles in architecture can lead to social innovation and economic growth, at least through its interdisciplinary approach, mixing sciences such as architecture, medicine, public health, psychology and engineering with culture, art and music.

The aesthetic value of our surroundings communicates the value of our society. Beautiful places are not only stimulating but have also been proven to be sources of enjoyment that make us feel less anxious and less stressed. A well-designed built environment can positively shape the social, psychological and behavioural patterns of our society. If we bring nature to the built environment through eco-design and fill our workplaces with art and culture, then we could optimise brain performance and restore our energies.

As more scientific research comes to light on the link between eco-design and salutogenic design and our health and wellbeing, it will become even more apparent that we need to develop applied research more robustly. The aim of this chapter is to illustrate how eco-design and salutogenic design principles are compatible with creating a built environment for a healthy global society. This research has shown that eco-design with salutogenic perspectives forms a theoretical framework for designing a built environment that could stimulate, engage and improve an individual's sense of coherence and thereby strengthen their coping strategies and promote health. To implement the above-mentioned design principles, it is necessary that organisations, governments and policy-makers understand the meaning of eco-design from a salutogenic perspective. Knowledge of which environmental factors contribute to health and wellbeing can thereafter become the guidelines for political decision-making.

In the process of making decisions it is important to have an interdisciplinary perspective where different individuals from different backgrounds and knowledge work together in this field. Professionals such as psychologists, architects, landscape architects, doctors, behavioural scientists, engineers and health promoters all have a part to play. Fortunately, it is becoming more common to use an interdisciplinary perspective as a central strategy (Barry, 2007). For example, the communication technology sector is recruiting sociologists, anthropologists and psychologists who can study and explain how a product will be used in different cultural contexts. The application of an interdisciplinary approach to work may challenge existing ways of thinking and make research and innovation more democratic and receptive to public input.

Decision-makers should take the following factors into consideration during the process of building: good lighting; positive interior distractions; and access to daylight, nature, art, symbolic and spiritual objects. Other important factors to be considered are the individual's need for control over lighting, noise, indoor temperature and the possibility of choosing when to seek social interaction and when to seek solitude. It is also important to create attractive and inviting spaces that promote social interaction and social support as well as creating spaces for restoration and private conversations. In order to motivate people to change their lifestyles it is necessary to offer them activities that strengthen their self-esteem and self-efficacy. This can partly be achieved by creating a salutogenic environment that facilitates healthy human behaviour and healthy lifestyle activities.

It is statistically proven that a person on average spends about 90% of their time indoors. It is therefore not surprising that more and more scientific studies demonstrate that the design, construction, and operation of buildings directly affects health. Air, microclimate, water, light, and decoration materials all have a powerful effect on both our physical and mental states. All business corporations striving for economic growth cannot ignore the problems arising from the incorrect organisation of the workspace, since the internal environment of the premises determines the health of employees and, ultimately, their productivity and the business's levels of profit. Our challenge is to commit to the innovation and fresh ideas that will inspire architects and planners to tackle a demanding economic outlook. The eco- and salutogenic design perspectives should be considered as a tool for designers to be more competitive: by designing highly salutogenic environments, we can reduce the rising burden of healthcare costs and save and improve lives on our planet.

According to Aaron Antonovsky;

> *"A measurable aspect of design that can help people operate at peak performance and help them to maintain physical and mental wellbeing. It is the ultimate investment in people in an architectural sense."*

In summary, this study has shed light on eco-design and salutogenic design principles for cities, the built environment and infrastructure that must promote health and wellbeing to increase productivity and profitability. Secondly, we have shown there is a need for more empirical studies that identify, investigate, and verify more benefits of eco-design and the salutogenic built environment. Thirdly, we encourage decision-makers to implement eco- and salutogenic design that promotes health and wellbeing.

Finally, it is important to acknowledge that ecological and salutogenic design approaches are still in their infancy. Neither has the perfect green building or green eco-city; nor has the complete application of salutogenic design principles been implemented yet. We can find some applications of these principles in the built environment but not their complete application in completed projects. There is more theoretical work, technical research and invention, environmental studies and design interpretation that needs to be done and tested before we can design a truly green built environment with an entirely salutogenic design approach.

We all need to continue this great search of our time, as it is the most important scientific question of our modern civilization in a post-pandemic era. How do we maintain our health and quality of life far into old age? How do we reduce the burden of lifestyle diseases by shaping our cities, the built environment, and infrastructure to actively promote health in a post-pandemic global society? This chapter presents the basic ideas and questions that need to be explored further in the coming years, highlighting the most important interdisciplinary research program to be developed in the future. The search for ecological and salutogenic design answers to create a sustainable and healthy global society will continue!

> ***"We shape our buildings; thereafter they shape us" (Sir Winston Churchill).***

> ***"Be the change you want to see in the world" (Mahatma Gandhi).***

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# THEME 2:

# SALUTOGENIC HEALTH SYSTEMS AND THE HEALTHCARE ENVIRONMENT

# CHAPTER II

# A SALUTOGENIC REDESIGN OF THE HEALTH SYSTEM

GUNTHER DE GRAEVE AND RICHARD ASHBY

Hospitals and health systems globally have been challenged to meet health outcomes. For decades, our health systems have focused on a pathogenic (disease) rather than a salutogenic (wellness) approach which, in turn, has contributed to the worldwide burden of disease. The challenges are well known and include an ageing population, significant comorbidities, chronic disease and changing patient expectations. Together with growing inequities in social determinants of health and wellbeing, these are contributing to demand on acute healthcare services that outstrip supply and are no longer affordable.

The solution to these health challenges is to work towards a salutogenic health system that transforms and optimises the current system to establish a sustainable service and infrastructure capacity to provide equitable and safe access. The current over-reliance on acute facilities to deliver care has led to infrastructure needs growing at a fast rate, with the size of hospital systems growing beyond what is sustainable. This is the result of infrastructure solutions being planned on historical activity and a focus on traditional models of acute care delivery rather than salutogenic-focused solutions. This has often led to infrastructure investment which does not meet the service need and is not able to adapt to new models of care and innovations, including digital and technology advancements.

Salutogenic-focused solutions would meet the patient and community expectations and reduce pressures because of changing expectations and demands. The modern patient is very aware of the factors relating to their health and wellness and is more technologically literate. Patients are expecting to receive timely care and to have their care delivered closer to or in the home. This is not a new concept, particularly for regional services, but it is also being pushed in our cities where convenient, safe and real time access to health services is in demand. Why drive in, find and pay for parking and wait hours to see a doctor for a 5-minute follow-up consultation when you could do so from the convenience of your living room, or break-out space at work? Why recover in an inpatient ward amongst patients experiencing severe illness when you could recover at home, supported by digital monitoring and consultation, and visits from a nurse when needed?

Changes to technology, with respect to digital health, are driving and enabling patient demands to be met. They are also driving changes in models of care that prioritise the long-term health of the community, focusing on out-of-hospital and preventative care. A salutogenic approach that includes preventive care has long been seen as the direction health services should take on the basis it will be better for patients, will reduce acute health needs and will ultimately be more financially sustainable. Digital technologies and an alignment of patient demands are making these shifts a reality. When combined, these challenges suggest we can no longer plan, deliver, or fund health services as we traditionally have.

Future salutogenic health systems must base the planning of health care services, infrastructure, workforce, and financial budgets on the following principles:

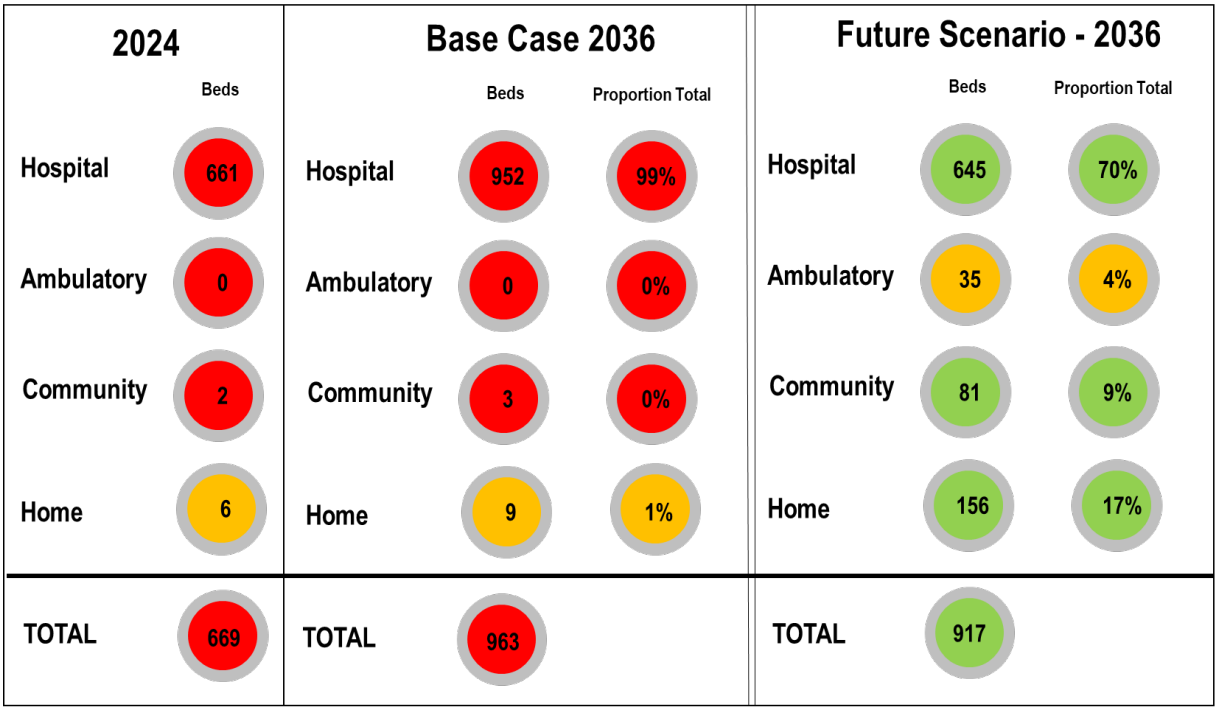
1. ***Sociable by Design***
   Fostering an environment that is patient- and staff-focused and responsive to their physical, emotional, intellectual, social, psychosocial, and spiritual needs.
2. ***Digital by Design***
   Health services that optimise safety, quality and efficiency of patient care and outcomes by integrating digital technology and platforms across the full spectrum of clinical and non-clinical functions/operation.
3. ***Adaptable by Design***
   Ability to adapt infrastructure and models of care swiftly and appropriately to changes which impact health services. This includes changes in policy and protocols, technology and medical advancements, demand and utilisation and, importantly, patient and staff expectations.
4. ***Sustainable by Design***
   Enable a health system which can provide safe, high quality care in a manner which is sustainable in terms of the economy, system funding, the environment, and the workforce.

Advancing this requires a new approach to health-service planning, operational funding and capital planning and delivery of health services that is integrated. A new approach – *the Salutogenic Health System Framework* – is put forward.

> *This patient focused approach is based on querying what service innovations, technology, models of care and preferred locations of health service delivery will be applied, and how they will impact the traditional quantum of hospital-based service we provide, how we will provide it and where we will provide it.*

The planning process focuses on care needs, health and wellness, and caring for people close to home off-site from an acute hospital campus unless clinically required. The conversation regarding requirements to deliver health care into the future is totally transformed, centring on the question: *"What will change in the future by way of technology and the way you deliver your services, and will that impact how and where you deliver your them?"* This question is key to all future service planning activities.

This new approach has recently been tested in a pilot in Australia. The new methodology was run as an alternative scenario in parallel to the traditional approved planning approach. Figure 1 clearly demonstrates the difference in the physical inpatient beds required. Under the traditional planning approach (base case), the hospital is projected to require an additional 291 acute beds by 2036. Under the new approach, care is delivered in alternative settings including the home, in the community and in ambulatory care. No new acute beds are required. Early indications of capital costing demonstrate significant capital savings compared to the traditional model. However, these changes would require significant funding policy change.




This new salutogenic planning approach will necessitate changes to operational funding models that underpin the health system. Existing health funding models are not well equipped to support collaborative care, out-of-hospital care, virtual and telehealth services, and innovations such as continuous remote monitoring and prevention of care for patients to avoid and manage hospitalisations. Significant changes are urgently required to enable care providers to actively drive care outside the hospital setting. In the short term, care providers could be funded using population-based funding models (modified by population-based factors such as the Socio-Economic Index for Areas (SEIFA)). Hospitals would continue to be funded primarily via activity-based funding but would be able to fund new models via outcome-based capitation, FFS, and block grant mechanisms. A raft of other changes to enable more hospital-in-the-home style services, supported by telehealth visits, will assist in significantly transforming the delivery of health care.

In the long term, there is a need to advocate funding model reform to ensure appropriate costing and pricing for services that are not provided by hospital-admitted and non-admitted services. This will allow for preventative measures such as digital care and remote monitoring and new, more efficient models of home and community-based care. Changes to health service funding are necessary to enable care providers to have the confidence that the changes they plan for will be implemented and funded, taking away a primary risk factor in implementing these changes.

Changes to health infrastructure planning, design and delivery are also necessary to support future innovations and to enable delivery of care closer to and in the home. New infrastructure such as digital care and navigation centres, and a centre that monitors, evaluates, and delivers care to patients virtually, are required to enable new, digitally-enabled models of care. A focus on smaller community-based health facilities that support more out-of-hospital, community and home-based care is also required. There is significant opportunity to reduce capital expenditure in the health system through building fewer acute hospital buildings (these are complex and expensive) and more ambulatory, community and digital infrastructure which is readily available and can be delivered at significantly less expense. Changes to infrastructure planning to ensure spaces are digitally enabled, sociably designed, and are flexible and adaptable to changing health needs in the future is necessary. This is critical as it will ensure health infrastructure can be best leveraged to meet future health needs without the potential for costly adaptations or new infrastructure in the mid-term. This requires the

reform of many design guidelines to change their focus from an overly prescriptive pathogenic approach to an outcome/performance-based system that allows for swift responses to new developments. This is necessary for innovation and change based on evidence or practice to be included within infrastructure and service-planning going forward.

## Issues impacting the sustainability of hospital and health services

Hospitals and health systems are being increasingly challenged to deliver excellent health outcomes within tight fiscal environments. Contributing to the challenges are an ageing population, an increasing burden of chronic disease, increasing patient expectations and, to a lesser extent, population growth. These are resulting in health service demands outgrowing population and gross domestic product (GDP) growth. This is creating challenges for our health system, with hospital performance a constant challenge, even where new facilities have been constructed to assist with growing acute demands.

The health system, however, is challenged to keep pace with rapid advancements in models of care, digital and technology advancements, and patient expectations, and is not adapting at the pace required. Activity-based policy rather than outcome-based policy and aligned funding and capital processes are contributing to this barrier stymieing the ability for the health system and its care providers to respond to these challenges. We consider some of the key drivers demanding health-service system change in detail further below.

### *Patient demand, emerging technology and models of care*

Health patients are increasingly digitally savvy, with many having high expectations regarding their care and treatment. Patients are also wanting health care to be convenient, safe, and delivered as close to home as is clinically safe to do so. Programs such as Rehabilitation at Home, Hospital in the Home, dialysis and IV Chemotherapy in community settings and home- and community-based mental health services are all well aligned to patient preference. However, the proportion of these services against total hospital activity is currently extremely low. The roll out of these services is stymied by requirements for nurses to physically visit patients every day. With digital health initiatives, including continuous monitoring using loaned equipment and telehealth consultations, the delivery of community and home-based services could significantly increase. These changing patient expectations are reflective of a trend beyond the health industry with most patients having access to the internet.

Digital health technologies and models of care are maturing at a fast rate and will continue to rapidly evolve over time. The key confluence is that digital technology is increasingly improving care and enabling demand to be met, often in quite different ways to that of traditional health care. A snapshot of some digital health technologies that are rapidly advancing and changing care are described below:

- **Wearables:** devices that we wear that can gather information about our activity that can be assessed live or after the fact, allowing remote management of care, increased self-awareness and the ability to intervene as soon as an issue arises. Examples include the Verily Study Watch (gathers ECG and other activity data for patients with cardiac disease), Apple Watch 6 (ability to detect hard falls, ECG monitoring and the ability to automatically communicate issues to carers) and Smart-Fabrics (allowing wearers an increased awareness of and ability to respond to environmental conditions (temperature, mechanical, chemical changes, etc.).
- **Ingestibles and Implantables:** devices that assist with diagnostics or automatic dispensing of medication. Examples include the CAPSOCAM, which is a micro-camera pill that allows investigation of the small intestine and can be used at home; and digital medication systems that are able to remotely monitor medication compliance — a major issue in many chronic diseases.

- **Bio-Printing / 3D printing:** the use of detailed imaging and 3D printing to print prostheses that are specifically tailored to patient needs in a live manner, significantly reducing intervention times and ensuring prosthesis are personalised.
- **Genomics and related fields:** the use of genomic, radiomic, proteomics and microbiomics to better understand and tailor the delivery of health care to individual circumstances, significantly advancing precision medicine, patient health, and economic outcomes.
- **Robotics:** The use of robots in pharmacy, imaging, pathology, and surgery, as well as in service delivery and supply chains. Robotics can ensure more precise and faster delivery for specific services, increasing efficiency and reducing opportunity for human error.
- **Big Data / AI / Analytics:** The use of artificial intelligence (AI) or advanced data analysis systems to identify correlations and opportunities for improved intervention and efficiency of service delivery, from amongst the myriad of health and personal data available. For example, the use of an automated plate-assessment system (APAS Independence – LBT innovations and Clever Culture Systems), a technology that uses AI to read culture-plate screening in pathology labs, increasing the efficiency of this process and allowing micro-biologists to focus their time on positive plate readings.

These are coupled with the myriad of non-digital innovations in health such as new drugs and vaccines, as well as patient health-related technology and the Internet of Things with its ubiquitous sensing and monitoring capabilities. There are incredible opportunities for technology-driven improvements to health care in the future, at least some of which are predictable today and which should therefore be contemplated in health-service planning. Examples of known technologies include driverless cars, which will reduce road trauma, down to the simple Fitbit and its descendants, assisting users in tracking key health data, improving their fitness and encouraging healthier lifestyles.

Notwithstanding these future-focused technologies, there are changes to models of care and innovations delivered now that are not translating into new service planning and delivery. For example, the management of diabetes outside of a specialist inpatient setting, with a focus on collaboration for the monitoring, treatment and sharing of information about a patient between hospital specialists, primary and community care providers has been demonstrated to reduce hospital admissions across a range of diabetes-related hospital admission pathways[1]. Over a 5-year study, between 22% and 42% of diabetes-related hospital admissions were avoided, with a concurrent saving estimated at more than $1,900,000. With digital technology enabling continuous monitoring of blood glucose and other matters, patients who present to the GP may be able to be immediately added to a program of collaborative care. Real time information could be monitored to ensure patient health is managed before it deteriorates, and prior to patients presenting to the ED and becoming inpatients. This type of care, enabled by digital technology, could be delivered today with real impact on improving patient outcomes, and reducing ED presentations, outpatient appointments and hospitalisations. The resulting cost savings and changes to future health-service demand and health infrastructure should be planned for.

The key issue is that our care providers are either slow on the uptake or are not progressing with the delivery of care via these new mediums. While some caution in the rolling out of new means to deliver services is warranted, traditional planning for future health-service needs and its consequent health infrastructure does not consider the potential of these changes.

> ***"This means that traditional health service planning locks in the way we deliver health services in the past, as opposed to the way we may deliver them in the future."***

Many of these changes have been stymied by a health-funding system that does not enable these new methods of care to be funded. What is not funded will not be undertaken. This is a significant and real barrier that is often cited as a core reason for not progressing alternate health service models.

The perceived time and effort to advocate and enact funding for changes is a barrier to advancing an aspirational change agenda.

However, crisis can generate rapid change. COVID-19 restrictions forced many health systems to adapt by providing remote mediums — primarily phone but also via web-based tele-health applications. Governments, clinicians, and patients were quick to adopt significant change and become familiar with these practices to ensure health care could continue to be delivered. The funding system also adapted, allowing these rapid changes in practice to be billable.

The impacts were felt beyond the initial nationwide lockdown. The Australian Institute of Health and Welfare (AIHW) published data for March to August. MBS services demonstrates 20% to 30% of patients were consulted via the telephone or video-conference, and where the problem was obvious in a GP setting, more than 50% were delivered via these means[2]. People adapted and continued to use the more convenient and accessible services despite lockdowns easing. We can expect the change to continue provided that funding continues for these mechanisms. If applied to an outpatient setting, such significant proportions of care delivered via these means has the potential to radically change the way outpatient care is delivered. This will impact health-service planning, infrastructure, and funding. Unfortunately, regardless of this significant change, planning and funding of outpatient services continues in a traditional, historical approach.

Patient demand, the increasing use, prevalence and capability of digital technology, and its consequent enablement of new models of care are significant changes for care providers. However, they also offer potential solutions to deteriorating performance and can improve financial sustainability. Opportunities to better embed changes supporting patient demands, new models of care and digital technologies into our planning, funding and infrastructure design are discussed further below.

### *Performance and financial sustainability of care providers*

Historically, in many developed countries, the primary solution to deteriorating hospital performance has been to build more hospitals. Large capital expenditure, long planning horizons, significant workforce increases and increases in operational expenditure all follow. While investing in acute health-service infrastructure can be justified, it does not necessarily lead to improved health outcomes. It does often lead to declining financial sustainability.

## An example from Queensland, Australia

The Queensland Audit Office's Financial Audit Report, Health 2020[3], identifies that the financial sustainability of hospital and health services (HHS) continues to decline, with 11 HHSs reporting operational losses totalling $82,000,000 (an increase of $48,000,000 compared to the previous year) and 7 HHSs reporting losses since they were created in 2012. There was a 4% increase in frontline health workers and an 8% increase in employee expenses. The quality of care from our health workers is not questioned. However, if expense growth continues at its present pace, the cost of the health system will soon become unaffordable. This is an issue as it will curtail the ability to deliver health services. The sheer growth in workforce is also an issue. Providing nurses by the bedside will become increasingly difficult as advertised positions outstrip graduate supply. This is already a significant issue for regional and remote areas and will be a larger issue across all health services in the future.

Of the 16 HHSs across Queensland, 15 (rural, regional, and metropolitan) are experiencing increasing costs to deliver a Queensland Weighted Activity Unit (QWAU). The cost of delivering a QWAU is generally increasing year on year above the funded value. The increasing capital stock and prevalence of older capital stock amongst some health services is leading to high asset maintenance costs.

From a capital perspective, HHSs with newer capital infrastructure, where an assumption could be made that operational costs should be more efficient and infrastructure should be more closely aligned to population needs, are experiencing large operational deficits (e.g. Sunshine Coast, $27,000,000; Gold Coast, $11,700,000). From a capital-planning perspective, the length of time it takes to plan, deliver, and commission health infrastructure is generally seven or more years. There is significant risk that what is initially planned for does not align with the needs of the population when it opens, and for future years.

> "***Effectively, we are building future infrastructure for past models of care. Considering patient demand, digital technology and changing models of care will change the type of clinical and support spaces we need in the future, planning our infrastructure with the future in mind is critical."***

Compounding the issue of cost and future functionality is the fact that health infrastructure is expanding in size (and hence cost) to deliver the same clinical service. Much of this is driven by Australasian Health Facility Guidelines (AHFG) being strictly adhered to, with these guidelines significantly increasing the area requirements for clinical, non-clinical, circulation and travel spaces. Increasing area results in increased capital costs, and operational costs for cleaning, heating and cooling, lighting, and staffing. For the same clinical space, a hospital built today can be up to 50% larger than hospitals built in the past. Even considering the trend towards single bedrooms, when applying a 50-50 single to double-bed split, the increase in size is still 45%, indicating the increase in size is not only to do with improvements to patient amenity. These increases are not always necessary. Opportunities to better plan adaptable vs bespoke spaces in consultation with clinicians, with future changes in mind, can lead to efficient space allocation while meeting clinical needs and safety requirements. On the other hand, the AHFG deal poorly with the design aspects of contemporary digital hospitals with some recently opened large hospitals having inadequate digital infrastructure from the start, leading directly to system failure and major incidents.

> "***It is clear it is becoming more expensive to deliver health services under traditional models of care service settings and a holistic approach to change is urgently required."***

It is not tenable or possible to continue increasing costs for the delivery of the same level of service while burdening society and the health system with large capital expenditure and its subsequent operational and maintenance costs. At some point, access to health services will be curtailed as the available funding will not be able to cover the service demand. This has the potential to impact health outcomes. While improvements to efficiency and productivity can be made within traditional service delivery, there is significant opportunity to drive innovative change enabled by digital technologies. This will enhance productivity in the delivery of health services.

Further, delivery under traditional models does not necessarily increase access or health outcomes. Issues with ambulance ramping, patients not being seen within clinically recommended time frames in the emergency department, growing elective surgery waiting lists, and bed blockage are all symptomatic of existing models of care under pressure.

These models are experiencing pressure as health service demand is outstripping population growth. As older persons make up a greater proportion of our population the consequent demand for health services is increasing at a fast pace, placing them under more pressure. Health issues associated with social disadvantage, including poor health behaviours (e.g., nutrition, tobacco, and alcohol intake), lead to higher prevalence of preventable and/or chronic illnesses. Health services that have pockets of older persons or areas with social disadvantage experience health service demand that is increasing faster than the growth in the population. Treatment under traditional models is also often too late to make a large impact to the health outcomes for such patients. Early intervention and preventative health initiatives would improve health outcomes and potentially reduce acute health-service demand.

Additionally, the tyranny of distance does not lend itself well to the delivery of health services under traditional models. Regional and remote areas have remarkably high patient transport and staff travel costs, a necessary expense for traditional models. This only continues to grow as regional and remote areas have higher proportions of older people, greater social disadvantage, and higher proportions of Aboriginal and Torres Strait Islander people. Access is often curtailed for these groups as not only is the cost prohibitive, but the time also required away from work, family and community means patients choose not to receive care. This exacerbates acute episodes of care, further embedding traditional models. It also leads to lower life expectancy in these areas. Not unsurprisingly, regional and remote areas include some of the highest users of tele-health, a direct means of curtailing the tyranny of distance, increasing access, and improving health outcomes. New models of care, enabled by digital technologies, could significantly increase access for these communities, allowing the re-allocation of travel expenditure back to health care.

The combination of an ageing population, issues associated with social disadvantage, distance and increasing capital design inefficiencies are leading to a situation where access to health services is curtailed, health outcomes will increasingly become compromised, and the operational position of health services will decline.

Planning our services and infrastructure in a manner that embraces patient demand, digital technology and new models of care has the potential to reverse these trends.

## Opportunities to Improve the Sustainability of Health Services and Infrastructure

While the challenges are considerable for the health system, many of the challenges faced present as opportunities for change. Salutogenic service planning is the beginning of this process. Health service planning should be adapted to be future-oriented and to embed emerging digital technology and new models of care into the modelling of projected service and infrastructure needs. A salutogenic servicing planning method is articulated below.

Beyond planning, the delivery of digital and new models of care relies on alternative funding models and changes to infrastructure planning by way of new and adapted facilities. A raft of operational funding changes is needed to allow funding for these models to be obtained, ensuring they will be able to be implemented. A description of alternate health facility infrastructure planning, including new building typologies, a preference for out-of-hospital facilities and ensuring facilities are adaptable and flexible to future health service needs is described in this chapter.

### *A salutogenic approach to service planning, informed by patients, emerging technologies, and changing models of care*

A new approach to service planning is proposed. This new approach — the Salutogenic Service and Infrastructure Planning Framework — will enable future-orientated service scenarios to be explored to respond to changing health, social and population health needs, versus the traditional historical assessment approach. The new approach and framework are outlined below.

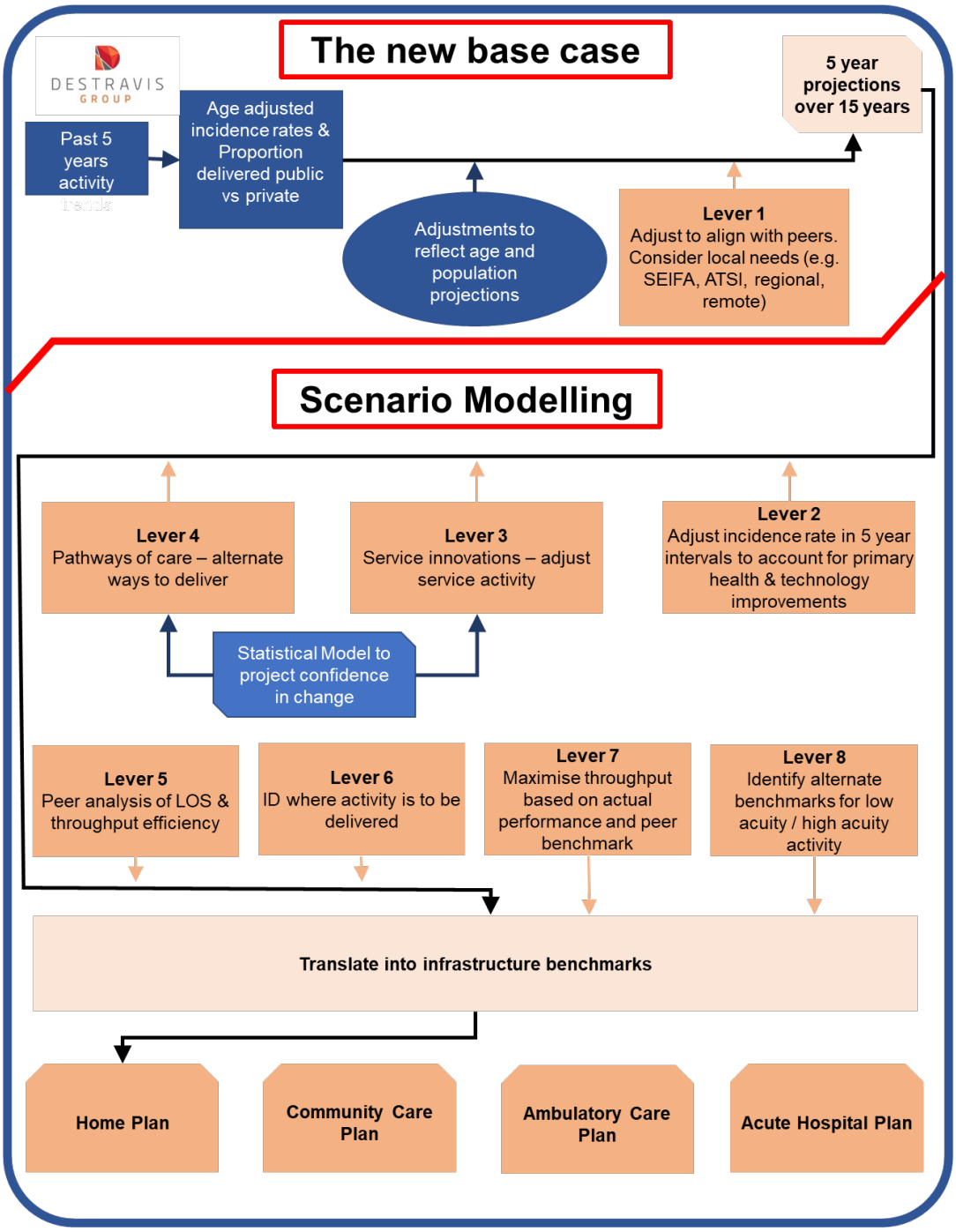



*Figure 2 – Salutogenic Service and Infrastructure Planning Framework.*

The new framework transforms service planning to focus on delivering care in line with future models of care underpinned by digital care and new technologies. This transformative change informs clinical demand projections that are reviewed and tested with clinicians to determine implications locally and on the system as a whole. Clinical demand projections inform supply requirements that consider the service setting and facility typology of where care will be delivered, including care at home, in the community, in ambulatory care centres, and acute hospital environments.

The process transforms the conversation on future health service needs, centring on the following questions:

- ***What services will the population need in the future and how will these services be delivered?***

- ***How will technology change the way services are delivered and will that impact how and where you deliver them?***

These questions are key to ensuring all future service planning activities are integrated and future orientated.

This approach builds on traditional service planning models including historical activity projections that are based on trends in the past 5 years of service activity. The approach maintains the age adjustment of these projections to align with population growth and characteristics. The salutogenic scenario also includes the following levers of change:

1. **Incidence rate adjustment**. To align with peer health services or populations. Considers SEIFA, ATSI, CALD, regional and remote allowances.
2. **Incidence rate adjustment**. To consider improvements in community health, primary health, or population-wide health programs (e.g., healthy eating, exercise, obesity reduction programs for children etc.). This lever is expected to yield small, incremental changes over a long period of time.
3. **Service Innovations**. Adjust service activity to account for innovative service delivery or new technology. Examples include remote monitoring of patients that may divert activity to new home- and community-based models; reduction in inpatient admission via early intervention programs; reduction in ED presentations for repeat attendees, the elderly, persons with chronic conditions and mental health conditions via a range of assisted primary health, community health, remote monitoring, and outreach services.
4. **Alternate pathways of care**. Identify significant technology or model-of-care changes that will ensure persons can be treated in new or alternate infrastructure. For example, diverting low acuity endoscopy (e.g., monitoring) from an endoscopy room in a hospital to a minor procedure room with an alternate staffing profile.
5. **Operational efficiency**. Consult peer hospital performance to determine if there are operational efficiencies that can be learned that will reduce LOS, improve patient flow, and increase service throughput without impacting patient outcomes or requiring more infrastructure. Apply modifications as appropriate, targeting performance to the top quartile of peer performance.
6. **Identify activity location**. Identify where the activity is to be delivered. Activity to be split into 4 pathways: hospital; ambulatory; community; or in the home. Examples may include providing a percentage of activity for medical admissions as ‘Hospital in the Home’, modifying the percentage of surgical activities and associated outpatients delivered in hospitals versus ambulatory settings.
7. **Maximise infrastructure throughput**. Identify actual throughput for spaces to determine the existing efficiency of service infrastructure. If it is below the benchmark, consult peer performance on infrastructure throughput to determine if there are practices that could be implemented that would increase throughput to the top quartile performance. Consider an extension of operational hours (evening and Saturday services) to increase infrastructure efficiency and improve accessibility for patients.
8. **Throttle infrastructure throughput**. It is recognised that emergency and complexity in some patients reduces the efficient use of some spaces within hospitals. The opposite is true for low complexity and planned activities, where increased efficiencies can be achieved. Achieving a scale of service allows the throttling of infrastructure to reflect different acuities and mixes of emergency and planned care. Lowering infrastructure throughput for emergency and complex care allows for appropriate delivery of infrastructure for these needs. The opposite is true for low acuity and planned care, where increasing throughput is possible. The selection of variable benchmarks dependent on the activity mix of the service should be considered under this lever, in conjunction with lever 7.

Levers 3 and 4 are supported by the recommendation to undertake statistical modelling for significant changes to service delivery or assumptions, based on several factors. This will allow some level of risk adjustment to be provided within the alternate projections, providing low, medium, and high levels of change to be modelled. It is recommended that statistical modelling considers the following factors to allow for the uncertainty of introducing new models of care or infrastructure into future service projections:

1. **Community acceptance**. Analyse the level of community acceptance of delivering a service differently or implementing new technology.
2. **Clinical acceptance**. Analyse the level of acceptance amongst the clinical workforce to the proposed changes.
3. **Clinical readiness**. Analyse the ability of clinicians to undertake the changes with or without significant training, education, or governance.
4. **Technological capability**. Identify the technology's ability to support the change identified (i.e., technology maturity, support of research through clinical trials etc.).

Lever 6 involves defining where care is delivered under the following four areas:

1. **Hospital.** Traditional acute delivery of same day and overnight hospital beds, procedural and outpatient-based services.
2. **Ambulatory.** An out-of-hospital health setting for primarily same-day activity (e.g., same-day surgical, dialysis, outpatient, rehabilitation) where patients can travel to and from the centre themselves without assistance. No overnight activity.
3. **Community.** Health services delivered in a community health centre or other health facility, where services are delivered in a setting with a residential look and feel, or within a residential or neighbourhood commercial centre. Examples include community health centres, residential rehabilitation or mental health, community dialysis centres.
4. **Home.** Services delivered in the home, either from visiting health specialists or using remote monitoring and tele-health technology.

The application of this method as a line of enquiry through service planning in processes will allow care providers to develop salutogenic service scenarios that are tailored to their specific situations. It will also benefit policy-makers by providing a standard format to review incoming information and to compare strategies proposed across providers.

### *Salutogenic service planning – a test case*

The Salutogenic Service and Infrastructure Planning Framework has been applied as a test case to a hospital setting in Australia. Modelling was based on the use of digital technology to support early intervention and modified models of care for high priority areas (e.g., chronic disease, ED presentations, endoscopy), as well as a significant shift to the delivery of care within the home and community. This modelling resulted in a projection that significantly reduced acute treatment space need and varied the location it was delivered. The projection is noted in Figure 3 below.

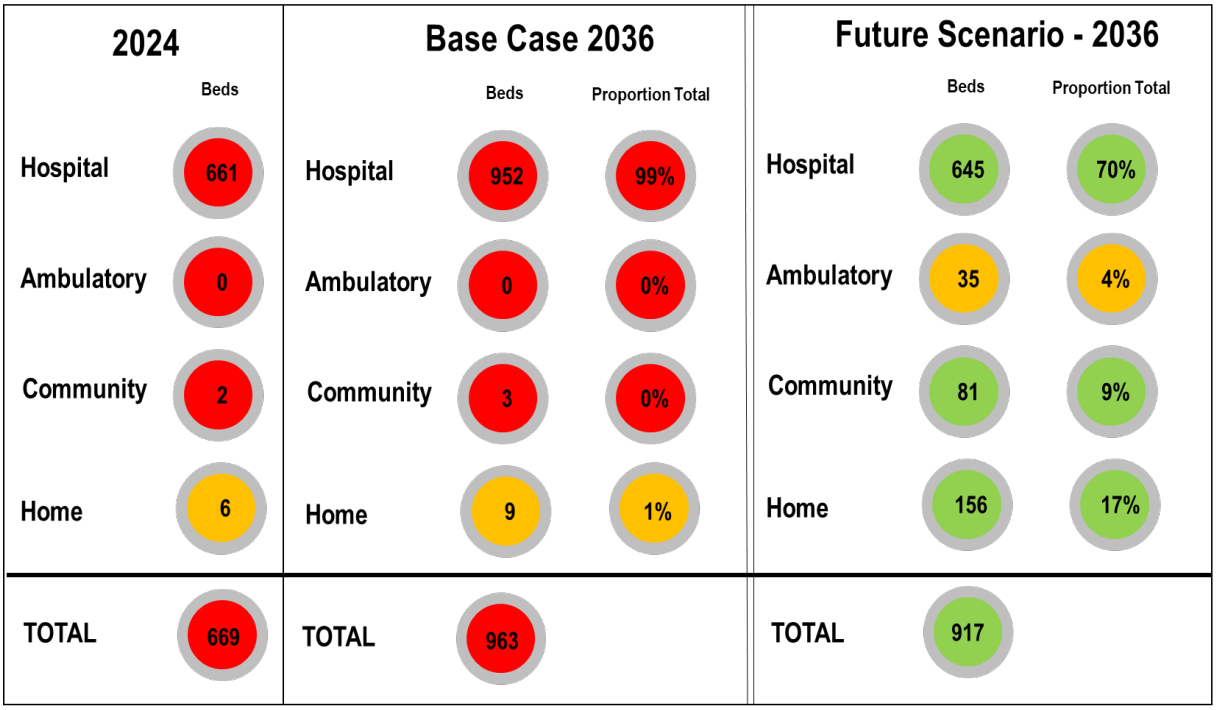



*Figure 3. Australian test hospital – Future Scenario –bed & bed alternative & where they are delivered.*

The shift is substantial. A net reduced future need of more than 200 hospital spaces, with growth in bed equivalent (e.g., hospital in the home services) activities offsetting the need to construct significant additional acute hospital infrastructure. The model prioritises both innovative models of care and models of care that can be implemented now. Increases to early access to health care and the delivery of care closer to and in the home is supported by a digital care and navigation centre, the centre point of remote monitoring, tele-health, and expanded 'Hospital in the Home' activities. Early analysis indicates significant capital cost savings and the potential for operational cost savings through hospital prevention and through increasing the efficiency of 'Hospital in the Home' models. Details of the targeted areas and more specific results are described in the next section.

### *Test case – method and results*

The test hospital serves a complex and diverse population with significant health and social needs, including a higher prevalence of chronic disease, high numbers of culturally and linguistically diverse people, high population growth and birth rates, and lower socio-economic status. These factors significantly impact public health-care provision with high emergency department presentations and high admission rates.

To better meet increasing demand, the hospital has already improved implemented models of care to drive efficiencies, including reducing long-stay beds, care planning that enables a shorter length of stay and early discharge, and advancing care in other settings including the home. The hospital is one of the most efficient hospitals compared to its peers for these factors. The focus of change for this hospital therefore needed to be more innovative and ambitious than traditional clinical service improvements.

Consultation with key clinicians and key stakeholder representatives was undertaken to inform assumptions regarding changes from key service directions that would have a large impact, to the delivery of more salutogenic services and infrastructure for the community. The suggested focus for change included:

1. Improved early care, monitoring and prevention of chronic health conditions, initially targeting diabetes, respiratory and gastrointestinal illness.

2. Improved care for people with a mental illness and/or alcohol and other drug addiction, including a significant shift towards providing out-of-hospital services and safe spaces for mental health patients presenting to the Emergency Department.
3. Improved early and preventative care for the elderly, including through improved monitoring and health prevention for people in the home and within nursing homes.
4. Improved palliative care, including providing more palliative care at home.
5. Alternate models of care for lower acuity patients who attend the Emergency Department.
6. Enhanced Hospital in the Home (HiTH), Rehabilitation at Home services, and the introduction of 'Mental Health at Home' services.
7. Alternate models for surgical and endoscopy services.
8. Increasing the proportion of activity delivered in ambulatory, community, and home settings, for the cohorts identified above.
9. Increasing the proportion of non-admitted (outpatient) activity delivered via tele-health.

A summary of the changes by the Salutogenic Service and Infrastructure Planning Framework lever is noted in Table 1.

***Table 1. Australian Hospital – Salutogenic Service and Infrastructure Planning Framework methods.***

<table>
<tr><th>Services</th><th>Levers</th><th>Salutogenic Service Parameters</th><th>Service change/s</th></tr>
<tr><td>Chronic Diseases</td><td>3, 4, 6,</td><td>Change to reduce ED presentations by the following:
<table>
<tr><th>Category</th><th>2026/27</th><th>2031/32</th><th>2036/37</th></tr>
<tr><td>Diabetes & Circulatory</td><td>25%</td><td>50%</td><td>60%</td></tr>
<tr><td>Gastrointestinal</td><td>25%</td><td>50%</td><td>50%</td></tr>
<tr><td>Respiratory</td><td>15%</td><td>25%</td><td>25%</td></tr>
</table>
Reduce potentially preventable hospitalisations for asthma, bronchitis, COPD, diabetes, hypertension and nutrition-related admissions by 30% in 2026/27 and 50% thereafter.<br>Diversions of ED-adjusted figures to community-based health of 40% and 20% to new urgent care centre. 20% diverted to GP hotline and 20% to primary care.<br>Proportion of HiTH activity to increase (noted in HiTH section below).<br>Consult room throughput for chronic disease OPD. Community – increase to 3,420 appointments per room, per year.</td><td>Introduction of alternate services for management of chronic disease patients in the ED, in partnership with the primary care network:<br>- GP Diversion 20% – Provider improved training and education to GPs in catchment area, ensuring they are skilled in managing patients with chronic disease. Refer patients from ED to nearby after-hours GP where appropriate.<br>- GP Hotline 20% – providing advice early to GPs to ensure patients can commence management of their issues before outpatient appointment. Reduces deterioration and resultant ED admission. New services.<br>- Diversion to Community Health 40% – Work with GPs, ED and patients to flow patients to community health team for ongoing management, education and self-care for chronic conditions.<br>- Introduction of Urgent Care Centre 20% – Divert patients with chronic diseases to urgent care centre, providing an alternate pathway for management of urgent but non-emergency and non-admission related ED presentations.<br>-<br>Institute remote patient monitoring & active push notification for self-care from Digital Care & Navigation Centre. Assists in managing known patients through preventing deterioration and improving health behaviours. In use by acute and community-based teams.<br>Integrated care for gastrointestinal patients – intensive multidisciplinary management of patients who have repeat gastrointestinal issues.<br>Room booking, improved patient-led booking system. Based on 30-minute average appointment time, 90% occupancy with a 5% DNA ratio.</td></tr>
<tr><td>Mental Health</td><td>3 & 6</td><td>Divert 50% of category 2-5 ED presentations of mental health, drug and alcohol patients to appropriate community health safe-space model.<br><br>Shift 50% of activity to delivery of care within the home.<br>Increase is staggered to take into account a gradual increase in use of new service models:<br>- 2026/27: 30%<br>- 2031/32: 50%<br>- 2036/37: 50%</td><td>Proactive management of repeat patients. Link with ambulance and police to develop proactive plans for managing individuals.<br>Increased referral to GP/NGO services from ED and community-based teams.<br>Implementation of a safe space/haven model, providing a place to go that is not in ED. Supported by NGOs, community and social support services.<br><br>Significantly increase outreach and home delivery model.<br>Significant use of tele-health.<br>Reference success in UK of these models.</td></tr>
</table>

<table>
<tr><th>Services</th><th>Levers</th><th>Salutogenic Service Parameters</th><th>Service change/s</th></tr>
<tr><td></td><td></td><td>Proportion of ED presentations are flowed to safe haven model.<br>Refer to ED for details.</td><td></td></tr>
<tr><td>Emergency Department</td><td>3, 6 & 8</td><td>Change to reduce/divert ED presentations by the following:
<table>
<tr><th>Category</th><th>2026</th><th>2031</th><th>2036</th></tr>
<tr><td>Diabetes & Circulatory</td><td>25%</td><td>50%</td><td>60%</td></tr>
<tr><td>Gastrointestinal</td><td>25%</td><td>50%</td><td>50%</td></tr>
<tr><td>Respiratory</td><td>15%</td><td>25%</td><td>25%</td></tr>
<tr><td>Mental Health</td><td>30%</td><td>50%</td><td>50%</td></tr>
<tr><td>Repeat patients (excluding categories above)</td><td>30%</td><td>50%</td><td>50%</td></tr>
<tr><td>Older person injury</td><td>50%</td><td>50%</td><td>50%</td></tr>
</table>
Target cohorts – 20% to Urgent Care, 20% to GP, 20% to GP Hotline, 40% to Community Health.<br>Flow on reduction to ED short stay.<br><br>Alternate infrastructure projection model with increased throughput for resuscitation bays (1000 per bay vs 500) and for treatment bays (1600 / 2920 vs 1315 / 2628). Calculation methodology as follows:<br>– Resus Point of Care (POC): (90% of adult triage 1 presentations + 25% of adult triage 2 presentations) ÷ 1000.<br>– Treatment spaces POC: (5% of all: adult triage 1 presentations +75% of all adult triage 2 presentations + 80% adult triage 3 presentations +40% adult triage 4) ÷ 1600) + (20% adult triage 3 +60% adult triage 4 presentations + 90% adult triage 5 presentations) ÷ 2920.</td><td>Introduction of alternate services for management of chronic disease patients in the ED:<br>- GP Diversion 20% – Provider improved training and education to GPs in catchment area, ensuring they are skilled in managing patients with chronic disease. Refer patients from ED to nearby after-hours GP where appropriate and available.<br>- GP Hotline 20% – Providing advice early to GPs to ensure patients can commence management of their issues before outpatient appointment. Reduces deterioration and resultant ED admission. New services.<br>- Diversion to Community Health 40% – Work with GPs, ED and patients to flow patients to community health team for ongoing management, education and self-care for chronic conditions.<br>- Introduction of Urgent Care Centre 20% – Divert patients with chronic diseases to Urgent Care Centre, providing an alternate pathway for management of urgent but non-emergency and non-admission related ED presentations.<br>Institute remote patient-monitoring & active push notification for self-care from Digital Care & Navigation Centre (DCNC). Assists in managing known patients through preventing deterioration and improving health behaviours. In use by acute and community-based teams. Particularly for chronic disease, elderly, mental health.<br>Integrated care for gastrointestinal patients – intensive multidisciplinary management of patients who have repeat gastrointestinal issues.<br>Urgent care pathways linked via iEMR.<br><br>Streamlined ED management. Better reflects contemporary models of care in ED where multidisciplinary treatment can occur in treatment bays, with patients flowed efficiently to where they need to be without the need to further move them.</td></tr>
</table>

<table>
<tr><th>Services</th><th>Levers</th><th>Salutogenic Service Parameters</th><th>Service change/s</th></tr>
<tr><td></td><td></td><td>Assumptions:<br>– 10% of adult triage 1 presentations proceed directly from triage to definitive destination (e.g. ICU or operating theatre) and do not receive further care in emergency department POC.<br>10% of adult triage 5 presentations were not modelled representing volume of patients who do not wait to receive care.</td><td></td></tr>
<tr><td>Palliative Care</td><td>3 & 6</td><td>Increase palliative care activity by 10% (with commensurate decrease in other inpatient care). Diversion of a proportion of inpatients who are likely to die within 12 months of admission.<br><br>Delivery of activity changed to the following, with change incrementally adjusted over time:
<table>
<tr><th>Year</th><th>Hospital</th><th>Ambulatory</th><th>Community</th></tr>
<tr><td>2021/22</td><td>55%</td><td>0%</td><td>20%</td></tr>
<tr><td>2026/27</td><td>30%</td><td>0%</td><td>20%</td></tr>
<tr><td>2031/32</td><td>20%</td><td>0%</td><td>20%</td></tr>
<tr><td>2036/37</td><td>20%</td><td>0%</td><td>20%</td></tr>
</table></td><td>Undertake proactive palliative care conversation with patients who are at end-of-life, seeking to place patients who agree onto an Advance Health Directive, with management of the patient undertaken by the palliative care team. Advance Health Directives should be available through the My Health Record.<br>Prioritise early intervention and reflect patient preference. Divert funding to manage patients at home.<br>Proactively manage residential-aged care patients and patients who need a bed within a community setting (i.e., within a bed in a residential-aged care setting).</td></tr>
<tr><td>Hospital & Rehabilitation @ Home</td><td>6</td><td>Increase proportion of HiTH & RaH over time, aiming for a growth rate of 2% per year (of total activity demand), with a 20% maximum for HiTH and 25% maximum for rehabilitation, as follows:
<table>
<tr><th></th><th>2018</th><th>2021</th><th>2026</th><th>2031</th><th>2036</th></tr>
<tr><td>Rehab</td><td>1.7%</td><td>5.7%</td><td>15.7%</td><td>25%</td><td>25%</td></tr>
<tr><td>IPU</td><td>1%</td><td>5%</td><td>15%</td><td>20%</td><td>20%</td></tr>
</table></td><td>Modification of legislation to allow remote monitoring and tele-health consultations in lieu of face to face visits on a daily basis will significantly increase the efficiency of servicing inpatients at home. Instituting a digital care centre will enable this change, with improved patient monitoring and tele-health capability allowing increases in remote care. Face to face visits become 1-2 per week, with daily or multiple touch points daily to check-in on patients.</td></tr>
</table>

| Services | Levers | Salutogenic Service Parameters | Service change/s |
|---|---|---|---|
| **Surgical Services** | **6, 7 & 8** | SD Elective – steps up to 50% delivered in off-site same-day surgical centre.<br>Outpatients – deliver where theatre activity is delivered (i.e., outpatients associated with location of clinician, with a portion diverted to a same-day surgical centre with the same proportion of theatre activity diverted.<br>Increase hours of operating rooms – introduce three evening sessions per week, thereby increasing throughput by 30%. Allows for increased throughput and some flexibility to increase evening sessions or add Saturday sessions for periods of high throughput (i.e., increase by a further three sessions for a total of 6 additional sessions – 60% increase in throughput).<br>Alternate throughputs for elective surgery SD and ON – base 1900 procedures per year – increase by 30% to account for lever 7 – 2470 procedures per room, per year.<br>Emergency surgery maintains 1100 procedures per year throughput. | Day surgery model. Balanced with volume of activity to create operational efficiencies.<br>Opportunity for delivery of public activity in private setting – outsourced delivery model.<br>Adding evening roster of workforce and allowing for late evening / night discharge of session patients. |
| **Endo-scopy** | **4, 6, 7 & 8** | Shift 60% of activity to minor procedure model. Minor procedure based on outpatient room style sessions that can be undertaken within the community.<br>Increase is staggered to take into account a gradual increase in the use of new service models:<br>- 2026/27: 40%<br>- 2031/32: 50%<br>- 2036/37: 60%<br>All minor procedures to be undertaken in a community setting.<br>Modify endoscopy room as follows:<br>- Hospital: 50%<br>- Ambulatory: 50%<br>- Community: 0%<br>- Home: 0%<br><br>Minor procedure room model aligned to efficient consult room model – 3,420 appointments per room, per year.<br>Each session to be 4 hours, increasing the number of sessions from 10 per week to 16 (60% increase in potential throughput).<br>Increases throughput from 2550 to 4080 per room per year. | Institute model for low acuity and screening patients that reduces the need for specialist anaesthetist guidance (e.g. 1 anaesthetist to 4 patients) through the use of new pharmaceuticals and future innovations such as the disposable scope.<br>High acuity activity is to remain in the hospital, with lower to moderate acuity patients seen in the endoscopy room streamed to a same-day surgical centre with a high throughput model of care.<br>The new minor procedure model undertaken within ambulatory or community health centres.<br>Minor procedure endoscopy: Based on a 30-minute average appointment time, 90% occupancy, with a 5% DNA rate. Five days a week, 8-hours a day service.<br><br>Introduction of evening and Saturday sessions for endoscopy rooms, reflecting patient preference.<br><br>Introduction of more evening and Saturday sessions for endoscopy rooms, reflecting patient preference. |

<table>
<tr><th>Services</th><th>Levers</th><th>Salutogenic Service Parameters</th><th>Service change/s</th></tr>
<tr><td></td><td></td><td>Low acuity endoscopy room in same day setting – increase already high; throughput by 30% (4000 to 5200).</td><td></td></tr>
<tr><td>OPD (tele-health)</td><td>4, 6, & 7</td><td>Proportion of activity that is delivered via tele-health as follows:<br>- 2021/22: 30%<br>- 2026/27: 40%<br>- 2031/32: 55%<br>- 2036/37: 70%<br>Tele-health infrastructure a combination of booths, offices and at-home delivery of services.<br>Modify delivery of outpatients as follows:<br>- Hospital: 50%<br>- Ambulatory: 0%<br>- Community: 50%<br>- Home: 0%<br>Modify throughput by discipline to allow for incremental increase in efficiency compared to current average appointment times. Only variance mental health (increase to 60-minute average) and rehabilitation (increase to 45-minute average).</td><td>Significant increase in the use of tele-health for initial and, in particular, review appointments. Significantly increases patient accessibility and convenience.<br>Reflect shift of some activity to community and ambulatory settings, increasing convenience for patients. Outpatient activity split to where clinicians will be based.<br>Improvements to room booking system and patient-led appointment booking. Full 5 days-a-week use of outpatient rooms, and learning from peer hospitals on ensuring efficiency in appointments. Lower FTA rate due to increased tele-health making services more accessible, with patients less likely to cancel or not turn up.</td></tr>
</table>

| Infrastructure Mapping Reference | | Occupancy | Days | Hours per day | Minutes per hour | Avg. Appointment time | FTA Rate | Value |
|---|---|---|---|---|---|---|---|---|
| Non-Admitted Clinics | Addiction & Mental Health | 90% | 250 | 8 | 60 | 60 | 5% | 1710 |
| Non-Admitted Clinics | Allied Health | 90% | 250 | 8 | 60 | 45 | 5% | 2280 |
| Non-Admitted Clinics | Cancer | 90% | 250 | 8 | 60 | 30 | 5% | 3420 |
| Non-Admitted Clinics | Children's Services | 90% | 250 | 8 | 60 | 30 | 5% | 3420 |
| Non-Admitted Clinics | Medicine & Chronic Disease | 90% | 250 | 8 | 60 | 30 | 5% | 3420 |
| Non-Admitted Clinics | Rehab Services | 90% | 250 | 8 | 60 | 45 | 5% | 2280 |
| Non-Admitted Clinics | Surgical Services | 90% | 250 | 8 | 60 | 30 | 5% | 3420 |
| Non-Admitted Clinics | Women's Services | 90% | 250 | 8 | 60 | 30 | 5% | 3420 |

Key impacts to service planning and subsequent infrastructure solutions for the hospital catchment from the above changes include:

- The potential to avoid up to 48 inpatient beds related to palliative care, surgical and chronic disease.
- No additional bed or bed alternatives required at the hospital in the longer term. These would be significantly reduced due to a shift in activity towards ambulatory, community, and hospital-in-the-home. Further, some shifts in the use of spaces between functions.
- The need for a small expansion of ED (10 spaces). This is a significant reduction from 80 spaces, due to chronic disease and other diversions
- The need for 19+ space urgent care centre. More spaces could be required depending on the projection model,
- 35 beds delivered in an ambulatory setting, and 19 other treatment spaces.
- 80 beds delivered in a community setting, and 158 in other treatment spaces.
- 156 bed equivalents of activity delivered primarily in HiTH, Rehab at Home, Mental Health at Home and Palliative Care at Home.
- Non-admitted clinics can be modified to increase the use of tele-health, with the growth in room need undertaken off site. No further need for outpatient department spaces at the hospital, with a reconfiguration of spaces required to support appropriate tele-health functionality.
- Note: surgical bed (SD and ON) numbers need to go through a more refined projection model to determine exact facility splits. The model is based on a split of theatre activities only.

A detailed summary table of the projection results can be found in Appendix A.

**Test case – assumptions and lessons learned**

The application of the Salutogenic Service Planning Framework for the hospital's catchment area includes several key assumptions about the implementation of service changes. Without these changes being enacted, it will not be possible to meet the identified service activity changes by way of location and infrastructure quantum. These assumptions are noted below:

1) Reform to ensure appropriate costing and pricing for services that are not provided by MBS or hospital-admitted and non-admitted services are included. This will allow for virtual care and remote monitoring.
2) Institute a population-based funding (modified by population-based factors such as SEIFA) model for out-of-hospital and outpatient services at a hospital or network level, focused on outcomes-based funding.
3) **Remote patient monitoring**. Include new outpatient items and costings for virtual care types underpinned by a clinical costing study.
4) **Increased care at home**. Remove the requirement to physically visit a patient at home every day. Replace with the ability to visit either physically or remotely.
5) **Increased care at home**. Broaden services to include hospital avoidance and secondary prevention, patients with mental health and other chronic diseases.
6) **Mental Health**. Include mental health patients within the allowance for the HiTH program, managed and approved by their psychiatrists.
7) **Outpatient funding**. Include advice to GPs as an outpatient appointment.
8) **Theatre. Evening and Saturday sessions**. Consult and create industrial mechanisms for evening and Saturday theatre sessions, including late (evening and night) discharge associated with these sessions, that are sustainable from a workforce and operational costing perspective.

**Lessons learned from the process include:**

1) Engagement noted concerns with adjusting incidence rates for specialty types (items such as chronic disease, rehabilitation, surgery and mental health were investigated). Concerns related

largely to the uncertainty of adjusting without detailed comparison of state-wide and inter-state rates, and an agreed state-wide position for making such changes.
2) Open conversations about performance, peer benchmarking and future needs are required to investigate the reasons behind existing models of care, and the capability and opportunities for changes to models of care in the future.
3) The process of enquiry for making changes to services and models of care takes time and requires significant clinical input. Realistic time frames should be implemented in any salutogenic service-planning project to allow for engagement and clinical and senior leadership agreement on the strategies to be adopted.
4) Changes at specific hospitals will not be able to be translated directly to other hospitals within the same network and across the wider jurisdiction. This is largely due to each hospital having different population health needs, capability levels, and historic flows and self-sufficiency ratios.
5) Having a mandated lessons-learned reporting for service and infrastructure would assist with making easy comparisons of salutogenic strategies between care providers, and with replicating methodologies across wider health networks.

### *Framework conclusion*

The changes identified above require a re-think of the way health services are funded to enable the delivery of digital health initiatives and changes to models of care. Many of the strategies identified for the test hospital could not easily be enacted under current funding models. This creates a barrier to the adoption of these practices which, in turn, limits the ability to meet patient demands and improve the financial performance of health services. Further, the changes necessitate modifications to infrastructure design and new facility types to support the delivery of care via digital means and increases to community and at-home care. Changes to funding and infrastructure design and planning are discussed below.

### *Sustainable health service funding – ensuring operational funding reflects new models of care and emerging technologies*

Changes to the way health services are delivered necessities a change to health funding models at federal and state levels.

There are currently no specific funding methods for continuous remote monitoring of patients with chronic diseases, for collaborative care between specialist, primary and community health teams, or for remote (e.g., telehealth enabled) hospital-in-the-home models, amongst others. While workarounds to existing funding systems may allow some of this to occur, there is a need to reform the health funding system to better allow for the delivery of new and digitally-enabled models of care.

Further to this, funding models for health services are focused on hospital-based care, specifically for Activity Based Funding (ABF). This is necessary and important to maintain. However, it focuses care within acute settings and a shift is required to better fund out-of-hospital care.

There is significant opportunity to further preventative, community and home-based care models through shifting to a population-based funding model. Such a model would allow for flexibility in the delivery of care by health services, focusing on delivering bundled activities for groups with chronic diseases and enabling the trialling and delivery of digitally-enabled models of care for managing these patients. Instituting a population-based funding model (modified by population-based factors such as SEIFA) for out-of-hospital and outpatient services at a hospital level, focused on outcomes-based funding, would enable new models of care to be established via outcome-based capitation, FFS, and block grant mechanisms.

Bundled activity payments for chronic disease, with payments across the primary, community and hospital systems, would enable collaborative care models to be instituted.

An Independent Healthcare Pricing Authority should be established to ensure appropriate costing and pricing for services that are not provided by MBS or hospital-admitted and non-admitted services. This will allow for virtual care and remote monitoring and new, more efficient models of home and community-based care.

To support this, clinical costing studies should be undertaken across the raft of new models and digital health initiatives. Ideally this should occur at the federal level to allow for nationally consistent guidance on payment. This would enable all states to commence trials and a broader roll-out of these models.

Other changes that would support innovation include:

- Removing the requirement to physically visit a patient at home every day. This could be replaced with the ability to visit either physically or remotely.
- Broadening 'Hospital in the Home' (HiTH) and rehabilitation and home services to include hospital avoidance and secondary prevention for patients with mental health and other chronic diseases. Mental health patients should be included within allowances for the HiTH program, managed and approved by their psychiatrists.
- Including specialist outpatient advice to GPs, allowing for the prevention of potential emergency or inpatient admissions prior to an outpatient consultation, as a funded tele-health service.

In short, there is significant need to reform health funding to allow new models of care and digital health initiates to be established. This level of reform is needed at the federal level to be most effective.

***Salutogenic health service facilities – ensuring the infrastructure we build aligns with changing patient expectations***

New hospital investment across many countries in the developed world is valued in the billions over the next decade and beyond. Planning and funding of these hospitals has largely been based on traditional models and there is significant risk that the newest hospitals will embed old models of care that do not reflect the digital innovations and new models of care desired by patients and governments.

Consideration of new building typologies for health care that enables home, community and out-of-hospital ambulatory care should be prioritised. This is due to the fact they reflect where health care will be delivered in the future, and they reflect patient preference. Some of these typologies include buildings we are familiar with, such as community health centres, while other typologies are entirely new. The initial list of care infrastructure typologies is noted below:

1. Hospitals.
2. Ambulatory care centres.
3. Outpatients centres.
4. Clinical offices.
5. Rehabilitation centres.
6. Planned procedure centres.
7. Specialist care centres.
8. Urgent care centres.
9. Digital care and navigation centres.
10. Community health and wellness centres.
11. Community primary health hubs.
12. Palliative care hubs.

13. Hospital in the Home hubs.
14. Elderly day-care centres.
15. GP practices.
16. GP surgery and specialist practices.

It is noted that much of the activity across typologies 1-9, and typology 12 and 13, traditionally occur primarily within hospitals. Relocating this activity out of hospitals where possible, leads to reduced capital costs for acute care services, with these new typologies often able to be delivered for significantly lower cost per square metre (given these facilities do not require the same level of design, redundancy and critical care expected within a hospital setting).

Further to this, many of the typologies can be clustered together to form a critical mass in the delivery of the health needs of a specific region. In the modelling undertaken for the test hospital, three key facilities developed as follows:

1. Digital Care and Navigation Centre, coupled with Urgent Care and Community Health.
2. Ambulatory and Rehabilitation Centre.
3. Planned Procedure Centre.

These centres enabled the salutogenic health-service planning scenario to be delivered in the future. Early costing analysis indicates significant capital savings in developing these clustered health services when compared to delivering them within an acute hospital setting. Part of the benefit is that these facilities can be accommodated in existing infrastructure or can be co-located with them. Locating these services in places such as shopping centres, commercial buildings and town centres can help reduce costs while avoiding major access issues with hospital such as public transport access and parking provisions.

## Digital Care and Navigation Centre

Critical to the ability to deliver salutogenic health services is the implementation of the Digital Care and Navigation Centre, an entirely new health infrastructure typology. This centre acts as the central hub location for the monitoring, evaluation, and delivery of care to patients outside of the hospital setting. It includes the ability to monitor patients remotely from continuous monitoring devices, share data between health providers for cross service, patient-centred care, tele-health-focused consultations and delivery of tele-health-enabled direct care services, such as hospital, rehabilitation or mental health at home. While generally new to many countries, such centres are up and running the USA. The Mercy Virtual Care Centre[iv] , Tampa General Hospital Command Centre and Johns Hopkins Judy Reitz Command Center being prime examples.

The planning, design and delivery of digital care and navigation centres is critical to the success of salutogenic health services. These hubs and their spokes should be prioritised and implemented as soon as possible.

In addition to this, delivery of clustered health services that focus on community and home-based care will assist in reducing the stress on acute facilities, increase access to care, and will assist in providing care closer to home — a key patient demand.

On top of delivering new health typologies and out-of-hospital clustered health services, the typical health infrastructure we have is often not well suited to the digital delivery of care. Implementing new standards and designs for existing outpatient, inpatient and procedural spaces is necessary if the full benefit of new digital health technology and models of care is to be realised. This can be undertaken through focused engagement with clinicians on the design of existing and new health infrastructure spaces.

## Adaptability

The adaptability that allows for the flexible use of health infrastructure also needs to be safeguarded for the future. While not a new concept, detailed planning of health facilities needs to enable the scale up, scale down and re-use of spaces for multiple functions. This will allow existing facilities to be repurposed towards changing health needs. Examples include ensuring appropriate floor-to-ceiling height for services for a range of functions, ensuring all spaces have enough digital connectivity and networking capacity, allowing for expansion and contraction zones, and avoiding bespoke room design to specific functions unless no alternative is possible (e.g. a resuscitation room). Such adaptive planning should be explicitly laid out in master planning principles with clear target ratios and gross area benchmarking to achieve significant area and cost savings. These should be carried forward through to detailed design processes to ensure our facilities are able to be adaptively re-used into the future.

## Sustainability

Sustainable also implies environmental and workforce sustainability. Hospitals are highly energy-consumptive and produce large amounts of waste. New hospital and health facilities should be designed to be carbon neutral. Most OECD countries are predicting health workforce shortages in the decades ahead. This applies particularly to nursing. Therefore, new health facilities should be designed to optimise staff efficiency enabled through comprehensive digitisation (fully digital clinical and non-clinical information systems; WiFi; RFID tracking; integrated clinical devices; smart communication devices; AI-enabled alerts; patient- and disease-management tracking boards; avatars, robots, and automated vehicle and drone systems etc.).

The retention, culture, and morale of the workforce are also enhanced by the sociable design of facilities, including teaching and collaboration spaces, end-of-journey facilities, and access to retail, safety and security, rest, and quiet spaces.

## Notes

[1] Nicholson EJ, Cummings MH, Cranston ICP et al, 2016, The Super Six model of care: Five years on, Diabetes & Primary Care 18: 221–6.
[2] Australian Institute of Health and Welfare, 17 December 2020, https://www.aihw.gov.au/reports/health-care-quality-performance/covid-impacts-on-mbs-and-pbs/contents/impact-on-mbs-service-use, accessed 18 February 2021.
[3] Queensland Audit Office, 9 February 2021, Health 2020: Financial Audit Report.
[iv] Mercy Virtual, Mercy Virtual Care Centre, https://www.mercyvirtual.net/safe-watch/results/, https://www.mercyvirtual.net/worlds-first-virtual-care-center/, https://www.mercyvirtual.net/wp-content/uploads/MRC_31300_MV_VIrtual_Tour_Guidebook_singlepages.pdf, https://www.digitalcommerce360.com/2017/09/25/mercy-healths-300-million-investment-in-digital-healthcare-is-paying-off/, accessed 21 February 2021.

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Sandra Surkamp – Director, Destravis Group.
Anthony Colwell – Associate Director, Destravis Group.
Renae Whiteside –Director, Destravis Group.

# CHAPTER III

# DESIGNING SALUTOGENIC HEALTHCARE FACILITIES FOR SAFETY AND QUALITY

PAUL BARACH AND DEREK PARKER

*In the future, hospitals will require disruptive and opportunistic changes in culture, systems, processes, technology and behaviours. The coronavirus disruption of our day-to-day lives has provided a rare opportunity to reflect on all things health and to reconsider what we do, how we do it, and why we do it, as we shift towards the collective rather than the individual. New buildings can help to unlock and catalyse this, but only as part of a wider vision through positive, restorative and forward-thinking design. All of this must combine to deliver the quadruple aim of enhancing patient experience, improving population health, reducing costs, and restoring deep joy at work. The hospital must address the holistic needs of patients and carers to actively promote their wellness, agency, and better outcomes. Carers, visitors and other users also need environments that help them during what can be difficult times while facing existential threats. The needs of staff must be comprehensively met in a transparent manner, so that they too feel cared for and valued. A change in outcomes – clinical or experiential – requires a major shift in the culture of healthcare and the underpinning public discourse emphasising communal needs. Creating salutogenic environments that promote health and wellbeing and a supportive culture can help promote healing for the patients and nurture the staff, all while being sustainable and equitable. Salutogenesis is now a respected and encouraged design goal. The downside is that the term 'salutogenic' can be overused by architects, most of whom may not know how to drive their schemes with a salutogenic methodology and may have a tenuous grasp of the scientific underpinnings of salutogenesis. To add to this, the pathogenic model of health is sadly still dominant in the healthcare sector and it will not reorient towards health promotion easily. To drive a change in all these aspects of the system, we need highly effective processes for co-creating designs and truly understanding what patients and staff value and pay attention to, as well as the importance of social bonding and other ways of connecting to and helping people. Far more research — practice-based, theoretical and empirical — is needed to enable the blossoming of salutogenesis in healthcare architecture, and to help guide us on what has worked and is effective based on reliable data. Good design must be about an authentic commitment to continual process improvement that respects meaningful co-design with key stakeholders in the support of wellness for patients, carers and staff.*

**"Health is not valued till sickness comes."**
Dr Thomas Fuller (1654-1734)

## Introduction

Patient safety and patient-centred care are emerging as key drivers in healthcare reform alongside financial and political drivers. Things have changed but often as a by-product of financial reform. (1) Belatedly, safety and quality benchmarks are being integrated into all healthcare organisations' strategic goals, and slowly into healthcare professional schools and training programs and healthcare architecture training programs. (2, 3) There is a more institutional focus on patient-centred care, but these are early days. Patients still experience needless harm and often struggle to have their voices heard; processes are not as efficient or transparent as they could be; and costs continue to rise at alarming rates while quality issues remain. (4)

The COVID-19 pandemic has upended global healthcare systems. The surge in infections and critically ill patients has tested the resilience of healthcare infrastructures and facilities, forcing organisations to quickly adapt and embrace emergency solutions. (5) The coronavirus disruption of our day-to-day lives has provided a rare opportunity to reflect on all things health and to reconsider what we do, how we do it and why we do it, and has thus accelerated the processes of innovation and transformation. (6) The nuts and bolts of planning and designing hospital facilities — the physical space, the social systems, the clinical and non-clinical workflows, and all of the patient-facing services — directly influence the quality of clinical care and the overall patient experience. Facilities should be conceived and constructed based on evidence-based design thinking and implementation, complemented by input from key stakeholders such as patients, families, and clinicians, including all patient-facing carers. Specifically, facilities should be designed to improve patient experience by offering options for urgent care, maximising infection control, supporting and streamlining the work of multidisciplinary teams, integrating research and teaching, incorporating chronic care management, and looking beyond mere diagnosis and treatment to patient wellness — all tailored to each patient's needs. (7)

Facility design endeavours often violate the cardinal principle of system reliability, which should be based on meaningful co-production, whereby the users are often not actively and continuously engaged or allowed to participate in the entire design process, but only in delimited windows of the process. (8) Without that participation, trust, and buy-in, the delivery of safe, value-driven care can be undermined. Often this leads to uninspiring waiting rooms and staff break-rooms that are too small to support staff respite and are uninviting. Indeed, financial considerations are often prioritised over patients' and staffs' needs, even though each is critical to achieve optimal results. This choice can cause, for example, an overemphasis on maximising space, resulting in mazes of small rooms and in the missed opportunity to orient waiting areas and other common spaces toward exterior views of nature and light that can have a calming effect on facility occupants. The architect Helmut Jahn argued that architects and designers have a professional responsibility to change the world for the better, and thus guide the users from what has been to what might be, otherwise progress is not possible. (9) We found that a strong association between a view of the outdoors and alertness and stress is conditional on the content of the exterior view, speaking to the importance of nature being part of the view in order to inspire. (10) Access to a view of nature and natural light for care-giving staff has direct as well as indirect effects on patient outcomes.

Architecture and design have been influenced by industrial societies for decades, and as a result, buildings such as hospitals have often been designed to function and look like factories with little focus on the true users' needs for natural light, deep reflection, and solitude. Clinical practice in hospitals focuses mainly on treating illness while often neglecting a patient's (and their family'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 and meaningful place. Juhani Pallasmaa, notable Finnish architect, argues that the task of architecture is the defence of the authenticity of human experience. (11) Architecture of the physical environment provides a narrative context that affects a person's behaviour through their senses and,

through its influence on the brain and the body, architecture can directly influence our healing experiences and the wellness of staff. Allowing spaces to be more neutral allows the patient and their family to customise their micro-environment and thus enhance the ability to adapt to different providers, patient types and emerging technologies.

## Managing Patient Expectations

Patient expectations refer to the anticipation or the belief about what is to be encountered in a consultation in the healthcare system. It is the mental model/picture that patients or the public will take away from the process of interaction with the system. (12) Patients want their doctor and other providers to respect their opinions, listen as they describe health issues and symptoms and ask follow-up questions in order to understand the cause of their illness. Patients come to a consultation in or outside the hospital, with stress and expectations of which they may or may not be overtly aware. (13) This emotional and psychosocial process starts before the encounter, and can be impacted by the parking, way-finding to the entrance, the ability of the building to induce a sense of feeling welcome, trust, confidence and caring, leading to the assurance that you (or your loved ones) are in good hands (see figures 1 and 2 for examples of hospital waiting areas). These expectations may be openly presented or the healthcare team may need to elicit them using well validated tools and approaches. Reactions to unmet expectations can range from disappointment to anger and often lead to lasting breakdown in trust and communication. Thus, knowing the expectations of patients can help avoid these reactions, enhance their healthcare experience, and reduce the exposure to liability. (14)

*Figure 1: Sacred Heart Hospital, Eugene Oregon.* Credit: Anshen + Allen with Ron Mitchell.

*Figure 2: Sacred Heart Hospital, Eugene Oregon.* Photo credit: Anshen + Allen with Ron Mitchell.

Studies have shown that as much as 70% of litigation relates to real or perceived problems involving physician communications, which influences patients' expectations. (15) Not meeting expectations can also result in non-compliance or suboptimal compliance and affect a physician's reputation in a community. (16) Patients with unmet expectations may never complain to the physician directly but will instead just miss appointments and not return for ongoing and follow-up care. (17) The days of absolute trust and blind obedience to doctors are over.

Patients' experiences, good and bad, accumulate because of clues embedded in these experiences. Clues are the signals patients perceive in using a service. (18) When interacting with a system of care, patients filter clues, organising them into a set of impressions. Patients may perceive clues rationally or emotionally, and clues may be defined by their presence or absence. Optimising a patients' service experiences requires sensitive management of the clues that comprise the overall service. (19) Well-managed aesthetic design clues can evoke positive feelings, such as trust and hope. Poorly-managed clues can exacerbate negative emotions, such as anxiety, stress, helplessness, anger, and fear. (20) The more important, variable, complex, and personal the service, the more clue-sensitive customers are likely to be. (21) Few services are more important, variable, complex, and personal than complex hospital care. Sick patients are likely to be acutely aware of experiential clues during health care. (22) What may seem to clinicians and staff to be a minor detail can constitute a powerful stimulus and be trust-building or losing to patients. (23)

Exploring patients' expectations is crucial for ensuring delivery of healthcare of the highest quality. Patients' expectations continue to increase. Therefore, a satisfactory balance should be achieved between patient expectations, physicians' perceptions, and priorities set by healthcare planners. Every patient who comes for a consultation has expectations based on his understanding of the illness, cultural background, health beliefs, attitudes, and level of understanding. (24) Patient demographics and visiting characteristics also contribute to this. How far the care team reaches an understanding with the patient will also have an impact on the successful outcome of the consultation. (25) The price healthcare providers and hospitals have to pay for dissatisfied patients and customers seems to be getting higher, thus the investment of time to deeply understand this issue

is certainly worthwhile for designers. Some of the general expectations of patients include the need to: (26)

- be welcomed;
- be listened to and shown respect;
- receive clear explanations and instructions about their condition;
- be treated by staff who show care/concern/compassion; and
- be treated by staff who are professional in their work.

## Theory of Salutogenesis

Salutogenesis is a concept developed by Aaron Antonovsky. It focuses on what causes health rather than what causes illness. He links health with the ability to comprehend, manage and apply meaning to stressful events. This ability is called a sense of coherence. The higher the sense of coherence, the less negative the impact of stress will be on mental and physical health. In the 1990s, architect Alan Dilani suggested that the same principles could be applied to architecture design changes. Although this was not explicitly Antonovsky's intent, it is in the spirt of his writings and teachings. Dilani was interested in identifying design attributes, architecture plans, circulation patterns and materials that promote health over illness. (27)

In contrast to the traditional study of the sources of disease, known as pathogenesis, salutogenesis is an approach to medical treatment and healthcare that focuses on the origins of health. Antonovsky, a medical sociologist, was interested in answering the question of how most people manage to live relatively healthy lives despite being faced with disease, emotional and physical stress, social struggles and other challenges: "*Given the ubiquity of pathogens—microbiological, chemical, physical, psychosocial, social and cultural—it seems to me self-evident that everyone should succumb to this bombardment and constantly be dying.*" (28) He wrote: "*the question then becomes not how some concentration camp survivors or poor people manage to stay healthy, but how any of us manage to stay healthy—the question of salutogenesis."* (29) By shifting his focus from disease to health, Antonovsky developed a systematic research approach with a focus on a continuum of what promotes health and joy on the journey to what causes disease and misery.

Antonovsky postulated that the traditional pathogenic approach to health belies a complete misunderstanding of health. Antonovsky argued that the pathogenic approach implies a dichotomous relationship between health and disease; that is, a patient is healthy in the absence of disease. This idea precludes the possibility of disease and health being interrelated, as simultaneous and multi-dimensional conditions. In the 1990s, architect Alan Dilani boldly suggested that Antonovsky's salutogenic approach be applied not only to medical treatment and research, but also to the physical design of healthcare facilities as a means to promoting health. (30) Dilani applied Antonovsky's theory to create psychosocially supportive design, a theory and framework which promotes health through the design of the physical environment. "*Design from a salutogenic perspective defines, not only the causes of stress, but introduces wellness factors that strengthen health processes*." (31) Examples include mental health facilities that offer quiet and solitude, and patient rooms that are bathed in natural light, emphasise transparency and access to nature and more. (32, 33, 34) In order to understand how salutogenesis can be applied to design, it is necessary to identify some key concepts of salutogenesis, the most notable being the dis-ease/ease spectrum, the relationship between stress and tension, and the role of personal and social resources that one has available — what Antonovsky calls a sense of coherence. He defined the health/disease continuum as a "multi-faceted state or condition of the human organism," and emphasised that salutogenesis is not about making a sick person well, but is rather about identifying their location on the continuum and mitigating the stress that may move them. (35) Assessing the effects of interior design on patient recovery and wellness, for example, can be measured and quantified. (36)

Antonovsky suggested that salutogenesis is a comprehensive theory of health promotion, which can impact the design process and the health/illness continuum, including reducing the length of a hospital stay. (37) Dilani argued that 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. (38) Health processes could be strengthened and promoted by implementing design that is salutogenic i.e., that focuses on the factors that keep people well, rather than those that make us unwell. The aim of salutogenic design therefore is to create an environment that stimulates the mind to create pleasure, creativity, satisfaction and enjoyment.

Salutogenic design is based on three tenets that combine to provide a sense of coherence — a thrust that pushes you forward and makes it easier to resist the forces of illness and infirmity. The sense of coherence is made up of constructs:

a) **Comprehensibility**. An ability to negotiate circumstances in order to maximise their benefit.

b) **Manageability**. The ability to maintain homeostasis and physical function in new space.

c) **Meaningfulness**. The desire to understand and support the need to resist illness in the first place.

While very attractive and easy to comprehend, how can these elements be rigorously measured in design?

Substantial evidence shows the power of design in healthcare settings, with it being able to improve health outcomes for patients. (39) Salutogenesis is a way of understanding the entire spectrum of wellness and illness. (37) Salutogenic principles as described above are a practical way to integrate the dynamics of health and experience into architecture. (38, 40) The pathogenic model of health remains dominant in the healthcare sector and, as a result, many stakeholder groups usually value functional efficiencies, traditional finishes and approaches (such as central staff stations) over what they may consider to be risky new inventions. Many designers, when faced with shrinking budgets, tight deadlines, constricted sites and margin-oriented project managers, may lack the courage to pushback against the client and not allow the value-engineering process to block the key salutogenic designs needed to support true wellness in settings.

### *Case Study—Palomar Medical Center, California*

The largest public hospital district in California, Palomar Medical Center was completed in August 2012. It used a highly interdisciplinary and participatory process throughout all key decision phases, involving staff at all levels of the organisation. (41) The project incorporates cutting-edge sustainable design to create a high-performance healing environment that refines hospital design ideas and challenges perceived limitations. Improving access to care and operational effectiveness through sustainable design were at the forefront of the design goals. The ecologically regenerative, 1.5-acre green roof and garden spaces featured on each level of the nursing tower are flush with drought-resistant vegetation, allowing for beautiful south-facing patient-room views. Palomar Medical Center is one of just two hospitals in the United States that bring natural light into operating rooms and rethink the entire patient and staff flow (see figures 3 and 4). The hospital was designed for agile adaptation for future space-remodelling and technology needs over the next few decades. (42)

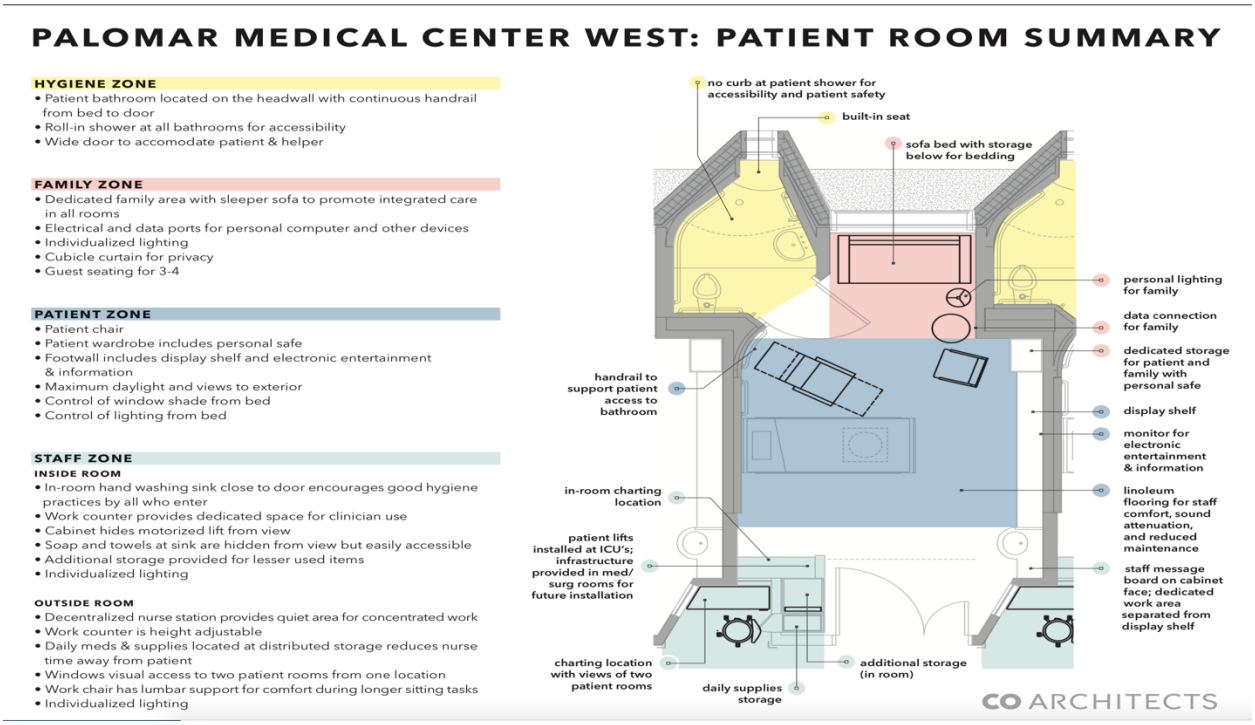


*Figure 3: Palomar Medical Center. Patient Room Characteristics.*

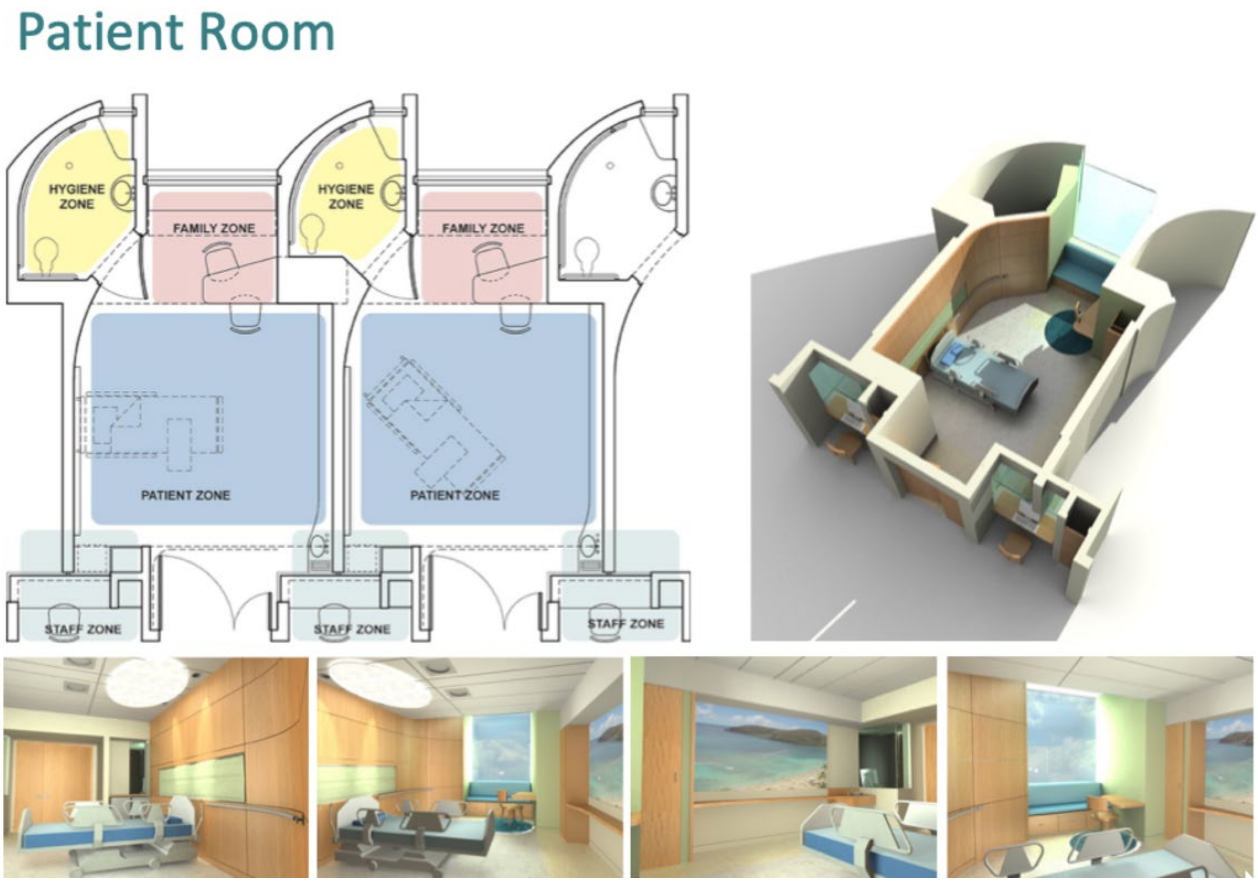


*Figure 4: Patient room layout, Palomar Medical Center, CA.* Credit: Anshen + Allen with Co-Architects.

The project, part of the Pebbles Design Project, implies that decision-makers embarking on a healthcare design project should carefully think through the design decision process as it relates to the context in which decisions will be made, as well as the leadership style of the decision-makers, to ensure the best possible outcomes. (43, 44) Some of the most important take-home messages from

this seminal project is that decision-makers should organise decision-making structures and processes to avoid patterns of group conduct or tendencies towards groupthink. (45)

Some architects argue that the ultimate design test when looking at new spaces and architecture, be it a streetscape, an office building, or a hospital, is assessing how health-inducing they are. (46) They expand the term to mean a "saluto-systemic" approach, applied to urban settings and referring to a broader concept of health, claiming that the complex system of an urban habitat needs multiple circular and interlinked systemic levels of "healthy action" (physical/ mental, social, sociocultural, ecological, economic and spatial health) in order to support the flourishing of human life. Secondly, a saluto-systemic approach to urban design should refer to both the process of designing and the formal architectural design. (47) Architects and building designers must turn their attention from the technical aspects of sustainability, such as a building's carbon footprint, to whether a space 'causes health', or allows people to thrive mentally, socially, and physically, and succeed in influencing both our physical health and state of mind (see Figure 5).


*Figure 5: The Leap Upstream, by Tye Farrow, 2015 in Chua G. The ultimate test for architecture and design: do our buildings and spaces cause health? (46)*

## Learning from the Evidence

Just as the evidence base matters when diagnosing, treating, and caring for patients with complex illnesses, it is also crucial to the design of hospitals and other care facilities. Design professionals, facility managers, and healthcare leaders can consult extensive literature on the evidence-based design of healthcare facilities, registry data on quality and safety, and stakeholder knowledge to inform optimal facility design. (48-52) Rigorous evidence on how physical, social, and symbolic environments affect care must be made actionable so that the information ultimately supports therapeutic relationships while improving patient safety and care quality. (20) Evidence-based design can bring empiricism to the design process, complementing imagination and judgement using the best evaluation and assessment tools. (53) Analysis of more than 400 research studies shows a direct link between quality of care, patient health, and the way a hospital is designed. Here are a few examples of how changes in design can improve the quality of care (54, 55).

- Patient falls declined by 75% in the cardiac critical care unit at Methodist Hospital in Indianapolis, Indiana, which made better use of nursing staff by dispersing their stations, placing them in closer proximity to patients' rooms, and enhancing patient visibility, adhering to good human factors of design principles.
- The rate of hospital-acquired infections decreased by 11% in new patient pavilions at Bronson Methodist Hospital in Kalamazoo, Michigan, which was attributed to a design that featured private rooms and specially located sinks.
- Medical errors fell by 30% on two inpatient units at the Barbara Ann Karmanos Cancer Institute in Detroit, Michigan, after it allocated more space for their medication rooms, re-organised medical supplies, and installed acoustical panels to decrease noise levels.

Other research has demonstrated the importance of empowering patients and families to, when necessary, remind clinicians to clean their hands before commencing care. (56) However, this practice can be effective only if handwashing sinks and gel dispensers are clearly visible to patients in the room. (57, 58) In a 2016 cross-sectional study in a 637-bed tertiary-care hospital in Canada, 247 hand-hygiene opportunities following care of a patient infected with *Clostridium difficile (CD)* were observed. (59) Glove use compliance was 85.4% (211/247), but hand-washing compliance after the care of CD-infected patients was only 14.2% (35/247). Hand-rubbing was performed instead of hand-washing in 33.2% of opportunities (82/247). The median distance between the patient zone of CDI patients and the nearest sink was 13.1 metres (interquartile range, 7.6-23.2). Sinks were directly visible upon exiting the patient's room on only 33.2% (82/247) of occasions.

There are many critical sources for designers to learn more about what is the best available evidence in designing salutogenic hospitals, and how best to learn the tools to assess the impact of the facility during formative, summative, and post-occupancy phases on the facility. (60)

## Designing for the universal *vs.* designing for the unique

Medical evidence of what does and does not work in caring for patients is not static but constantly changing, requiring building to be carried out in an agile manner, accommodating for inevitable changes. (61) The same is true in facility design. The learning process is iterative and typically incremental, constantly infused by daily lessons from real patients and the clinicians who provide their care, and based on the best in social and natural sciences knowledge. John Weeks, a British architect working at the Nuffield Division for Hospital Studies in the 1950s was involved in the very early stages of the 'industrialisation' of a number of hospital activities, such as central sterile supply services, and took the lead in measuring things, in order to provide design data for future projects. (62) Weeks highlighted the importance of multi-functional potential for combined inter-connecting examination and consulting rooms, and how the workflow of nurses can be modified in the interests of improved patient care. (63) It was a model for flexibility within a logical plan: a large building that was serviced and flexible, which he called "indeterminate architecture." He argued that, provided the designs of the entrance and principal routes were clear and logical, and each building could readily expand its services, then any adaptation, extension or rebuilding could be undertaken without disturbing the rest. (64) This approach allows for infinite changes to accommodate different workflow needs and new technology innovations.

## Ongoing challenges with the evidence supporting salutogenesis

The concept of salutogenesis has grown in popularity and has become a buzzword in healthcare architecture. However, there is a need for honesty, clarity, and moral integrity in the design of hospitals, and an appreciation that architects are not clinicians or healers, and buildings are not medicine. Both facilitate wellness, but should not be construed as proximal agents for healing. This is especially true for complex and expensive spaces such as operating rooms and intensive care units that require a huge amount of technology and th integration of a myriad of factors related to flow,

safety, human factors and occupational wellness. (65, 66) The term ‘salutogenic’ is often overused by architects, most of whom may not know how to drive their schemes with a salutogenic methodology and those using it may not always even have a solid grasp of what salutogenesis means. As a result, the term can mean ‘friendly-looking’ or ‘leafy’, and there is so much more unexplored potential when implementing this approach. Exaggeration and unsubstantiated hype can diminish the professional reputation of designers, undermine trust by hospital executives and clinicians in the work of designers and, ultimately, diminish the credibility to those who are trying to use the best solid science and data to radically improve the quality and sustainability of healthcare design. The pathogenic model of health is sadly still dominant in the healthcare sector, which has been slow to reorient towards health promotion. (38)

We believe healthcare design is at a tipping point in the discussion on fully assessing the impact of the built environment. It is worthwhile to evaluate this large body of work and assess what is effective, to inform the next generation of building designers, to set a new research agenda, and to expose what is well intended but unsubstantiated. (67) Far more research — practice-based, theoretical and empirical — must be published and disseminated, as it is much needed to show what works, what is effective, and what has simply been hyped. (68) This requires architects and the professional organisations that bring designers together, to support research, to better address these ongoing questions about the lasting impact of salutogenesis principles on patients, staff and societal outcomes.

Another concern is based on the recognition that this body of important work about the impact of salutogenesis, is almost totally focused on the developed world. Designs, unfortunately, still have little impact for the majority of the world’s population who have so little. For example, healing gardens are irrelevant to those without potable water or adequate drugs. Evidence-based design can mean little and can be indeed incomprehensible to the 22,000 children who die every day because of malnourishment. (69) Do the design and medical communities have a responsibility to apply design and creative energies to make a real difference to the lives of billions of poor underserved people? And if so, how can we do that and be accountable for our efforts?

## Can we change the design process?

If we accept the proposition that healthcare is a system and that the physical environment is a component of that system, we might then ask whether that part of the system could be improved. In other words, how do we incorporate the best of human factors and systems-design thinking to healthcare’s physical environment, and can these intercalated layers of cheese (using James Reason’s well-known Swiss Cheese model) have more of the holes filled in? (70) There are many glaring human-factor deficiencies in the design of many healthcare environments that contribute to adverse events. One example relates to patient falls, and it is a concern which is sufficiently significant to have been placed on the national list of patient safety objectives. The design of the environment and its human-factor affordances have direct and indirect impacts on patient falls, and this has only recently started to be addressed by regulators. (71, 72) Hospitals have latitude in choosing which finish materials to use, and there are clear and dangerous consequences when using slippery surfaces. Why do deficiencies in the designed physical environment continue to occur? While there has been too little peer-reviewed study of this question, the design process does have a number of characteristics which may be at fault. Design professionals, in the course of study for their profession, generally do not study ergonomics, human performance science, or the science of how human beings interact with their environment. (3)

An unstated conclusion of Donald Norman's book, The Design of Everyday Things, is that designers don't know enough about everyday users. (73) Designers study design, not human beings. This deficiency may manifest itself in the results of their work. Aside from not having a rudimentary understanding of human performance and its limitations, such as fatigue, stress and sensory degradation, designers are insulated from users and typically have too little face-time with them.

Designers, then, must make assumptions about users based on their own, and not the users', experience. Healthcare building design projects often begin with a set of assumptions made by the owners, the designers or others. Many of these assumptions are not adequately tested before or during the design process. For example, a functional program may be created by the owner and stipulated to the designer as a given. Often, not enough opportunities exist to question or test the contents of the program or to work with clinicians and others involved in care to find better methods that match their lived experiences. These short-term cost savings can contribute to many downstream design deficiencies that add up to large maintenance costs and, indirectly, to patient adverse events that occur years later as a consequence of the increased risks of the design. (74)

The process of design commonly used in healthcare is linear. It starts with the architect working with the series of assumptions, proceeds to a greater definition of the floorplan and massing, and then equipment, information technology, building systems, furnishings and other components are added. There is a natural and financial inclination not to loop back and look at evolving issues in a holistic light. If the plan is done, the solution must be a different piece of equipment, a different furnishing, or even worse, a process change. Likewise, after the equipment and technology are selected, usually just before construction begins, there is resistance to changing any part of the design which has been determined before. We need to modify and optimise the decision-making and design process in order to disrupt the rigidly present boundaries between design for quality, for productivity and for procurement, as we focus on increasing the quality, while reducing capital and ongoing costs through innovation and process optimisation. Encouraging disruptive innovation ideas at all stages by not finalising key decisions in a multi-year design effort, until all decisions are final, enables a much longer window time for learning and engaging contributions from all stakeholders, including those traditionally lower in the organisational hierarchy.

These characteristics of the process are exacerbated by the fact that it is generally led by a single component of the design team, most frequently the architect, and compounded by staff feeling uncomfortable or fearful to speak up, even when it does not make sense to them. (75) We know that when nurses don’t feel safe psychologically and are afraid to speak up, many more patients are harmed and might die. (76) In alternative scenarios, the team is led by a 'program manager', a 'construction manager' or by an 'owner's representative'. The problem with these forms of leadership is that they often focus on one aspect of the project, such as the budget or the schedule, for example, to the detriment of others key factors.

Many design project analyses have identified methods to avoid these pitfalls, so that the resulting physical and operational environment is as safe and effective as possible (Figure 6). This should include easier ways to get patients out of bed, such as using double doors in patient rooms, as in Palomar Medical Center (45), and in using innovative beds that convert to chairs. (77) This type of bed has a retracting frame mounted onto a fixed frame. A patient support is formed by serially connected head, seat, thigh, calf and foot panels, with the seat panel being fixed to the retracting frame. Movement of the retracting frame towards the foot-end of the bed causes the head panel to rise and the leg panel to drop, thereby creating a chair.

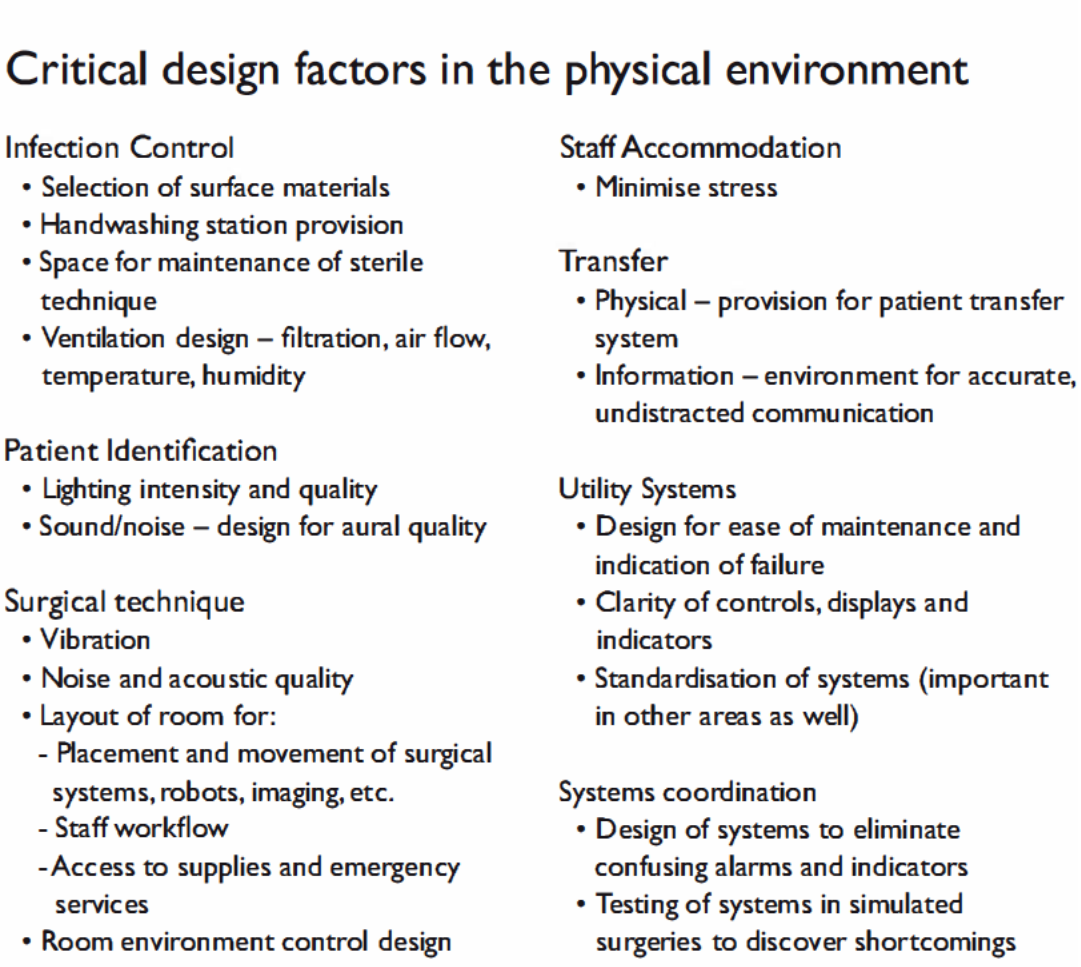


*Figure 6. Critical design factors in the physical environment (78).*

**Evaluate, Implement, and Deliver True Value**

Designing a hospital facility involves daunting complexities, including detailed advance planning, reconciling the needs and constraints of different stakeholders, and context-specific design factors for scale and sustainability. Design components that are well beyond clinical care matter greatly. Complex tertiary facility design initiatives are challenging to evaluate on a continuous basis while maintaining accuracy, cooperation, and transparency. (20) National guidelines are needed that help to create a minimum base of evidence to help guide the design community, hospital executives and regulators at state and national levels. (79) Evaluation results may be unreliable when the influence of factors such as patient variation and staff experience on clinical outcomes, safety, cost, and satisfaction cannot be attributed with precision. (80) Nonetheless, ongoing efforts to evaluate facility-influenced results against design goals are essential and must be clearly measured. Otherwise, it is difficult to determine what is the design or service intervention that has made a positive impact on outcomes and what is not working to inform future design work. (81)

Lead hospitals use the following guiding tenets to help assess how well their facility design is delivering value. (82)

- Treat the creation of safety as part of a process that addresses the safety and integration of all system components, as part of the culture.
- Embed researchers and rigorous research protocols into physical and organisational design initiatives.
- Track quality metrics such as adverse events, infection rates, timeliness of care, and ED/urgent care visits and share this risk registry data with designers.

- Include evaluation of design in patient and staff satisfaction research (e.g., satisfaction with treatment spaces).
- Monitor and document changes in the efficiency of care delivery and protocol adherence.
- Track patient flow, cost of care, and waste metrics within the system using data dashboards.
- Conduct regular administrative rounds in the facility to receive direct feedback from patients, families, and staff, and observe how the facility is being used.

These strategies apply to all types and service lines of healthcare facilities. The first part of this task is to define the characteristics of the environment from the perspective of design. On top of the accommodation of new systems and procedures, patient safety teams must deal with the risk management aspects of the environments and processes surrounding those which are already in use. The building codes and regulations need to be modified to allow for these changes. Building design-related contributors to hospital-acquired infections, for example, can include inadequate maintenance of filters; the use of floor, wall or ceiling materials which are hard to clean; poor placement of hand-washing stations; and insufficient space to maintain sterile separation. (83) Including training and familiarity with research methods is essential in all designer and architect training programs. (3, 60, 84) Having a clear strategy for evaluating implementation efforts — not merely for soliciting design ideas — is essential in ensuring the long-term value and sustained impact of facility design initiatives.

## Conclusions

Healthcare leaders and clinicians place enormous emphasis on the quality of clinical care, often with great success. The salutogenic model can be hugely instrumental in framing questions around health. What are the origins of health? What is health? Antonovsky's conception of health championed a shift to a position with salutogenesis alongside pathogenesis. But some of the shortcomings in care that nevertheless persist can be addressed by seeing a facility's design — its physical space, social contexts, and patient-facing systems and processes — as integral to how care is delivered on the journey to health and wellness.

We believe that society is at a tipping point, and it is worthwhile evaluating which examples of salutogenic design are effective in informing the next generation of building designers as they set a new research agenda, while also highlighting that which is well intended but unsubstantiated and misleading. It is valuable to remember that we are designing hospitals for multiple generations of providers and patients. At times, there are three or four unique generations with different expectations, needs and attitudes. The modern clinical-care team has greatly expanded the need to raise the quality of clinical care, but has also introduced inter-professional challenges and, at times, different mind-sets on what constitutes optimal care and who is best suited to deliver it. The full blossoming of salutogenesis in healthcare architecture requires far more inquiry and research — practice-based, theoretical and empirical — to be published and widely disseminated. We need to know what has worked and been effective, what is data-driven, and what has been hyped. The potential for salutogenic design to reduce healthcare budgets and improve health on a population level is impressive, but it must be tested and retested so the arguments for salutogenic approaches are as watertight as research for new drugs or vaccines.

The post-pandemic hospital must address the holistic needs of patients to actively promote their recovery and agency, with better outcomes and, where possible, care at home with the right support. Family members, visitors and other users also need environments that help them during what can be difficult and stressful times. The needs of staff must be prioritised, including protecting them from existential threats so they too feel cared for and valued. The pandemic has sadly highlighted that this aspect has often been missing or undervalued. (85) Many staff have died or have been disabled in the pandemic and there is no better time to seriously address their needs.

Driving change in all healthcare design aspects requires highly effective processes for co-creating designs and truly understanding what patients and staff value and pay attention to, as well as the importance of social bonding and other ways of connecting to and helping people. We must continue this process beyond the completion of the hospital building itself, providing opportunities to reconnect and create more social coherence once the hospital is in operation. Hospital designers must focus on creating an organisational and societal learning cycle that feeds into each subsequent design in a virtuous learning and improvement loop.

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# CHAPTER IV

# ENRICHED ELEMENTS OF SALUTOGENIC ENVIRONMENTS

TYE FARROW

Until quite recently in terms of human history, our attitude towards public health and general *state-of-well-being* has been holistic: we have focused on maintaining a healthy diet and lifestyle. Five-thousand years ago, traditional Chinese medicine took a holistic approach to achieving health and wellbeing by cultivating harmony in one's life. The Greek physician Hippocrates, considered to be the father of medicine, emphasised diet, lifestyle, and environmental factors, not only to prevent illness but to *cause health*. The Greek philosopher Aristotle, whose concepts of ethics are the foundation of Hellenistic philosophy, held the central concept of "eudaimonia" which is commonly translated to mean happiness, welfare, or *human flourishing*.

The Roman Empire followed the Greek way of thinking, promoting a healthy diet and lifestyle and supporting it with public infrastructure such as public baths, aqueducts, and sewer systems that improved the health of the population.

In European societies, from the 1600s through to the 1800s, a variety of intellectual, religious, and medical movements arose, featuring self-healing and holistic approaches to health. Among these movements were homeopathy, osteopathy, chiropractic, naturopathy, hydrotherapy, herbalism, and spiritual anthroposophy.

## Changing attitudes towards public health

Our views on public health have also evolved over time. The American physician Lester Breslow, whose work had a large impact on public health, defined three eras of public health. The first era was that of the Industrial Revolution period, up to the 1800s, when overcrowded cities were overwhelmed by communicable diseases. Lack of sanitation and little or no access to clean air and other necessities led to the establishment of public health authorities. At that time, architects, urbanists, and landscape architects worked together with public health officials to create healthier environments, including extensive park networks. Urban design guidelines were created to reduce over-crowding, improve air circulation, and provide access to daylight and sanitation.

The second era of public health began in the 1940s, when the reduction of infectious diseases meant that people were living longer. The damping of the waves of communicable diseases led to an upsurge in non-communicable and chronic disease.

We are now entering the third era of public health, where we can *activate optimal health* by creating *enriched environments*, with generative elements that cause health. In this third era of public health, society is shifting to a *wellness* mind-set, versus a *healthcare* point of view.

Our interest in being healthy has never been higher. Now, with the re-emergence of globally-spread viruses, wellness has become the number-one priority for city dwellers and will likely remain so after the waves of pandemics have been dampened. This is evidenced by the number of companies moving into the wellness sector. According to the Global Wellness Institute, the global wellness economy was a $4.5 trillion market in 2018: "The industry grew by 6.4 percent annually from 2015–2017, from a $3.7 trillion to a $4.2 trillion market, nearly twice as fast as global economic growth (3.6 percent annually, based on IMF data). Wellness expenditures ($4.2 trillion) are more than half

as large as total global health expenditures ($7.3 trillion, based on WHO data). The wellness industry represents 5.3 percent of global economic output."

## The modern focus on disease over health

In the last hundred years or so, the holistic views have narrowed. Our focus shifted to curing disease and injury, rather than on creating health. In 1910, the Carnegie Foundation funded an assessment of North America's medical education system. Their Flexner Report stated, in effect, that anything other than Western, evidence-based medicine, was *witchcraft*. This set the stage for a disease-oriented, evidence-based pathogenic medicine. *Health* became synonymous with *healthcare*, which is a medical treatment. The Western, evidence-based model had extinguished the older, more comprehensive approach, that links physical, spiritual and mind health with social wellbeing.

Under our current system, we debate issues such as the efficiency of medical care, waiting times and delivery systems, while overlooking the larger questions of how to shift to a mind-set of health-creating abundance and how to move from *illness prevention* to a state of *health promotion*.

The illness mind-set is pervasive: a Google search for the words "cause health" generates countless variations on "cause health problems," "cause health abnormalities," "cause health risks" and "cause ill health"; nearly every link is for healthcare deficiencies and *illness prevention*. Few, if any, will lead to affirmative outcomes and *health promotion*.

Attitudes are evolving: The World Health Organization takes a broader, more holistic view when it defines health as "a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity" (World Health Organization, 1948).

Beyond "health" is the concept of "wellness": defined by the Global Wellness Institute as "the active pursuit of activities, choices, and lifestyles that lead to a state of holistic health." In other words, wellness emphasises the holistic, active, embodied physical engagement that leads to mind-body health and social well-being.

## The role of place and environment on health and wellness

A core dimension of wellness, and the pursuit of holistic health, is "place" and our designed environment. More specifically, the elements of our physical space. Research has confirmed that where one lives has more impact on one's health and wellbeing than the medical system, beyond episodes of serious disease, of course.

The elements of our environments (*enriched* environments) in which we can thrive ecologically, physically, economically, culturally, and socially, can be consciously created. As a society, we can create environments that meet deeply-rooted biological, physiological, and psychological needs. We can create environments that reverse the surge of lifestyle-related diseases and alleviate the drowning of the human spirit. We can create sustainable and holistic living conditions where we can *flourish and prosper*, instead of merely survive.

The full range of design factors that influence our total health extend beyond the state of our physical wellbeing and ecological health, to include qualities of place that affect our state of mind and thereby enrich and accelerate optimal health.

The design of every public space, building, campus, community, and home must be judged in terms of its capacity to activate optimal health. Over the past century, people have become numbed to the harmful effects of denatured, disconnected, and dismal design. Numbed as we may be, we are nonetheless affected by the design of our physical environments. The main problem of our surrounding designed environments and habitations is that they are not intentionally designed for active health promotion – to *cause health*.

Space is not neutral. Space always has some purpose and is effectively a *prescription* which could improve our health or limit our abilities and thereby create illness. The elements of enriched environments are intentional design choices, ingredients that either improve or reduce our capacity to thrive. They have positive consequences for our state of wellbeing, mind, and neurological nourishment. In all the environments we inhabit, we must reflect and ask questions. How does this place make me feel? Does it cause health? How could it make me feel better?

## Ecological health

Our "ecological health" is affected by the demise of the natural ecosystem. While most initiatives in environmental sustainability have focused on the damage to our natural resources, only recently have we begun to address the full spectrum of human and natural environmental health needs.

The design community has responded with rating systems, checklists, and standards: the LEED Building Certification, the Living Building Challenge, the Delos WELL Building Standard, and the Fitwel Rating System. For the most part, these focus on quantitative assessments of the physiological impacts of indoor or outdoor environments, and how qualities like air, water and light affect health and physical fitness.

## Societal health

We can enhance our societal health through the way we create our neighbourhoods and communities. We can diminish societal inequities, limit food swamps, and create the conditions for people to connect and engage with others in meaningful ways.

Health must be an intentional overlay for the design of public spaces, in more ways than simply the physical design of public streets, parks, and urban squares. Design is a channel to represent and communicate the possibility of engaging and inspiring a spontaneous, generous social life that activates optimal health on a neighbourhood and city scale.

## Physical health

Design can disrupt physical health and trigger chronic disease, as can be seen, for example, in the zoning and planning of car-dominated suburbs. Or design can improve health, as seen in New York City's Department of Design and Construction's "Active Design Guidelines."

The NYC document proposes a range of tools to improve health and reduce obesity and diabetes, through intelligent design choices which enable daily healthy lifestyle choices. It includes design strategies that promote natural movement with, for example, convenient and comfortable stairs that encourage their use, or the location of building functions to encourage ambulating. Or facilities that support exercise, through pedestrian-friendly exteriors and massing, multiple entries, stoops, and canopies over streetscapes.

We know there are measurable qualitative aspects of design that affect psychological, physiological and sociological health. We can intentionally create, through design, a measurable dimension of "comprehensibility, manageability and meaningfulness." And, most importantly, we can create the "sense of purpose," as framed by salutogenesis, that is a predictor of a strong sense of coherence and thereby health and wellbeing outcomes, again related to the impact of mind health through stimuli from the built and natural environment.

## Mind health

Emerging research in neuroscience on architecture reveals the fourth element that supports optimal health, the fourth leg of the "health table": mind health. Mind health can be positively affected

through place-making and is an essential element of a strategy for regeneration that enables us to thrive and prosper, rather than merely survive.

Through design and positive stimuli, we can connect the dots between psychological cognitive and pre-cognitive reactions that have physiological responses. These responses fundamentally effect human performance and our ability to grow.

After a century of pathology-centric views, dominated by medical fears and phobias, we can aim higher. Instead of focusing on preventing disease, we can focus on what creates mind health.

Limited attention has been paid to discovering the causes of health and to creating an "anti-fragile" state, as defined by Nassim Nicholas Taleb, whereby the system itself "increases our capability to thrive against stressors, shocks, volatility, noise, mistakes, faults, attacks, or failures." In effect, a system that causes health: environmental, physical, economic, and societal health.

To summarise the pressing problem at hand, despite knowing the role of design and the built environment in creating health and wellbeing, there is not enough attention given to this fundamental aspect of the role of design in creating health and wellbeing, or *causing health* though design.

## The goal and method of this chapter

The goal of this chapter is to discuss how the above-mentioned problems could be framed and to bring attention to the disciplines involved within the field of design and public health, so as to understand and create an interdisciplinary approach to our environments, so they are not only functionally good, but actively improve our health and wellbeing.

The method used for this chapter is based on the theory of salutogenesis by Aaron Antonovsky, along with other related research within the design and health fields, and how to link this theory to the design of the built environment to enhance and actively encourage health creation. It also grows out of my own interpretation of salutogenic design as a practicing architect and my experiences of making through doing, with the intention of creating a built environment that actively causes health and wellbeing. My professional work and outcomes have been demonstrated and recognised by several global organisations, as well as the International Academy for Design and Health. It is this experience, along with my Master's degree in neuroscience applied to architectural design, which brings me to these conclusions.

## Enriched environments

We can intentionally create "enriched environments" that enhance human performance, through specific spatial characteristics, both cultural and causal, and thus support optimal health.

Spaces can be tuned for constructive human behavioural performance, by choosing characteristics that evoke positive basic emotions and background bodily feelings; characteristics that evoke surprise and happiness (taking us from alert to calm) instead of fear, anger, disgust and sadness (taking us from tense to lethargic). These characteristics can create sensory, perceptual, motor, and physiological inactivity and, therefore, are salutogenic health outcomes.

## Salutogenesis or "causing health"

Salutogenesis as a term was coined by the medical sociologist Aaron Antonovsky, who framed it as a concept that sees health as a positive force, rather than a collection of deficiencies. His pioneering research into the relationship between health and illness is outlined in two books, published in 1979 and 1987. Antonovsky focused on the characteristics of individuals who were more resilient to the stressors of daily life, and who, he claimed, exhibited a "sense of coherence" about life and its challenges; qualities that helped them cope with stress through an active healthy lifestyle.

As an example of society's focus on disease over wellness, "pathogenic" is the medical term that means origin of illness. I will use the term "causing disease", as it is easier for the public to conceptualise than its counterpart, "salutogenic", which means the origins of health.

The distinction between causing health and preventing degradation is crucial. The "cause health" view is focused on leveraging human assets and capabilities, regardless of their current state. It engages us in building on these strengths to activate health. Salutogenesis should be the basis for judging all buildings and public spaces.

## The elements of enriched environments

The elements of enriched environments are those design choices that improve human wellness and performance by stimulating constructive bodily proprioceptive, exteroceptive and interceptive responses. They follow a neurophysiological discovery called neural mirroring: we model, or *feel into*, the same behaviour or feelings which we observe in another. This is tied to the neuroscience discovery of "primarily affordances" that lead to either Gibbsonian motor affordances or metaphoric motor actions.

This transitions into a concept known as "embodied simulation," in which an experiential understanding of an object or building environment evokes a motor or perceptional action sensation within us. This is as if we are doing the same thing that we are observing in the object, building or environment. In a way, it is like empathy, but for what we observe.

Our perception of space is multimodal. Our bodily experience of moving affects all our senses. How we relate to an environment and make sense of it is a direct result of how we experience the world.

These elements, or characteristics and atmospheres, of enriched environments create embodied simulations within our mind/body biological and chemical systems. Like architectural "super-vitamins," they can enhance and activate optimal health, as measured though neurological, physiological, psychological and sociological feedback.

The effects of enriched environments, and the ways in which a person's surroundings can positively or negatively affect them can be seen in the research of Hebb, 1947; Krech, Rosenzweig and Bennett, 1960; and Gould et al., 1999.

## Enriched environments stimulate and increase brain activity

Research in neuroplasticity and neurogenesis (Gould et al. 1999) is beginning to raise awareness that learning capacity and memory can be improved by our surroundings. Not all aspects of the brain are fixed, or destined to deteriorate over time, as was previously assumed. Instead, the brain is changeable or "plastic" throughout adulthood, with the potential to create new neural networks under "enriched" conditions.

Research on the brains of mice indicates that environmental enrichments, such as being raised as pets in an appropriately stimulating cage, leads to increased cognitive development. Single mice raised in cages with toys, ladders, tunnels and running wheels showed more than a 25% rate of synaptogenesis, the links between neurons that result in increased brain activity, and a thickened cortex (Rosenzweig, 1960-64).

The research also shows that a lack of optimal stimulation also impairs cognitive development, as demonstrated in the case of Robert King and the "Angola Three," who spent 29 years in solitary confinement, 23-hours a day, in a windowless prison cell with virtually no human contact. As a result, King's hippocampus which, among other things, regulates memory, spatial orientation, and emotion regulation, was damaged. He lost his ability to navigate and was unable to recognise faces.

Such discoveries have been applied to the treatment of brain-related dysfunctions, including Alzheimer's disease, while a lack of stimulation may be proven to impair cognitive development (Chuang, 2010) (Verret et al., 2013) (Murrell et al., 2013).

**Architecture can enrich the brain-mind-body**

In many ways, architecture is like food: it can enrich the brain-mind-body or starve it; it can encourage social engagement or create loneliness. It depends on the architectural "nutrients" that we consume. For many, the buildings we live and work in are "empty calories": the built equivalent of unhealthy diets. Fast food and lack of social engagement are associated with a lack of cooking and eating together; they are sensory-deprived and mentally unfulfilling.

*Image 1: Roxborough House; Farrow Partners Architects.*

As with our built environments, this empty-calorie attitude has adverse results, ranging from obesity and chronic disease to a lack of socially unifying conditions, such as sharing a table and breaking bread. Like many activities and places we occupy, cooking food has become a transactional exercise, with us only doing the bare minimum of what is asked, to provide protein and calories, and no more.

Today, many people have very high expectations around what and how they eat, how and where food is grown, and how it supports local economies. Many people see themselves as more than consumers of unhealthy and monotonous meals, and instead as part of a movement that appreciates food sustainability and nutrition, and which enhances the social and sensual experience of cooking and eating. This has a more forward-looking level of societal appreciation.

Enriched environments influence the "barometer that is one's feelings" by "rediscovering the world in which we live yet which we are often prone to forget" (Merleau-Ponty) through the phenomenology of action-perception, through the pleasure-displeasure and activation-deactivation interpersonal circumplex structure on the positive activation-pleasure axes.

*Image 2: Mater Private Hospital; Farrow Partners Architects and MCA Architects.*

We know that space and place are two different things. Here, we define space as a mapping of Cartesian coordinates of objects in space, as viewed through the lens of the 17th century French philosopher, Rene Descartes, in which the relationship of one object to another never changes but is fixed and defined.

Place is defined as the phenomenological experience of an action-perception-learning-memory-emotion (Michael Arbib 2020) human moving through space, in which the perception of objects in relationship to each other, and one's own body, is continuously changing, due to ever-changing atmospheric conditions.

Similarly, house and home are different: a house is the physical spatial measurements and programmatic elements that make up a residence in which one or several people reside; a home transcends those Cartesian coordinates and is a place shaped by an individual's or family's specific collections of items that create an architectural atmosphere by holding memories, personal feelings, and meanings. Home environments are filled with experiences, events and intangible stories that linger in the occupants' memories, and are projected on and into the structure of physical elements. They create a sense of purpose, as defined by salutogenesis.

*Image 3: Royal St. Georges College; Farrow Partners Architects.*

## Stimmung and the 'atmosphere' of a space

Places transmit a psychological "temperature" which we "feel into" — a concept known by the German word "stimmung", meaning atmospheric mood, which is often associated with music and the state of an instrument once it has been tuned. Atmosphere, as it relates to architecture, is a harder concept to define. It is more nebulous, of the moment, and "invisible, intangible, elusive, without physical limits, unstable, instinctive, highly subjective to the individual, and often described through metaphors" (E. Canepa, 2019). Atmosphere is the "sign impressed on our senses and our intellect by the experience of the architectonic space" ether consciously or, more often, unconsciously (E. Canepa, 2019). Atmosphere is "a state that is hardly defined not because it is rare and unusual but, on the contrary, because it is omnipresent – even thought at times unnoticed – as the emotive situation" (Griffero, 2014).

## The elements defined

The elements of enriched environments are non-Cartesian, innate and distinctive. They are the architectural atmospheric aura of place, activated by the cycle of mood-action-perception-learning-memory-emotion-mood. The elements offer two types of qualitative attributes: those associated with the emotional realm, and those related to the physical space. In addition to the functional purposes of a space, the elements define a stimmung – a set of feelings that the architecture can convey. The elements include generosity and legacy; a sense of occurrence; optimism; nature; variety and vitality; authenticity; solidness, silence, stillness, and intimacy.

### 1) Generosity and Legacy

We respond positively to surroundings that give us more than they are asked to and that communicate a higher purpose, that are aspirational and hint at something bigger. The feeling of being part of something larger can increase our sense of connection and empathy, and enhance our wellbeing. Design that embodies generosity and legacy — that exhibits responsibility and is durable beyond any basic requirements for sustainability — can affect inhabitants and make a lasting contribution to their health.

“The notion of generosity in architecture has emerged in various ways and for various purposes. The expression is generally employed synonymously with abundance, taking on a positive sense in its connotation of something initially unrequested being added to a built project—a gift offered beyond the requirements” (Silvio Carta 2017).

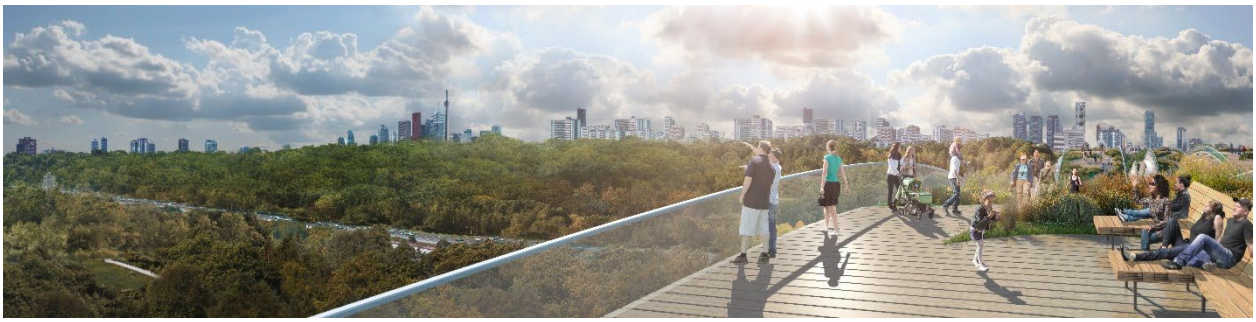
Juhani Pallasmaa defines the idea of generosity in architecture through the concept that the architect, through design, provides their view of the world and life. The person using the building is experiencing the architect’s generosity, which transcends the “naïve realist view of architecture as a professional craft that serves only practical and economic purposes by means of building technology” (Pallasmaa, 2011).

Francis Rambert puts forward the idea of “generous versus generic” and what “more” architecture can give to a city and those that use it regarding the “cultural, contextual, spatial, and habitable *more*” (Desveaux & Rambert, 2008).

Generosity also relates to how architecture can allow a space to change, adapt and evolve to suit those that use it, thus making it their own. “The characteristics of such space shall not be solidly defined, as the users will configure the space and its functions over time and use” (Silvio Carta 2017).

Architecture of the last thirty years is separately tied to a concept of speed and timelessness: a larger sense of time, that is grounded, where the passage and marking of time merits attention, not just the shaping of space and form.

People gain a sense that they are part of something bigger than themselves in certain environments. The buildings become part of their surroundings and a part of the daily lives of the people who use them, giving comfort, hope and a sense of wellbeing, and becoming part of our consciousness and subconscious as we interact with them.



*Images 4 & 5: The Living Bridge, Farrow Partners Architects.*

## 2) A Sense of Occurrence

Venues with a sense of occurrence make us feel engaged and stimulated. We sense the energy of the built surroundings and the people in them, prompting us to think, act and feel in new, unexpected ways. These places "do not pass quickly before our eyes in the guise of objects we 'know well' but on the contrary, hold our gaze, ask questions" (Merleau-Ponty, 1948). They are accelerants for our senses, where we can watch discreetly from the edges and/or choose to be watched at the centre of activities.

Importantly, these places are not over-stimulating, but intriguing, vibrant places with a changing cast of people, points of focus, composition, and movement.

*Image 6: The Toronto Montessori School, Bayview Campus, Farrow Partners Architects.*

*Image 7: The Toronto Montessori School, Bayview Campus, Farrow Partners Architects.*

### 3) Optimism

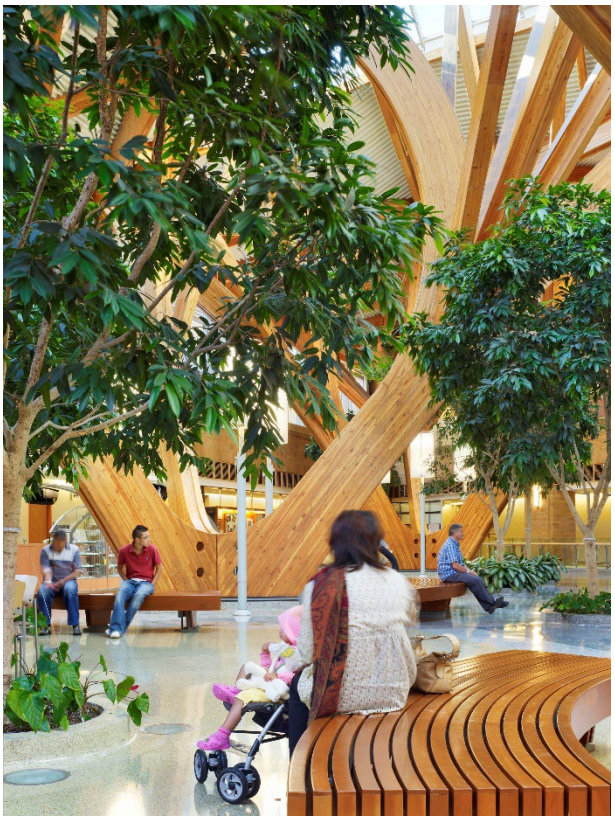
Areas with optimism radiate youthfulness, abundance, and life. They have a contrast of mass and gravity, of light, lightness, and flight — a sense of weightlessness that defies gravity and often encourages an upward gaze. Places that shape our embodied cognition invigorate us, make us feel more alive, and open up possibilities in our mind's eye. They expand our horizons and allow us to contemplate new possibilities.

Places with optimism express purpose, promote wellbeing, and celebrate daily life; they enhance our ability to create social change.

*Images 8 & 9: The Shaare Zedek Medical Centre Cancer Centre. Farrow Partners Architects & RO Architects.*

**4) Nature**

Places with "nature" are inspired by natural shapes, light, and materials, biophilic elements and the laws of nature. They contain mid-range fractal patterns of dimensional complexity.




*Images 10 & 11. Credit Valley Hospital Cancer Centre. Farrow Partners Architects.*

The study of biophilic design explores our innate need to connect with nature, natural elements, and forms. This field of enquiry emphasises the restorative role that design can play in helping us cope with stress and mental fatigue. The use of natural, local materials and indigenous plants and landscape forms creates connections to the land and with layers of history and cultural identity. Places of protection, refuge, and overviews with a sense of prospect offer a primal sense of comfort. Natural shapes such as curves convey feelings of ease and friendliness, while sharp angles convey tension and hostility (Bar and Neta, 2006) (Vartanian et al., 2013).

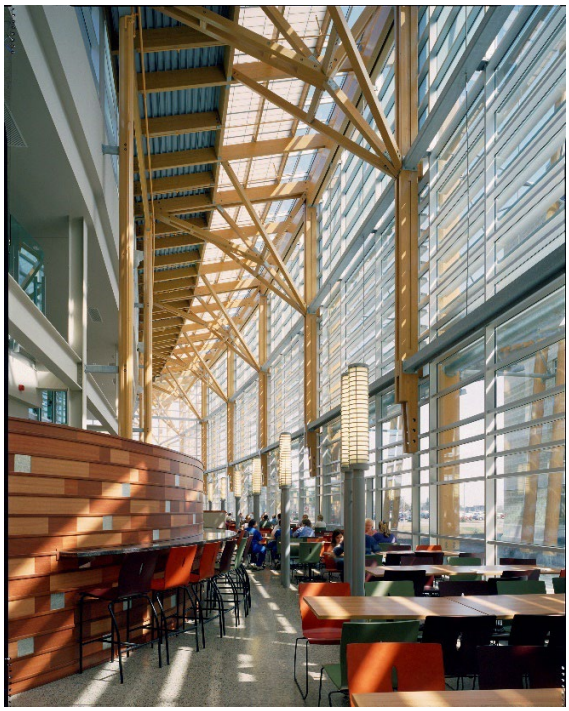
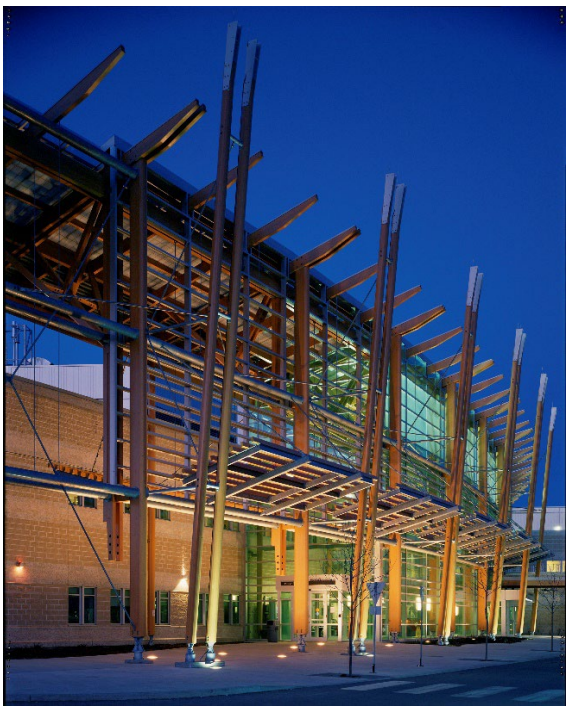
Like biophilia, hortophilia, coined by neurologist Dr. Oliver Sacks, and based on the root "horti" (as in horticulture) is a newer concept. Defined as our "desire to interact with, manage and tend nature", it is deeply ingrained in us. Hortophilia adds a phenomenological and kinetic animation to our engagement with nature. The powerful effects of nature's attributes on our optimal health are more than just spiritual and emotional; they include physiological, psychological and neurological responses.

Humans are hard-wired to perceive nature's fractal patterns, from the form of a tree's trunk and branches to the fine veining of its leaves. Some fractals repeat, while others lead to chaotic fractal patterns. Certain ranges of fractal dimension, or density, are more pleasing to our eyes. Our pupils employ fractal search patterns, first scanning larger elements like tree trunks or cloud patterns, then shifting to finer elements like branches and curves of cloud elements.

Similarly, the rhythm, pattern, shape, light, and shadow of building forms can reflect a mid-range dimensional "visual sweet spot" with which we emotionally resonate (Richard Taylor, 1999).

**5) Variety and Vitality**

Spaces with variety and vitality offer a range of experiences and a sense of discovery; they stimulate positive emotions and background bodily feelings of seeking, curiosity, and a sense of freshness.

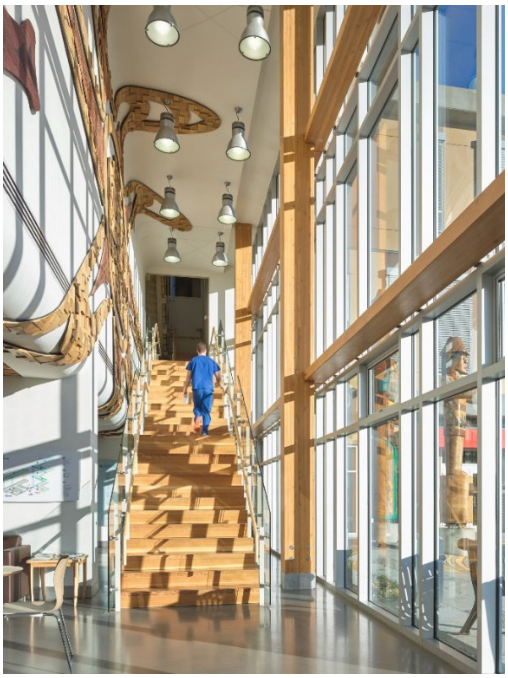
*Images 12 & 13. The Thunder Bay Regional Health Sciences Centre. Salter Farrow Pilon Architects, of which Farrow Partners Architects is a successor firm.*

Often, the buildings we inhabit are directional, with linear way-finding providing limited choice for where we are to go. Instead, buildings can provide an overlay of atmospheres that create curiosity and seeking, that seduce people to stroll and saunter, wander and discover, instead of simply getting from A to B. A sense of coherence — a vital element of a sense of purpose — is more than singular directionality, but the overlaid variety and vitality of multi-dimensional experiences affecting all of our senses.

Recent neuroimaging research has discovered that people who spent time wandering and discovering a new neighbourhood experienced positive persistent emotions that lasted beyond the initial travel. The neuroimaging revealed that the wandering stimulated both the hippocampus and the ventral striatum regions of the brain, the places associated with memory, learning, decision-making and reward processing. Simply put, wandering in areas of variety and vitality makes us happier and more mentally resilient (Heller, A.S., et al, 2020).

**6) Authenticity**

Environments with authenticity exude a sense of reality and rootedness; they feel that time has passed here. The instant we first enter a building, room, or area of a city, we consciously and subconsciously experience its atmosphere and mood. Just as when we first meet someone new, we determine whether they are real and genuine, or artificial and fake. Buildings communicate their authenticity in how our feet touch the floor and how the sounds bounce off the walls. Environments are often described as warm or cold, which can come from the materials used: some physically absorb heat from the environment or take heat from our hands-on touch, like the differences between leather, wood, and stone, and glass and steel.

*Images 14 & 15. St Mary's Hospital, Farrow Partners Architects and Perkins Will.*

Shapes, form, and symbols can communicate a reality and rootedness, or the opposite. Research at the University of Toronto into how fast food can impede happiness (Julian House, Sanford E. DeVoe, Chen-Bo Zhong, University of Toronto, 2013) found that symbols of "impatience culture" undermine our ability to experience happiness. They produce negative consequences for how we experience pleasurable events, through a psychological effect called priming. Our subconscious is influenced by exposure to these clues — we think and react differently based on the authenticity or shallowness of our surroundings.

**7) Solidness, Silence, Stillness, and Intimacy**

An unplugged architecture is one that allows us to listen to our own being. It is of human scale, layered with subtle compositions. It does not offer an absence of sound, but visual sound and, even in a busy world, includes places that offer stillness.

*Image 16: The Samara Resort, Farrow Partners Architects.*

*Image 17: The Samara Resort, Farrow Partners Architects.*

Richard Sommer in his 2019 University of Toronto exhibition, "New Cicadia, Adventures in Mental Spelunking", posed the question: "Have our tech-infused lives caused us to forget the benefits and pleasures of losing ourselves in states of repose and reverie? What would happen if we disconnected from standard time and external stimuli within a dream-like space specifically designed for relaxation, reflection, and repose?"

We are familiar with the constant buzz of the city; the noise that drowns out the subtler sounds that surround us; not to mention the rhythm of our breathing and beating of our heart. Overlaying the noise is often a vast, "placelessness" and the loss of a scale which we can relate to physically and emotionally.

An environment can offer a more appropriate scale and proximity, to establish a relationship between our body and the environment. The environment can reflect the sounds around us and transmit them back to our bodies to be heard (and not only in our ears); the way sound vibrates from wood, leather, steel, glass, and stone is different, and can create a warm tone or feel reflective and empty. A building's mass and "tone" should relate to the scale of a human body.

These are the qualities that define places where we want to enter, linger, and stay a while; places that draw us in and make us feel more mindful and at peace; places that we want to get to know and discover, versus those we want to keep on passing through. The qualities of light and shadow, and how light falls on a surface; the materials used and their surface depth, sheen, or reflectivity; the sound of the space; and its shape and form. These elements add to sensations of stillness and intimacy.

## Creating places that expand, rather than limit, human capabilities

We can create spaces with generosity, spaces that open possibilities and expand capabilities for the people who use them, instead of leaving them feeling mentally weak and unfulfilled. Research shows that social and spatial influences can exercise and strengthen our mind-body relationship, and that lack of stimulation impairs cognitive development.

In the 1980s, researchers discovered that some people, with no signs of dementia in life, were found at autopsy to have brains consistent with advanced Alzheimer's disease. Somehow these people had large "cognitive reserves" sufficient to offset their brain damage, such that they could function normally. They were described as having the mental "ability to engage another gear and suddenly accelerate to avoid an obstacle." The places that people inhabit was found to be a key factor in developing these cognitive reserves.

## Conclusion, discussion, and further research: in judging the merits of public spaces, health must be the primary factor

I have attempted to use my professional experience in this chapter to contribute to the development of salutogenic design that activates optimal health and wellbeing. I invite you to discuss this topic because we, as architects and designers, have a great responsibility to shape our society's health and wellbeing.

In designing public spaces, we must be dedicated to creating enriched environments — places that actively cause health. We must recognise that there is no such thing as a neutral space. What we create either causes cultural, economic, ecological, and mind health, or erodes it; it either promotes or limits our abilities to thrive physically, emotionally, and socially. We should not tolerate any more design that causes disease, depression, and boredom. The choice is ours.

# CHAPTER V

# DESIGNING SALUTOGENIC SPACES TO PROMOTE HEALTH

ROSSANO ALBATICI AND STEFANO ANDI

*The value of a door opening pleasantly onto a garden cannot be measured by counting how often and how steadily it is used, or how many hours it stays open. The decisive thing may be a breath of liberation in the almost ritual act of opening it before breakfast or on the first warm and scented spring day. R. Neutra [1].*

## Introduction

At the time of writing this paper, a year has passed since the declaration of a global health emergency following the outbreak of the Covid-19 pandemic, triggered by the SARS-CoV-2 virus. Much has been written about the causes at one level or another, and many ideas have been put forward on how best to tackle the problem in the short term, especially through health measures, and a new organisation of society reflected in numerous restrictions imposed by national governments. Some researchers have explored the connection between sickness and environment, and it has been stressed that there is the need for "transformative change, using the evidence from science to re-assess the relationship between people and nature, and to reduce global environmental changes that are caused by unsustainable consumption, and which drive biodiversity loss, climate change and pandemic emergence" [2]. It is a vision that moves towards a bio-psycho-social approach to human health, whereby attention is shifted from the diseased organ to the human being as a complete whole, not least considering the environment in which the person lives, in all senses: physical and biological, relational, psychological, social, and ecological.

In this scenario, the built environment plays a role of primary importance regarding both the impact of the construction industry — environmental and economic — and pollution created by the energy management of an often outdated and power-hungry stock of buildings, as well as guaranteeing conditions of hygiene that make it possible to prevent the onset of illnesses. Following the salutogenic paradigm, buildings can be designed not only to guarantee suitable conditions of hygiene and psychological and physical wellbeing, but also to promote health factors in their surrounding environment, stimulating the self-restorative element in individuals to give them mastery of the healing process:

> "Health is not a static condition but finds expression in a dialectic relationship with the environment through an adaptive and transformative plasticity that involves overcoming and processing potentially health-threatening stresses. An example of this adaptive capacity is the immune system" (Carmelo Samonà).

Accordingly, an environment that supports a person to promote health can facilitate the production of resources able to fortify the immune system and increase its readiness to take on possible external hazards, including viral threats. Architecture can therefore become a formidable tool by which to anticipate, counter and contain the problems and the effects associated with possible future pandemics.

## PART A: Design and Rhythm

### *A pathogenic approach to architecture: business as usual*

In a 2018 report, the World Health Organization defined healthy housing as shelter that supports a state of complete physical, mental, and social wellbeing, providing inhabitants with a feeling of *home*, including a sense of belonging, safety, and privacy.

The concept of a healthy building is an emerging area of interest in the world of architecture, for both academic research and industry practices, as observers have noted a growing incidence of pathologies among occupants, identified as being connected with the built environment. This is a matter of importance for health given that people, on average, spend 60% of their lives in a dwelling and 90% of their time in enclosed environments.

Some diseases are directly associated with poor standards in the design and maintenance of buildings which, over recent years and with an increasing and almost exclusive focus on energy efficiency — hence on the aspect of reducing losses through the outer shell — have become like containers, more and more enclosed and sealed, where problems caused by possible errors in design and inappropriate management of the living space tend to be magnified.

The two pathologies directly attributable to the relationship between people and buildings are Sick Building Syndrome and building-related illness. The worrying fact is that, according to the WHO, as many as 30% of inhabitants living in new buildings are affected by these health issues. Extensive research has been conducted in this field and, recently, theories have appeared identifying the fundamental factors that characterize a healthy building, of which the parameters afford a guide for proper design able to ensure the health of inhabitants: ventilation, air quality, thermal health, water quality, moisture, dust and pests, acoustics and noise, lighting and views, safety, and security.

This approach, however, which bears similarities to that pursued in the sphere of medicine, is definable as pathogenic in nature, with the aim being to identify elements that can cause discomfort and illness, anticipating their onset or minimising/eliminating the factors responsible. The theoretical basis is the IEQ, Indoor Environmental Quality, defined by ASHRAE, as a perceived indoor experience of a building's indoor environment. It includes aspects of design, analysis, and the operation of energy-efficient, healthy, and comfortable buildings. IEQ takes into consideration thermohydrometric, acoustic and visual aspects of the enclosed spaces where people live and work, likewise the air quality, taken as an integrated whole.

Nonetheless, research in the sphere of IEQ tends to focus on understanding the state of an environment measuring the quantitative aspects of physical quantities that define wellbeing, by way of appropriate sensing media able to exploit recent advances in information and communication technology, through a process of collecting copious amounts of information referred to as "occupant-centric data". These items of data are combined, subsequently based on statistical type indices to give an integrated wellbeing index (WBI), expressed mathematically. Complementing this approach is the notion of the healing environment (HE), which sees people not only as receptors of perceptions by which physiological actions are induced, but as sentient beings interacting cognitively with the environment in a subjective manner, experiencing inner sensations that influence their relationship with the world and consequently their perception of it. Humans are complex, multidimensional beings, and cohesion of body, mind, and spirit is a hallmark of healing. On this premise, studies consider measurable aspects of the environment, but also qualitative elements like the state of mind of individuals, their feelings, their age, habits, lifestyle, education, and culture, and so forth. In effect, individuals are influenced by each other and their physical environment [3].

A theory developed recently concerning an approach to indoor climate, combining IEQ and HE, divides the sensory processing of environmental input into four successive stages [4]. Starting with the sensation produced in the occupant by the environment by way of receptors located in the body

and connected to the nervous system, there is then a second step consisting of a subjective perception where psychological aspects of a personal nature come into play, by way of a personal thought process, typically including past experiences, arousal, and current emotional state. This is to some extent an unconscious process. The third stage is one of cognition, i.e. becoming conscious of the environmental perceptions and stimuli and responding via a subjective action "based on a conscious and logical thought process and free will." The fourth and final stage is one of expressing a sense of satisfaction or dissatisfaction with the environment.

A user-centred theory of building design has therefore now been proposed where the cultural, psychological, behavioural, social, and contextual dimensions are also considered. This theory, however, continues to reflect a homeostatic conception of wellbeing and state of health. The end in view is to guarantee a set of environmental conditions that will remain stable over time, as far as possible, while adapted to individual needs or, in any event, be perceived by the user as giving satisfaction based on subjective sensations and perceptions at a given moment. The conditions are managed via control media based on advanced building automation systems of precision and efficiency such that any changes in the indoor microclimate can be corrected swiftly, and values re-established within set ranges.

The template remains that of La Mettrie's *homme machine*, a reductionist view that has led, in architecture, to the design of increasingly mechanised living spaces, held hostage today by a pervasive digitalisation. In building practice, the approach is based on the use of simulation software applying refined techniques, with machine-learning and the Internet of Things, which adjust to our preferences and operate on network-connected devices, allowing real time analysis of monitored data and its management, according to cause-and-effect binary logic principles. It is an essentially static process, therefore, concerned with the physical and the mineral, while ignoring the element on which the health-awareness and self-healing mechanisms of the person depend: the live human body.

### *A paradigm shift: salutogenic design*

During the 1970s, the Israeli American sociologist, Aaron Antonovsky, introduced the theory of salutogenesis [5], which identifies health as a dynamic process whereby a person is never altogether well or sick but lives in a "health-sickness continuum." The question he posed in the sphere of his research, with genial intuition, was: "Whence the strength?" In other words, where does a human find the resources to stay healthy and overcome moments of sickness? The aim is therefore to make a shift towards the pole of health, meaning that it is important not only, or not so much, to ask oneself what is causing an illness (pathogenic approach), but rather, what are the factors in one's life that generate health (salutogenic approach). On a biological level, to keep a steady state of health, the human organism naturally seeks homeostasis, defined as the capacity of the organism to compensate actively for environmental disturbances through a coordinated physiological action, made possible by the plasticity of its *milieu intérieur* [6]. All the same, "the salutogenic model maintains that the essential quality of the healthy organism is not homeostasis, but that it is uninterruptedly transforming heterostatic processes into homeostatic processes, which enables it to handle an enormous number of processes and gives it a great capacity for adaptation" [7], through a process of homeorhesis. Current research in this field is moving towards a "broad salutogenic approach" determined "first by the consideration both of individual physical, mental, emotional, relational and spiritual aspects, then of social, economic, cultural and environmental aspects, and finally of interactions between internal (personal) and external (contextual) aspects" [8]. Speaking of "environment", it is reasonable to suppose that the built environment, too, figures among the factors able to promote health.

The relationship between person and building is complex, however, and not definable simply in terms of linear cause-effect actions or bi-directional type action-reaction. It must be seen more as a system, self-regulating dynamically in an attempt not to preserve baseline parameters, but to maintain its organisation following a principle of non-equilibrium, instability, and change. In effect,

"the built environment and its indoor environment with occupants is clearly a complex system characterised by feedbacks, interrelations among agents and discontinuous non-linear relations" [9]. Authors in the field of psychophysiology speak of "allodynamic regulation", considered broader than heterostasis, which subsumes the wide range of regulatory processes represented by the concepts of homeostasis, homeodynamic regulation, heterostasis, and allostasis. In this regard, one acknowledges that regulatory processes are not always determined by the wish, conscious or otherwise, to return to a set-point level (i.e., to states of wellbeing generally accepted as such). The situation is fluid and dynamic, as expected in a system where the whole is more than the sum of its parts.

"This idea of context, which is valid in different degrees and forms depending on the specific nature of each milieu, sits in contrast to that of space as a neutral container […] mechanistic neutral space has no influence on the elements it happens to encompass: it is a container, pure and simple; and similarly, the self-same elements do not contribute to the specifications of its properties […] That which emerges when describing the theoretical nodes of Bernard's notion of milieu is, rather, an idea of systemic space of inherence" [6]. "I can now summarize what is meant by the salutogenic orientation. It derives from the fundamental postulate that heterostasis, senescence, and increasing entropy are core characteristics of all living organisms" [5].

These theories, which derive essentially from the sphere of medical and biological sciences, are reflected directly in the building and architectural design sector. Indeed, there is a shift currently in theories regarding comfort towards a focus on heterogeneous and dynamic indoor conditions: "less rigorous control, more personal autonomy, and a more responsive indoor environment would improve occupant experience of indoors" [10], besides reducing the energy demands of buildings. A recent addition to the debate is the concept of multi-sensory variability, occurring either dynamically throughout the day, or spatially across different places. It is acknowledged that the temporal and spatial variability of environmental stimuli is a positive for health, cognitive performance, and the general sensation of pleasure. Similarly, researchers have revisited "alliesthesia", the concept — introduced in 1971 by French psychologist Michel Cabanac — of a psycho-physiological phenomenon describing the interdependent relationship between the inner state of an organism (constantly changing) and the pleasure or displeasure prompted by given stimuli. In short, pleasure is experienced not when an aim is achieved, but in the process of achievement, as it is precisely the act of movement, within and without, by which pleasure is generated and developed.

The question one can now ask is whether this variability of environment might be beneficial, not only in keeping people healthy or enhancing their wellbeing (healthy building design), but also in promoting health, and how it might be managed while ensuring compliance with comfort and energy efficiency conditions, imposed by the current regulatory framework (salutogenic design).

### *A new research path based on stress theory*

One possible path of research is based on stress theory. Stress is a psychophysical response to tasks that can differ markedly in nature — emotional, cognitive, or social — and are seen by the person as excessive, producing entropy. It is also definable as the relationship between the person and the environment that is appraised by the person as taxing and endangering to his or her wellbeing. According to Hans Selye, stress should not be eliminated, as it is the spice of life: to live without stress would be equivalent to dying. When faced with a stressful event or stressor, real or imagined, people respond by registering tension, and stress is what remains when this same tension is not successfully overcome. Stress is therefore a factor of importance, since it activates individual resources as agencies of health and healing: distress (a negative psychological response to a stressor) is reduced, whereas eustress (a positive psychological response to a stressor) is favoured, and this has an evident impact on life-satisfaction. The aim therefore is to promote a fine balance, subjecting our body to stresses of moderate magnitude and significance (excessive stress would lead to chronic situations and illness), training it appropriately in such a way that it learns, over time, to generate positive tensions and develop a form of tension management that must be adequate and efficient and

can have salutary benefits. Tension can indeed be salutogenic. In this way, suitably stimulated by the surroundings, the body gets used to managing stress in an appropriate manner and coming up with ready and efficient answers, employing a repertoire of mechanisms that are instantly available and able to restore homeostasis. Antonovsky introduced the concept of "exercise model potentiation", i.e. boosting the capacity for coping with stressors by way of exercise, based on the premise that an environment requiring nothing is, by definition, a stressor (underload concept). These individual capabilities, which derive from successful tension management, are known as General Resistance Resources (GRR). In other words, the characteristics of a person, a group or a community that provide an individual with the ability to tackle stress factors effectively. GRRs can facilitate active adaptation of the organism to the environment (tension management) and increase negative entropy. Thus, the idea is to achieve balance through a process of adaptive homeostasis, a recently introduced medical term defined in literature as "the transient expansion or contraction of the homeostatic range in response to exposure to sub-toxic, non-damaging, signalling molecules or events, or the removal or cessation of such molecules or events" [11].

In essence, when people in an indoor environment are exposed to the four main domains of occupant wellbeing (thermal, acoustic, visual, air quality) and are subjected to gentle stresses (i.e., those considered acceptable and manageable, with temporal variations occurring within a given range), the body can be trained by increasing GRRs, to achieve the creation of a stimulating environment that forces the organism to seek homeostasis through mechanisms of adaptation where biology, architectural and bio-meteorological systems are finally integrated, thereby cultivating a close relationship between the occupied environment and the biological system.

### *The curative building: PNEI and rhythm*

According to the recently introduced wider salutogenic approach, the various factors that can help to maximise the health-promoting inner resources of individuals also include the environment, both in the broad sense (economic, ecological and social) and in the narrower sense (i.e., the built environment). Appropriate basal activities and, likewise, quantitatively and temporally suitable responses of the stress system to stressors, are essential to experience a sense of wellbeing, deliver an adequate level of proficiency when performing tasks, and enjoy positive social interactions. Moreover, thanks to the stimuli received from the environment and the training that follows, individuals can regain the ability to take control of healing processes, redefining their appropriately trained capabilities for adaptation in readiness to defend against any pathogen that may come along, and thereby provide health factors able to combat a stressor with suitably positive tensions.

Support is also provided in this area by PsychoNeuroEndocrinoImmunology (PNEI), a recent science which argues that the central nervous system (CNS), endocrine system, and immune system make up an integrated network, and any action on one — positive or negative — has repercussions on the others. In particular, the immune system, which defends us from every kind of chemical, traumatic or infective insult and maintains the integrity of our organism, can be seen as a sense organ able to recognise non-cognitive stimuli such as viruses, bacteria, and toxins, working and collaborating in a complex network together with the other two systems. It is "an integrated self-regulation network which aims at maintaining homeostasis, that is to say a constant chemical, physical, biological and psychological state of the internal environment (*milieu intérieur*) in response to stimuli of varying kinds, from infective to psycho-social" [12], internal and external alike.

When individuals receive signals from the world around them via the senses (including the familiar five of touch, taste, smell, sight, and sound), and especially via the CNS, they form impressions and relate to that world accordingly. Acting on the environment occupied by people, guaranteeing dynamic perceptions in time and space, the CNS is stimulated and, through improved tension management, can stimulate, train, and thus strengthen the immune system, ensuring better and quicker responses to external attacks, viral included, and have a positive influence on the course of

a pathological event. In the end, architecture affects a person's behaviour, their neural and endocrine systems, and through its influence on the brain and the body it can directly influence health.

***The building acquires curative powers***

The hypothesis above requires change, from the imperative technical and mechanist approach typical of our times and used exclusively in the world of architecture, engineering and construction (AEC) even today, to a biological approach that focuses attention on the quality of living conditions. It is not possible to study and understand different realities using the same cognitive method: the way in which knowledge develops must adapt to the object of that knowledge. The relationship between human and building cannot therefore be studied with a reductionist approach, typical of the mineral world, which is based on cause and effect. The human organism is a temporal entity endowed with life, and that which must be explored is the main process (albeit not the only process) in which it is reflected: rhythmical movement, which is the vehicle and source of health [13].

With regard to the health of people and referencing the studies of Panksepp [14] and Steiner [15] in this field, seven vital processes of the human organism have been mentioned, expressing the life force that flows and pulsates in our being. Two of these, having pertinence in the sphere of salutogenesis [16], can be related directly to the built environment: respiration and heat. Based on the relationship with the external environment and the *milieu intérieur* of the human body, they are linked to rhythmical aspects of the organism: expansion/contraction of the lungs, and heart rate. The lungs and the heart are, in effect, central elements of the rhythmic respiratory and vascular systems, both housed in the middle part of the body, the torso.

Salutogenic design expresses these two vital rhythmic processes in architecture, based on movement that slows to stillness, but then breaks out rhythmically into movement once again: "Architecture is music in space, as it were a frozen music" (Friedrich Schelling).

*Fig. 1. Goetheanum in Dornach (Switzerland), designed by R. Steiner. Main corridor of the central part of the building.*

### *The heat process*

Thermoregulation of the human body is a complex phenomenon that uses voluntary and involuntary processes to maintain a constant internal temperature independently of climatic conditions existing outside the organism. These conditions are discerned through the agency of receptors located in our skin which send impulses to the hypothalamus, part of the central nervous system, rather like a thermostat, by which biological mechanisms are activated to restore internal body temperature to around 37°C. As humans we do not perceive an absolute temperature, but a change in temperature. Through this perception mechanism, we can relate to the external environment based on how we discern the temperature of bodies that surround us, and compare it to that of our own body. In this way, accordingly, we can know what is going on outside of ourselves, but also control what is going on inside, by activating proprioception mechanisms. Our interest in the world is awakened but, at the same time, so is our self-awareness. We acquire a meaning and, consequently, we act with awareness in the world.

Furthermore, the perception of pleasurableness afforded by a stimulus changes with the inner state of the organism, according to the psycho-physiological process of alliesthesia described previously. Conversely, an environment maintained at a constant temperature leads to a sensation of thermal boredom, a state of discomfort that often cannot be attributed to a specific cause as there are no outside stimuli to trigger the activation of an internal response.

The skin has a role of primary importance in thermoregulation processes, as it presents an extensive venous/capillary system able to dissipate or retain body heat through mechanisms of vasodilation and vasoconstriction, the first and involuntary system by which body temperature is regulated. In effect, there are two main layers lying just below the epidermis: one, outermost, in which blood vessels are located, and another, innermost, where the nerve endings sit. Thus, heat is sensed both by the nervous system, as mentioned above, and by the vascular system that serves the entire body, internally as well as peripherally. It can therefore be said that thermoregulation is first and foremost a circulation problem [17], given that blood is the main carrier of body heat. It is related to heart rate, and the heart can be defined as the organ of heat. Once again, a matter of rhythm.

According to this approach, in order to train people in tension management, it is important that they inhabit a space — be it a dwelling or a workplace — where they are exposed to different and dynamic thermal situations in both the short and the long term, and are not forced to stay put in environments maintained at a steady and controlled temperature, as is effectively the case with today's building standards, which envisage structures designed to perform more efficiently. Variations in the temperature of modern interiors tend to remain within set ranges that are kept as tight as possible.

More exactly, differences in temperature between different areas, glazing that allows direct radiation (linked with improved mood, higher sleep quality and lower blood pressure, as well as being a natural source for vitamin D), the use of blinds, awnings, solar greenhouses, and airflows circulated at different temperatures, all enable perception of the relationship between the world outside of us and the world inside of us, providing a bridge between bodily and spiritual processes, activating our will and awakening our interest [3].

*Fig. 2. Eurithmyhaus in Dornach (Switzerland), designed by R. Steiner and E. Maryon. Detail of the oriel window.*

In effect, heat is not only a physical process, but one of the senses whereby the human being activates proprioception — the capacity for awareness of one's own body and of one's relationship with space, in an ongoing and continually renewed dynamic relationship with one's surroundings.

In a broader sense, moreover, heat can also be generated by elements that are not in fact referable to the physical aspect, and therefore attributable to a change in temperature. Every sense contributes to a perception of the world that surrounds us, and the more the senses are involved in a particular experience, the more the experience becomes full and rounded. Warmth comes from light: natural lighting, direct or indirect with, if possible, a view to the outside and overlooking things that are green (biophilic design) and in movement (restorative design), can be a carrier of heat, as can artificially light if an appropriately selected colour temperature is utilised. Similarly, the colour of indoor and outdoor surfaces can have an influence on the sense of heat and on thermal perception, according to what is known as the "hue-heat hypothesis", in particular when considered "not only as a covering but using its intrinsic qualities to produce a psychological and perceptive influence on people (for example resorting to techniques such as haze and lazure painting for walls, and such like)" [3]. Moreover, building materials themselves and their shapes can generate a sensation of warmth, as created, for example, with wood finishes, which improve the human perception of thermal comfort, whereas metals are associated with cold sensations.

*Fig. 3. Residential home in Laives – House A (Italy), designed by S. Andi. Detail of the chimney of the "olle" oven.*

## The respiration process

The respiratory system can be divided into two main parts: pulmonary respiration and cellular respiration. The first, which is physiological respiration, or breathing, places us in contact with the surrounding atmosphere and is made possible by the lungs: two organs that expand and contract rhythmically thanks to the action of the diaphragm. During embryogenesis, the lungs form negatively and grow creating internal voids (hence, they are accommodative organs). These voids develop into bronchi and allow the lungs to perform their main function: the exchange of gases with

the blood (taking in oxygen and expelling carbon dioxide). Oxygenated blood is then circulated around the whole body to enable the second, cellular respiration that allows the tissues to exchange oxygen and carbon dioxide. Accordingly, it can be said that the human organism is pervaded by respiratory gases: “inside each one of us there is a body of air that obeys its own laws and is revived and regulated by the negative space of the lungs, functioning as hollow organs” [17]. Respiration is not only rhythmical, but is also involuntary, like the beating of the heart. However, unlike the heart it can be more easily controlled: breathing can be affected by psychological stimuli and, conversely, exercising control over breathing and its rhythm can impact on our state of consciousness.

So, there is a clear and often unexpressed relationship between people and the indoor air that surrounds them. The tendency in passive, nZEB buildings today is to minimise this interrelation, creating imperceptible and constant air flows at an even temperature in all rooms and enclosures, irrespective of their intended use. Even the natural exchange of air with the outdoor environment is kept at a minimum to control heat exchange (summer and winter) through ventilation. Here again, the rhythm element and its importance to human health is underestimated, and stillness is preferred. However, recent studies have shown that people persist in their habits and feel the need to open windows, even when not required or necessary from an energy standpoint: “two mismatches exist between building technology and household behaviours. First, there is a mismatch between the wish for quick adaptation, and inert building technology. Second, a mismatch exists between the desire for different room temperatures, and the fact of homogenous, generally high, temperatures. Both mismatches drive households to open windows often and for long periods of time” [18].

This means that it is important to provide rooms with natural ventilation, where possible, both for cooling at night and for the management of air quality during the day, giving people the freedom to operate opening systems for themselves (doors, windows, grilles) and allowing them, if required, to sense the movement of the air around them and feel they are in control of their environment. This promotes occupant comfort, productivity, and health within apartment housing.

The geometry of the space, likewise, can reflect the contraction and expansion of the lungs, accompanying the respiration process with spaces that are by turns tighter (concentration, densification) and more open (dilatation, rarefaction), organised typically as a succession of areas that are roomy to a greater or lesser degree (both in plan and in elevation) to heighten the live perception of space.

Spatial variations can also be accompanied or, if necessary, replaced, by a judicious use of colour, both in terms of hue (variation of colour on surfaces) and shading (varying intensity, chiaroscuro, areas of light and dark).

The opening and closing of windows and doors is also connected to another aspect frequently overlooked in 4.0 buildings: acoustic wellbeing. It is often supposed, in fact, that acoustic wellbeing is achieved in silence, or an absence of noise, with the result that various measures are adopted, aimed at mitigating and ultimately reducing noise levels as far as possible [19]. This is an approach that can lead to acoustic boredom. Sounds can indeed have negative but also positive impacts on human health, wellbeing, and quality of life, based on the indoor soundscape approach. Soundscape is defined as the “acoustic environment as perceived or experienced and/or understood by a person or people, in context” [20]. Recent research has found that comfort is mainly influenced by outdoor sounds, and that human voices and natural sounds coming from outside can be comfortable. Sounds can provide stress relief and restoration, and may also have positive health outcomes, not forgetting the rhythmic aspect of the human organism. The potential of acoustic variability, either dynamically throughout the day, or spatially across the different places we inhabit, can stimulate building inhabitants and, from a PNEI perspective, reinforce the human organism and its systems.

*Fig. 4. Ingrid Leodolter Haus in Wien (Austria), designed by wup_wimmerundpartner. Common spaces for the guests.*

*Fig. 5. Weleda AG, branch of Schwabisch Gmund in Stuttgart (Germany), designed by studio bpr – architektur. Entrance hall.*

## PART B: New Perspectives for a Post-Pandemic Architecture

### *Architects and Quarantine*

The home, or architecture more broadly, is that man-made shell creating an internal space that is needed as a dwelling for the inner self of a person, as distinct from the outer self, in which the person is not confined but rather, projected, into the world, along with the external environment, nature and a multi-faceted society. But then, the home is that creation which, more than anything else, serves as a protective physical shell, harmonically echoing the vital processes of the organism — a psychological projection and reflection of the individual, or the self. And so, for the best possible performance of these four functions that correspond to the four systems of the human constitution (physical organism, organism of vital processes, organism of interior spiritual life, organisation of the self), the home and, in general, any architectural building, must have features and qualities that relate positively to and support and develop those systems. If this does not happen, the building (but also the built-up area, or the city) will not be fit for human beings and will prevent them from developing their existence to the point that, in extreme cases, damage will be caused to their physical, organic, mental, and spiritual health. Precisely due to the contingency — as lengthy and radical as it transpired — of being confined to within four walls because of the lockdown imposed during the Covid-19 pandemic, big difficulties have emerged on the health front for individuals and society alike, connected with the violent and unexpected outbreak of the epidemic, not least in enforced home life. Again, the question arises: do our buildings accommodate people correctly, as they should?

### *The Four Areas of Architecture where Action is Needed*

The four systems of the human constitution described above can be referred materially and directly to four aspects of the architectural organism, which become the main areas in which action can be taken, initially with the end in view of designing buildings that will be health-giving to humans [21].

**1. Space**. The human self is an entity that seeks to develop freely in a varied, open, and changeable space, and is adaptable to the pursuit of personal destiny, aspirations and aims, and of existential tasks in which that self is recognisable. In terms of solid architectural language: a space with character, flexibly expanding and contracting, fluid, with the capacity (by virtue of the elements determining its physical make-up, such as forms, volumes, proportions, colours, materials, and dimensions) to express the identity of individuals, their position in the world and their purpose in it, their pathway in life, and their goals (function, envisaged use, style values, etc.).

**2. Colour.** The inner life, the spirit, is a place where humans live privately through all their experiences, sensations, emotions, feelings, volitional impulses, all passing changeably through different states of consciousness — awake, half-awake, and asleep (unconscious). It is with these often-lively dynamics that features of the architectural interior also dialogue and interact with one another. The qualities of dwelling space such as taste, practicality, sense, organisation, and visual impact, form the atmosphere created by diverse elements expressible in terms of style. Since, from the standpoint of architectural language, this dimension has much to do with qualities of light, the main design tool able to translate these qualities is colour — the dynamic between light and shade. In the past, buildings were full of colour, even Greek temples. In the modern era they have lost their colour, or colour has been used merely to indicate non-architectural values, as in the case of symbolic colours for functional uses or simply for decorative preference. Colour has even been eliminated entirely in some buildings, as seen in the domination of blinding white walls and the hard, dry black of outlines and borders (door/window frames, furnishings, etc.), or with every possible intermediate shade of grey and beige. The spirit finds no vitality or nourishment here, pinned down by dazzling brightness or sinister darkness, or oppressed by monotonous greys. The effect of these environmental situations on human health, especially mental health, is plain to see: sadness or joy, passive or active behaviour, balance or obsessive instability.

**3. Form.** This is the fundamental architectural element that characterizes every building in terms of perception and, more than others, has also symbolised the history of architecture. But if one looks more closely, it is that component of architectural language that expresses plastic and volumetric qualities, and those of the nature of a surface. The dialogue between the form of architecture and the human experience of it exists in the accord or discord between that form and the very forms of the human organism — in proportions, in the articulation of parts, plastic values, modelled or modulated, voids and solids, relative dimensions, etc. An architecture that is intent on speaking to the human being should embody the same plastic, proportional, varied, dynamic and rhythmical qualities.

*Fig. 6. Residential home in Laives – House B (Italy), designed by S. Andi. Main façade of the south building.*

Conversely, the insistence on giving a building the form and structure of a machine increasingly accentuates the idea of the building as a technological mechanism, in contrast to the more appropriate organic image of a place designed to accommodate a living being. The question that must be asked in the situation we have here is: what effects does the action of these forms have on people, in terms of wellness or sickness, salutogenesis or pathogenesis? It is a question of key importance if we wish to evaluate the role of architecture in promoting the health of people generally, and more especially in the event of a virus-induced pandemic.

**4. Materials and Advanced Technological Performance.** Research has made great leaps forward in recent times, reflected in products offering extraordinary new physical and visual qualities. However, this progress has almost always coincided with the use of artificial, synthetic materials and/or manufacturing technologies right at the cutting edge. The advent of artificial materials places human beings alongside elements of their environment with which they have no affinity, since these elements do not come from the natural substrates of which humans are made bodily — animal, vegetable and mineral — and the same is true of nature itself. We already know the consequences for the environment. What are the consequences for human beings? From the physical and vital standpoints, the problem is the same: foreign substances that have nothing to do with the processes of our organism. We ought therefore to develop a different kind of consciousness regarding these products, other than material, utilitarian exploitation, on the level of the soul and spirit. Here, a broader view is required, since products of modern technology all come from the use and action of

the two forces discovered and developed in the modern era: electricity and magnetism. Without these two forces there would be nothing of the technological society we know today, or the conquests of material progress now enjoyed. But their availability has brought a leap in civilization of which we have yet to grasp the full impact. Spiritual-scientific research (Rudolf Steiner) describes the origin of these two forces artfully and liberally as a decayed, corrupted part of sunlight (electricity) and chemism (magnetism), which man manages and exploits but does not understand and, because of this, he is often trapped and ruled by them. The only way to address these domains with awareness and control is to develop conditions of spiritual consciousness superior to those we have at present: imagination and inspiration.

Today, beyond having recourse to the values of green building in the quest for sustainable architecture, there are two paths to pursue, by way of seeking to promote an antidote to this rampant and disturbing "technologisation" of building and architecture. One of these is through art. The artistic process passes through various stages which, through human action and consciousness, involve both the material and the spiritual dimensions. In essence: the first stage of creative exploration consists in the acquisition of raw material separating and extracting it from its natural, native surroundings (clay, stone, timber, fibres metals etc.), which necessarily involves an outwardly damaging and destructive action. In the second stage, these raw, amorphous materials are processed by the transforming action of various techniques and are reworked to assume new forms and characteristics in new man-made items. Thus, a new reality is created. A new world of objects that did not exist before. What is important, however, and reflects positively on this process, is that the reconstruction should be touched by consciousness and artistic endeavour, inasmuch as this draws on positive spiritual values that will be stamped on the new man-made item. A second path, mentioned only in passing here, is the development of a spiritual science; not materialist and reductionist, but spiritual and of the living.

## New Perspectives on Building Scale

The nature of the Covid-19 pandemic is essentially that it compromises the airways of those who are infected, producing a form of atypical pneumonia. The environmental aspect of this medical-health situation is the serious neglect of the general impact that current living conditions have on breathing in humans and broadly, on rhythm which, from physiological and biological standpoints is at the core of organic balance and healing processes. Beyond the strictly organic and biological aspects, and beyond those wider observations concerning the dimensions of living spaces (today, all too often claustrophobic) and the consequences of planning on town and city centres, one can also point to certain senseless, illogical and unhealthy features of the built environment which, in 20$^{th}$ century housing have restricted the capacity of humans to breathe, not only in the literal sense (air-lungs), but figuratively too (perception-representation). Dwellings that are cramped, bare and featureless, or chaotic, disorderly, ugly, or at all events typified by sensory characteristics of a formal, unilateral (forms, colours, spaces, materials) or radicalised nature have, by now, enveloped us everywhere in places where it is hard to "breathe". Also, the fact that minimum permissible room heights have been reduced to 2.70 - 2.40 metres, compared with the generous spaces of the past, and that ceilings have become flat and dull, has undoubtedly had an indirect effect on freedom and breathing space. Another aspect is the hermetic separation of "indoors" and "outdoors" by abolishing the window in its true sense (natural ventilation and light) and the transformation of the building, formally and aesthetically, and substantially (systems), into an autistic technological box.

From these same standpoints, it will be necessary to rethink work and meeting spaces, to provide rooms or areas for people to gather, affording much greater comfort and ease. For example, the factories of Adriano Olivetti in the 1950s where, in addition to canteens with architecture of real quality (the Ivrea factory was designed by Ignazio Gardella and is an organic masterpiece of the 20$^{th}$ century), there were libraries and notably comfortable relaxation areas for all.

## Proxemics: the Impact of the Pandemic on Spatial Behaviour

Proxemics is the study of how people use space and distance themselves from one another based on the psychological relations between them. Evidently, if the threat of viral contagion is to last for a very long time, as many believe, with the danger of periodic setbacks, all habits connected with meetings and relations between people will inevitably change. More space will be needed for occupants in dwellings and, we might add, better architectural quality of housing. More space will be needed for human relations — family and interpersonal —unpolluted by TVs, computers and mobile phones if possible. More space will be needed to engage with neighbours (balconies, terraces, communal meeting areas) and have greater freedom of movement, favoured by architecture that is imaginative, free, dynamic and fluid. No 'little boxes' and, moreover, it should be greener in the neighbourhood.

If architecture is to promote health, the identification of spaces dedicated to living, working, and caring is also of key importance. And if gauged to fit real people, rather than "persons without qualities", these same spaces become places of prevention. If both the home and the workplace take on architectural qualities suited to the living processes of the person, the architectural environment will certainly be hygienic, salutogenic, conducive to health and wellbeing. It will serve, de facto, as a widespread aid to prevention, territorially, and in cities. And this will fit in with new perspectives for a reorganisation of the public health system based on prevention, not only on cure. In the words of Nigel Crisp: "Health is made at home, hospitals are for repairs".

*Fig. 7: Elementary school Spreewaldgrundschule in Berlin (Germany), designed by H. Baller. Accessible roof garden.*

*Fig. 8: Nikolaus Cusanus Haus in Stuttgart (Germany), designed by studio BO WE PA – Bockemuhl, Weller und Partner. Inner garden in the entrance hall.*

### *Urban, Spatial and Landscape Scale*

It is foreseeable that, in the near future, social customs and the way we live our lives will change, as dictated above all by the statutory regulations governments will put in place to cope with possible future pandemics. Forms of living and relational spaces will also have to change, as will our relationship to the environment that surrounds us. The technocratic ecologism of today, based on deterministic and positivist scientific criteria (e.g. cause-effect), must be replaced by a moral ecology. In many fields, the answer can be found in the working scientific paradigms that underpin the various disciplines oriented towards the anthroposophical "science of the spirit" mentioned above. In the field of agriculture, the ideas and practices of biodynamic and organic farming offer answers. In medicine, one can look to the image of the tripartite man — body, soul and spirit — reflecting a concept of sickness which, with health, forms part of a vital unity integrated into the person and invites methods of anamnesis and treatment that consider human beings in their entirety and acknowledge their individual destiny. In wider public life, the answer can be found in the theory of social three-folding, of which the Waldorf Education movement provides an embryonic example, and the Universal Anthroposophical Society is a special experimental example. All domains offer ideas and indications whereby structures can be enriched and transformed, radically in some cases, along anthroposophical lines, even the economic and social sphere, perhaps the most delicate and tricky in our time.

We can now take the discussion onto the larger scale of public spaces, the city, geographical areas, and landscape, which opens an even more complex and broader field, requiring not only change and innovation of an exact nature, but wide-ranging revolutionary shifts involving the maturity of civilisation as a whole, on social and cultural levels. With this end in view, three possible areas of action are set out below.

1. A radical change in science and knowledge systems, away from the modern deterministic and positivist approach, or from the reliance on inductive processes, towards a more spiritual, Goethean vision and scientific method, would imply the acquisition of the buildings in which we live, work, study and so on, as an everted and objectified part of personality, hence in every way an expression of that personality and consistent with it. Buildings should therefore express the unique characteristics of people (individual or community). On the one hand, they should not, as is currently the case, reflect the abstract, "typical" human, or the theoretical average person, the current physical/biological model, on which every publicly-funded, cooperative or other building or housing programme is based. This is de-personalised and collectivist. Nor should they reflect the converse: the nature of a self-centred egotistical individualist (the model of consumerism, elitism and capitalism). This calls for a detailed study of the relationship between human beings and their 'third skin', the building, in concrete and broader terms (not symbolic-analogous, or purely physical-biological) which, in a social sense, should lead to examples of dwellings or settlements that are unitary but articulated, differentiated but coordinated. In a word: organic (organic planning).

2. A second aspect to point to with real improvement in mind is the relationship that a human being has with nature and life forces, not least on a macro-scale. The present epidemic has highlighted the markedly negative factor of an environmental situation marred by pollution of all kinds and an ever-diminishing relationship with the natural world. New planning in this area will need to reverse the trend and move towards a fresh appreciation of the relationship with the natural elements, no less than with wealth-creating and social imperatives, and perhaps more so. For example, every new settlement and built-up area must include an intrinsic quota of green areas (as is already the case today for parking, toilet facilities, etc.) as active, living areas instrumental to the development of human life forces, benefitting public and private users alike. This allotment of land area will also have to be assigned a preferential business and tax value, both for individual private use and communal public use and, on this basis, there will be a need for other registry classification criteria, including the relative asset values. The validity of this measure will then be increased or otherwise by a building architecture that achieves synergy with the green component (biophilic approach), rather than being foreign or hostile to it.

3. This type of change in planning approach naturally creates the need for new concepts and new references, both legal and cultural. And this in turn opens a further problem with the current situation: the confusion between bodies and powers in society. In a healthy social organism, the task of the cultural sphere is to identify the principles and the laws that govern the real, but also to show creativity in imagining new innovative scenarios. All this in a climate of freedom of research, and of independence from extra-cultural and extra-scientific factors. The task that falls to the business sphere of society is to activate entrepreneurial forces at different levels, and economic resources to aid pursuit of the aims identified above, bearing in mind the fundamental principles of solidarity and brotherhood. Finally, it is the job of the political and legal spheres to translate ideas into laws and regulations, safeguarding the equality of citizens and the goals of society (growth, vocation, how it evolves), but based on the knowledge and planning framework provided by the cultural sphere.

Today, this threefold approach to social organisation, deriving from the studies of Rudolf Steiner [22], is neither familiar nor respected nor recognised as being necessary. The priority aims of planning should be entrusted to the cultural sphere of society, where there is freedom of thought, and planners must operate independently of the business interests that drive research today. The nuts and bolts of planning management should therefore be entrusted not to politicians, but to new social organisms, such as associations of competent people (professionals) who come together independently

to guide decision-making based on what is needful and useful. Thus, investment choices will be dictated by actual needs, and solidarity between the players involved. Building activity should be steered by a process of self-regulation towards those areas where there are real shortages, and away from inflated sectors. Resources, and even vocational choices, should be diverted into sectors such as agriculture and welfare services. These choices affecting control and guidance must be arrived at through the study and assessment of real-world situations and based on solid and contemporary phenomenological processes by competent persons.

Finally, to recapitulate what is proposed, we can summarise as follows:

1) The development of a broad-based science/art of planning applied to the domain of the living (Goethean organic science) and to that of the human sciences (science of the spirit), in a setting that affords maximum freedom of research and invention. Similarly, the development of a science/art of architectural design that is conducive to a building activity genuinely concerned for and engaging in dialogue with the human being (living organic architecture).

2) The transformation of planning practice, with responsibility entrusted to an economic sphere consisting of professional and arts associations having expertise in each of the single domains involved, interacting with and pursuing aims in a spirit of solidarity and fraternity.

3) A reduction in the political-legal sphere to its precise, central task of formulating laws and regulations designed to ensure democratic equality between citizens and between bodies, excluding the cultural and ideological determination of aims and principles as currently accepted. Similarly, involvement on a practical level in economic and financial activities (e.g. affecting social, low-cost, and collective housing, etc.).

## Author Contributions

The paper was conceptualized jointly by the authors. PART A – contents, methodology and writing by RA. PART B – contents, methodology and writing by SA.

**Note:** all pictures are of the authors, except for figures 5 and 8 (credits: courtesy of arch. Alberto Nadiani, Forlì – Italy).

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# THEME 3:

# SALUTOGENIC OUTDOOR AND INDOOR ENVIRONMENTS

# CHAPTER VI

# HEALTH-PROMOTING URBAN DESIGN IN A POST-PANDEMIC SOCIETY

MARK W JOHNSON

## Introduction

The design of the urban environment plays a key role in and has a great impact on the health and wellbeing of people. However, the urban planning of the 19th and 20th centuries created a harmful impact on health in the US, although some Victorian ideas hold promise for sophisticated community design in pandemic times. As we retrofit our cities for the future, old and new thinking could lead to shifts in policy and planning norms to better prepare us for the future challenges of healthy urban environments. The author, as an expert in the field of urban design, with decades of practice and experience worldwide, highlights in this chapter the trends and issues of healthy urban design that have been developed over time. I want to urge urban policy-makers and the academic world and colleagues to pay more attention to this crucial design thinking that should be considered as the foundation of a healthy society.

## Why does urban design matter?

Most people today, at least in developed countries, pay more attention to some of the more complex relationships between personal health, public health, and urban design. Most planning professionals are aware of the dangers of over-consumption and of the damage to health caused by polluted air, water, and soils. We could clearly see the consequences of unhealthy lifestyle choices that are often linked to urban design. However, we have become aware of a variety of environmental issues such as climate change and the impact of energy consumption, as well as the need to address sustainability in almost all of our choices. We even understand that the increasing frequency of obesity, especially among urban children, and the rising incidence of diabetes, asthma, and similar diseases in our cities results, in part, from poor urban design. We may not be fully aware of all the linkages (e.g. between food deserts and obesity), yet we know very well that eating nothing but junk food and having low levels of physical activity are not good for our health. We are now more aware of the link between non-communicable diseases (so called lifestyle-related diseases) and the quality of urban design. We are also more aware than ever before of the impact of urban design on life expectancy. In many regions of the US we can say, “Tell me your address, I will tell you how long you’ll live!”

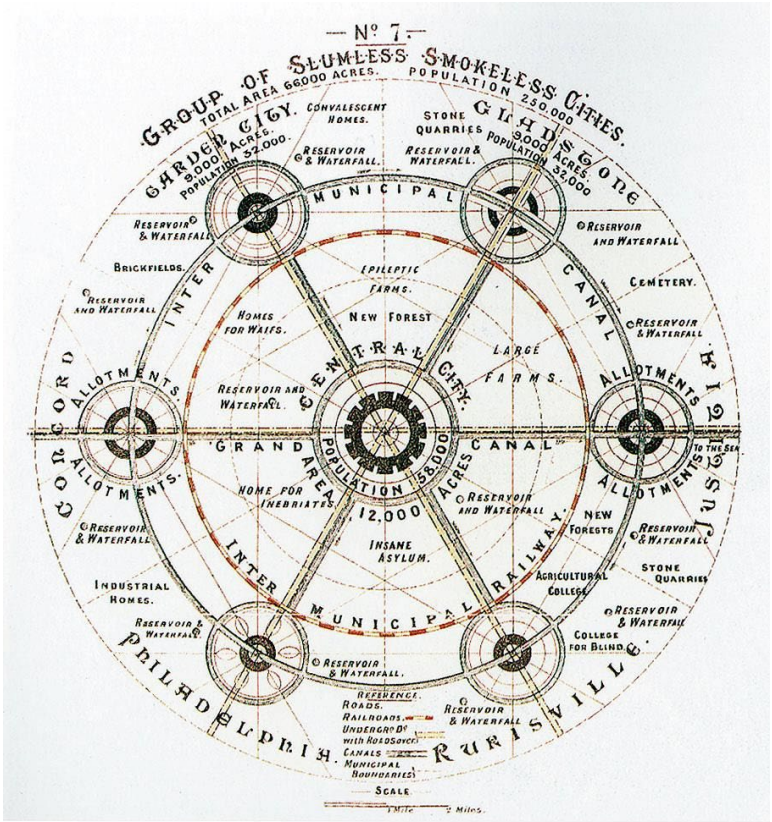
Public health officials worldwide understand these issues and the causes and consequences of poor food and lifestyle choices. But all too often the people who most fundamentally influence these outcomes are not educated well enough in interdisciplinary thinking to understand, and consequently do not pay attention to their role and power in influencing public health through urban policies, urban planning, and urban design. In most American cities there is a plethora of agencies, institutions and social service providers that diligently pursue the impact of public health issues. They are of critical importance to improve the physical and mental-social health of the community. Public health issues are disconnected and unrelated to many of the root causes of the problem which stem from antiquated policies, standards, and practices regarding urban design. It is important to consider how to shape the city in terms of infrastructure, transportation, environmental policy, housing policy, tax policy and the very organisational structure of government to have a positive impact on the health of citizens.

## A harmful consequence of urban design

### *A Harmful Legacy*

In the late 19th century, there was a global concern about the problems of industrial society and the damage it caused to the environment and people. Seminal works such as *How the Other Half Lives* (1890), by the Dane, Jacob Riis, highlighted the growing gap between the wealthy and the poor on whose back that wealth was generated. Great minds came together in debate. New programmes and institutions emerged to address the problems of the time. Among the many ideas that had developed by the 1890s were two that were seemingly rich and were supported by the great thinkers of the time. However, in retrospect, these have had harmful consequences for the health of people.

The Country Life Movement was one of several idealistic and even utopian visions of new thinking about city form and function. This movement advocated the development of railroad and streetcar suburbs to be populated by urban dwellers in search of a healthier lifestyle in a pastoral environment (and of course an escape from the environmental and social ills of the city). In Ebenezer Howard's Garden City, and landscape architect Frederick Law Olmsted's plan for Riverside, Illinois, two deeply held ideas quickly moved from concept to convention and, by 1915, these ideas were at the foundation of global urban thinking. Howard introduced the notion that land uses that are not alike should not be located together. Olmsted introduced the idea that even similar land uses should be set in pastoral landscapes organised around transportation systems. Riverside was the first railroad suburb, and in its plan, we can see the same pattern later applied by Howard. The concept is that cities should be built as separate cells or modules of use, swimming in green and linked by supportive transportation, water, and sanitary infrastructure.




Meanwhile, the City Beautiful movement made a major contribution to the organisation, structure, and beauty of the city, upon the principle that urban parks and parkways could bring greenery and grandeur into the city, with a presumption that these interventions would lead to improved social, economic and health conditions for urban populations. The parks systems of Chicago, Minneapolis, Denver and Kansas City are well known examples. Of course, we need not look very deeply to learn that these interventions were no guarantee of the betterment of urban populations. In some cases, these very parks and parkways became the centres of crime and social decay.

These ideas coincided with the invention of the car and the aeroplane, and of the use of railways for commuting. With the adoption in 1915 of the first New York City zoning ordinance, which required the isolation of uses, one by one and like by like, revolutionary ideas had become standard convention. In a lawsuit entitled City of Euclid versus Amber Realty Co., the US Supreme Court found that the zoning was valid on the basis that it was critical to preserve public health, safety, and welfare. Isolation of use and dependence on transportation became the law of the land, and virtually all of America subsequently conformed to this new suburban model.

### *Challenges: Improving Health with Urban Design*

Urban theorists are only beginning to undo the damage caused by this progression of ideas that worked in their time, but which have become a curse during our time. Our intense reliance on the automobile, fossil fuels, and consumption have resulted in social isolation, sedentary lifestyles and industrial-scale food production and distribution. The consumer society that is at the root of today's sustainability and health challenges began with these decisions.

The United States Centers for Disease Control and Prevention (CDC) has acknowledged this in recent years with a significant initiative to understand the role that community design plays in supporting public health. Its "Design and Building Healthy Places" publication states: "Since 1900, life expectancy in the United States has increased by approximately 40 years. Only seven of those years can be attributed to improvements in disease care; the rest are the result of improved environmental conditions, including sanitation and water." Furthermore, the CDC promulgates research and guidelines to assist in the development of healthier communities, and has published these eight principles for healthy community design:

1. **Increase physical activity.**
2. **Reduce injury.**
3. **Improve access to healthy food.**
4. **Improve access to clean water.**
5. **Decrease mental health stress.**
6. **Strengthen social fabric.**
7. **Provide fair access to jobs.**
8. **Minimise the impact of climate change.**

Slowly, these principles are working their way into the dialogue of urban planning and design. The 'new urbanism' movement in the US has made inroads toward changing zoning codes towards more compact, mixed, and interconnected patterns, but so far has mostly affected greenfield, consumptive forms of new suburban development. My interest, and that of my firm, Civitas, has been elsewhere, in the regeneration of our core cities through forms of community design and intervention that address systemic operations of infrastructure, at the scale of large territories of influence. Our goal is simple: to influence urban thinking and to implement urban projects that make a demonstrable difference in the lives and health of urban communities.

## A New Model and Vision of Urban Design

In recent years, my firm Civitas became engaged with the Working Group for Sustainable Cities at Harvard, which mixes academics and urban professionals in the exploration and sharing of information. Our question was this: what would the elements of sustainability be for a city that has suffered under poor physical, social and economic health for decades? With this in mind, we began working with the city of Newark, New Jersey. Planning director, Toni Griffin, and sustainability officer, Chelsea Albucher, along with Mayor Cory Booker, were in the process of creating a new vision for the city based on real metrics that revealed actual conditions. Some of these findings about the city's inhabitants were striking. In 2008, for example, Newark's population was 13% unemployed and 40% of all adults did not work, pointing to a population of 9% elderly, 26% of whom lived in poverty. On top of that, 34% of children lived in poverty, and half of those in single-parent homes.

Mayor Booker and his staff created a vision, Shifting Forward 2025, about which the mayor said: "Newark will set a new national standard for urban transformation by marshalling its tremendous resources to achieve security, economic abundance and an environment that is nurturing for families." This vision came with the notion that the city had suffered under a cycle of disinvestment that disabled, disenfranchised and destabilised the population. His goal became the creation of a virtuous cycle of success, based on jobs for residents through growth; healthy and safe neighbourhoods by design; and making Newark a ’city of choice'.

With this vision we set out together to establish a framework — Sustainable Urbanism for Newark — to demonstrate the ordering of elements that need to fit together into a cohesive set of policies, and then actions. This exercise was revealing in one important way: we found almost no correlation between the organisational silos of the city and the goals for a sustainable city. In fact, as we have so often found in our efforts to stimulate systemic regeneration, the silos themselves are often primary obstacles to satisfactory rebirth. The silos of modern city organisation are in fact powerfully reinforced against the very interconnected, integrative urban systems and forms that we now know are fundamental to sustainable economies, and social and public health.

The Newark example requires that we consider how the city establishment can be redirected to focus on this set of objectives, issues, and outcomes. Instead of seeing the city as a collection of separate infrastructures, of separate land uses and of disconnected economic activity, our proposed framework for a healthy and sustainable Newark is:

**Goal 1: Growth.**

- Grow activity at air and seaports.
- Increase retail spending to create and capture jobs.
- Retain open land as the basis for creating new jobs through green industry.
- Improve mobility to jobs to make employment accessible.
- Improve freight mobility to attract job-creating industries.

**Goal 2: Health and Safe Neighbourhoods.**

- Build safe, active, connected places throughout the city.
- Create new access to diversify quality housing choices.
- Create adequate access to parks and recreation at many scales.
- Create public education and social and health facilities that are located and staffed to serve the community first.

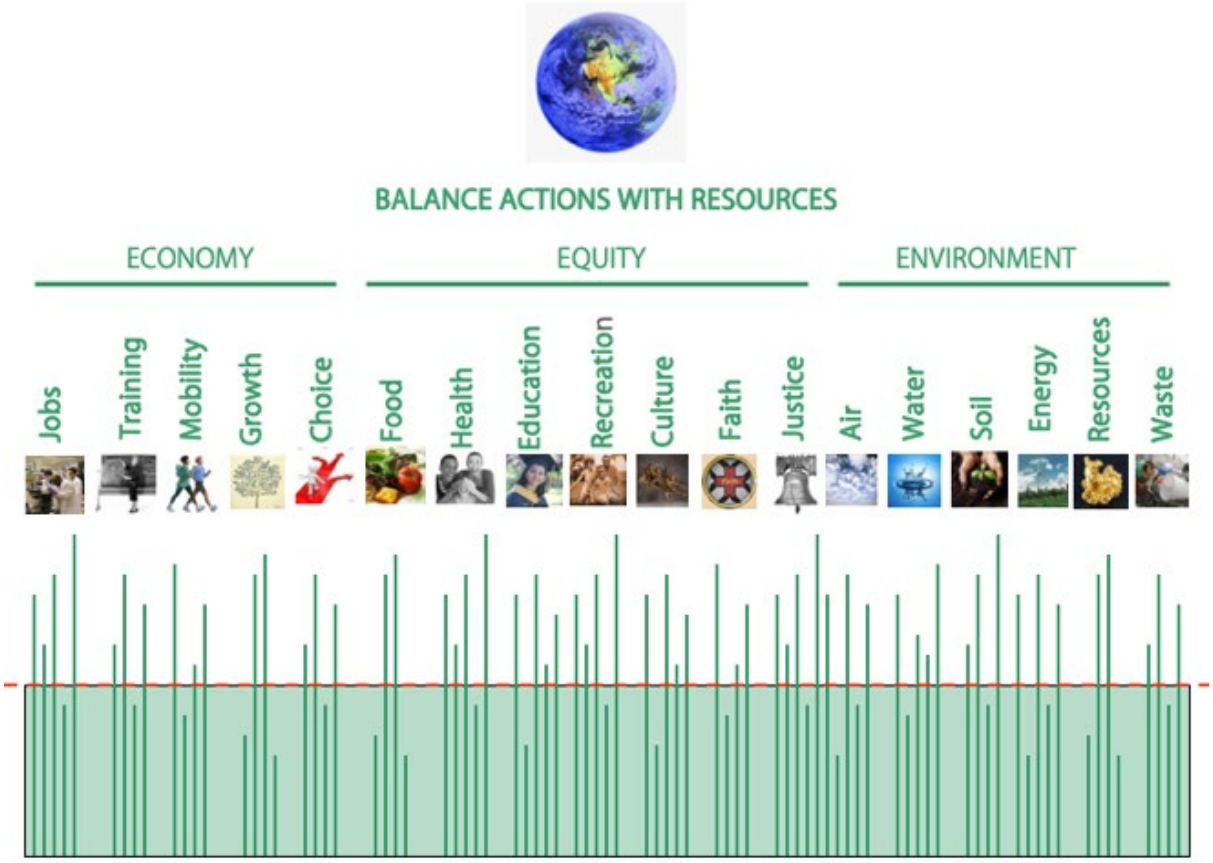
**Goal 3: Choice.**

- Facilitate downtown living.
- Promote a city of learning.
- Make the river a regional environmental, educational, and recreational asset.
- Promote historic and cultural assets.
- Create a green and healthy environment.
- Focus on people.

FOCUS ON PEOPLE

Requires understanding universal needs and aspirations

| ECONOMY | EQUITY | ENVIRONMENT |
|---|---|---|
|  |  |  |
| Jobs<br>Training<br>Mobility<br>Growth<br>Choice | Food<br>Health<br>Education<br>Recreation<br>Culture<br>Faith<br>Justice | Air<br>Water<br>Soil<br>Energy<br>Resources<br>Waste |




This ordering of objectives will clearly require a review of governance, organisation and methods for the creation and delivery of urban services to the people, where they need them: in the community. This principle that services, facilities, transportation, and infrastructure should be designed to support community health is not only fundamental, but also requires a shift in thinking and policy that is necessary to make our cities healthy and sustainable under today's economies, social orders and technologies.

## Driving Force for Change: Case Studies

We have spent years investigating, planning, and designing interventions in cities with this principle at the forefront. Each time we encounter a new city we find a need to address this principle in a review and shift in governance. Again and again we find that making change that lasts depends on two things: revealing the opportunity that is latent in the place to restore, rehabilitate and regenerate existing resources as catalysts for change; and building leadership that understands the need for such integration of the objectives we found in Newark, and that is ready to act in order to bring about change. There follows a few examples of recent work in which we have found success meeting these goals. Each of these projects has a deep and complex story but, in many ways, it is their strikingly powerful visions of the reintegration of people, place and economy that form the basis for new hope for our communities and their health.

In the Central Platte Valley of Denver, Colorado, we have spent over 20 years helping change this post-industrial wasteland into a productive and healthy community. Key to this success was a strong mayor with a visionary approach: Wellington Webb saw the potential to revitalise a (nearly) dead river. By making the river become an active part of a healthy environment, we could envision making the land and community into healthy urban design. By giving life back to the river, it gives life back to us. This mantra is one that I have used for years to get citizens, policy-makers and civic

leaders to realise that this wasteland could be a source of revitalisation, and that the river itself could be the source of a healthy community that would be connected to the daily life of people, active and vital and well integrated to the lifestyle.

## Habitats for People and Wildlife

The transformation began with vision and planning, but also with the creation of new governing entities, notably the South Platte River Commission, who were tasked with making the river a healthy, flowing river with habitats for wildlife and people, as a connector of the city to its region. The project's success stems from research into soil and hydrological conditions, which were reconstructed to establish a site that is nearly 40% native wetland and upland restoration, bringing nature into motion in the heart of the city. Since the construction of the park and system of bridges, streets and transit, the area has gone from wasteland to a completed, vibrant, and mixed community.

*Photo 1. New development in the former railyards embraces Commons Park as a centre for health, recreation and relaxation.*

The revitalisation of the Los Angeles River was the product of several collaborators, notably Tetra Tech, Mia Lehrer and Associates, Wenk Associates and Civitas. The nature of the design team — a combination of a wide range of knowledge platforms and different intelligences — created this visionary and implementable plan under the leadership of the city's Bureau of Engineering. This project has had a major impact on how the community and the governing bodies view the river as an urban asset to the community to improve health and create a catalyst for a healthy regrowth of the 32-mile-long inner-city corridor. Fundamental to this vision is that the design concepts are actually achievable; and that the Bureau saw the need to break down silos within itself and across agencies and jurisdictions, leading to the formation of three new governing entities tasked with achieving the plan, and the development of a diverse base of community supporters who now see that the river can be one of the region's most significant assets, instead of the dangerous and derelict corridor that it was for 80 years.


*Photo 2. Connectivity is key to healthy urban regeneration. Bridges in Commons Park connect over railroads, river and motorway to enhance healthy mobility and relationships.*

## Engage People with Nature in the City

Civitas was founded with this mission: to engage people with nature, in cities. Almost 40 years later and during a pandemic, this mission resonates more clearly than ever. The Victorian idea of Howard, Olmsted and many others, was that people should live in contact with nature. Bold and important visions resulted in major park systems from City Beautiful, and visionary interventions such as our country's largest parks: Central Park in New York, Forest Park in St Louis, Fairview Park in Philadelphia, Golden Gate Park in San Francisco, Balboa Park in San Diego, and many more. These large open spaces, each being several hundred hectares in size, provide diversity, relief, and respite. They give shape to cities and symbolise the forward-thinking of prior generations. They are destinations that house many activities, institutions, and attractions as well. Now, in this time of social distance and caution, they are limited in capacity and access or are closed until the pandemic comes under control. But the open spaces, the fields, meadows, forests, and gardens are suddenly full of people. People are walking, playing, cycling and enjoying many other forms of being outdoors, either alone or with family and friends, in a way that is safer in terms of disease transmission than indoor spaces.

The need for outdoor space and stimuli from nature has suddenly expanded on a global scale as people seek relief from cramped quarters, quarantine, and from their prior social life in shops, restaurants, bars, gyms, libraries, and more. Our need to stay safe has dramatically changed how we live, meet one another, and spend our time. Where we once may have ridden the subway to Central Park, today we fear the subway's close quarters, surfaces, and air. We need places we can walk to and in; places that give us light, air, sun, greenery, and a sense of safety in the presence of others and hope for a better future. Instead of the large parks of our Victorian past, we need that sense of nature and place close to us, at home, in every neighbourhood, with connectedness and generosity to support distancing. Our large parks will always have a role to play, but today it has become clear

that we need threads of green, more space on our streets for people instead of cars, more pathways, greenways, and choices to enrich our everyday lives without the need for cars or transit for access. We need cities that are retrofitted with green at the micro-local scale, within a 15-minute walk from home. And we need this in every neighbourhood of every city, especially neighbourhoods that have become disinvested, in food deserts, and in those places where access to green is often most limited.

## The Pandemic Era and its consequences

In this pandemic our world has become immediate. We live and work at home most of the time. We need food and services that we can walk to. We need room to socialise and exercise outdoors without getting in a car, bus, or train. In the wake of the pandemic, we will retain our desire to satisfy our needs more locally, at two scales: digital, whether via online shopping or teleconferencing; and analogue, by having a diversity of food, goods and services close to home. A new era of localism is upon us, an era where cities will begin to form into myriads of neighbourhoods and villages, less focused on a core downtown, less reliant on an industrial perimeter and more focused on local centres. Unlike the grand visions of Howard's garden city, where everything was isolated in nature, our next-generation cities will be formed on clusters of local life connected by a mosaic of nature threaded to, through and around us, within easy reach. It will be a city of villages, with villages of neighbourhoods set in a mosaic of green with access to all facilities that we need: school, workplace, recreation, and leisure.

## Urban Acupuncture

Urban theorists and designers have been trending toward localism for several years, without labelling it. Interventions such as Superkilen in Copenhagen, the Highline in New York, the greenway movements now so popular in Denver, St Louis, Northwest Arkansas, and others, all show the way towards a new model of healthy post-pandemic living. In recent months, parks, trails, and greenways have seen dramatic upswings in usage, with as much as a three-fold increase in trail and park use. The satisfaction we get from outdoor movement is now essential to our physical and mental health. We need interventions that are small, local, and effective: acupuncture at the urban scale, to deliver what we need in small quantities that will add up to large networks.

In St. Louis, we are currently mid-stream in updating the master plan for the Great Rivers Greenway District, a taxing district that covers two counties and dozens of municipalities, including the city of St. Louis. While the work is ongoing, we have conducted extensive interviews and surveys to understand the current context of facts and opinions. In its first 20 years, Great Rivers Greenway has built 128 miles of high-quality trails and environmental corridors against a long-range plan for 600 miles. Of the many findings we have made through our investigations, there is a clear indication that people today understand the value of a greenway that is close to home, easily accessible, and that functions as a linear park. To many, the idea of a greenway network is about transportation, exercise, and recreation for those on cycles — a form of travel. But to a greater number who now understand the cabin fever of the pandemic, the idea of a greenway as a local amenity for walking outdoors is rising rapidly as an important value. One thought under discussion is the idea that greenways might be built as local fragments that serve immediate needs, especially in under-served neighbourhoods, and that eventually they will add up to a system. This is not an idea at the expense of system-building, but one that suggests the immediacy of our awareness of needs that only months ago might not have been recognised.

In Denver, master planning is underway for the 5280 Trail, a new intervention of a green loop surrounding the core downtown and connecting several neighbourhoods. The idea began pre-pandemic, partly because of seeing how the New York Highline provided an experience and connectivity that was previously unnoticed. In the 5280, we propose to use existing street spaces to convert space that was reserved for cars into linked spaces for movement and rest, for people and nature. The proposal is based on a system of different techniques to cleanse storm-water, grow

vegetation, introduce safe, comfortable ways for walking, sitting, and gathering, with occasional room for pop-up events. With the pandemic, the idea has gained interest and support rapidly, promising local access, connectivity, neighbourhood identity and opportunity for residents and businesses.

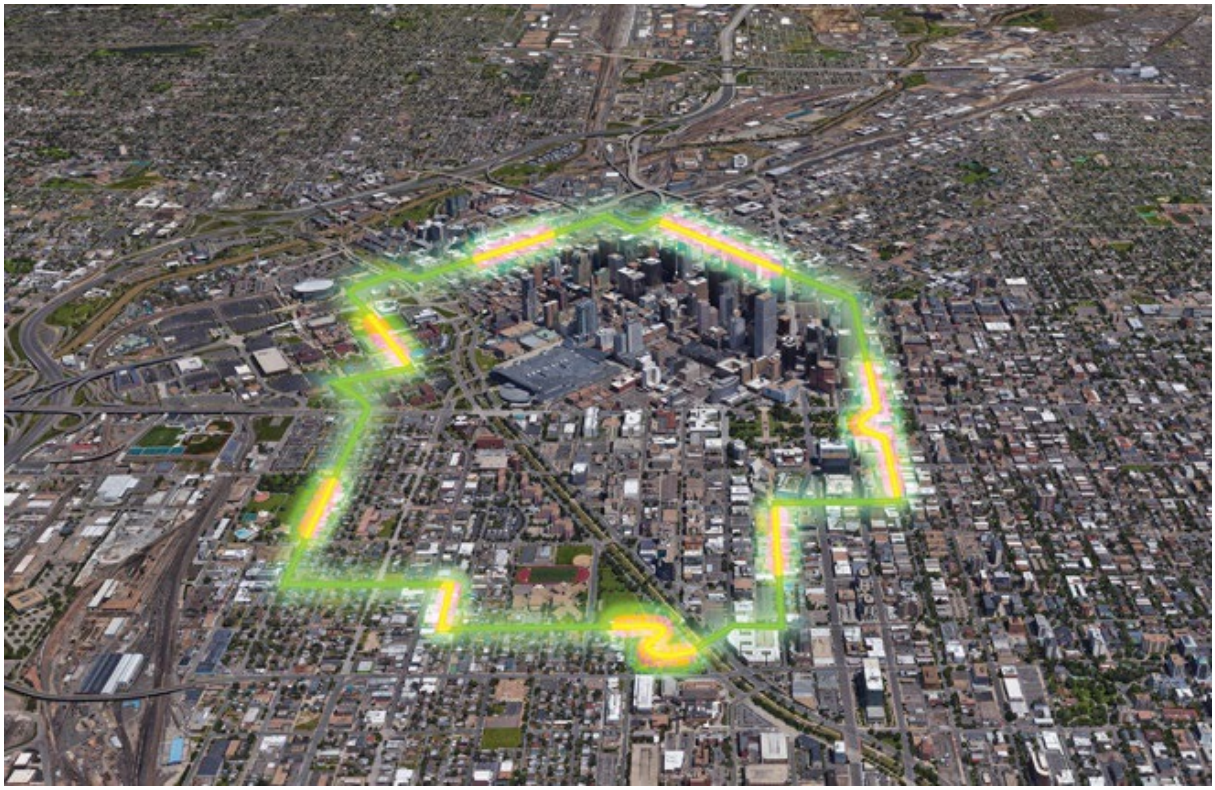


*Photo 3. The 5280 Loop will surround central Denver with a 5-mile walking/cycling greenway of health and social connection.*

In Calgary, we completed the reconstruction of St. Patrick's Island, a 9-hectare island in the Bow River adjacent to downtown Calgary. Easily accessible by foot or bicycle, the island is less than 300 metres from two different light rail stations and adjacent to the Calgary Zoo. The purpose of the island is to give the people of the city a place to engage in nature that is easily accessible. Prior to our work, the island was in poor condition and had high rates of crime and homelessness. With an extensive program to talk about the future of the island with citizens, the design team built a program that envisioned widespread restoration of decayed forest and riverine habitats, combined with the insertion of discreet activities and pathways to create a walking circuit, or loop, of movement. Two central features have attracted the most use. First, a new water channel was designed to cut across the island, with a hydraulic design that naturally slows the water to a safe speed. This has allowed the creation of a large beach space which is now routinely active with children and families wading and playing in the water and relaxing on the beach, with adequate scale for social distancing, even with large numbers of people. The second feature is a large hill that supports play, performances, and special events. This park, which was considered unsafe just a few years ago, has now become Calgary's most visited park, and is a place to be alone in nature, to walk and restore the mind and be inspired for the challenges of life. It is a place considered to be an opportunity rather than a problem.

*Photo 3. People rest on a newly created beach in downtown Calgary.*

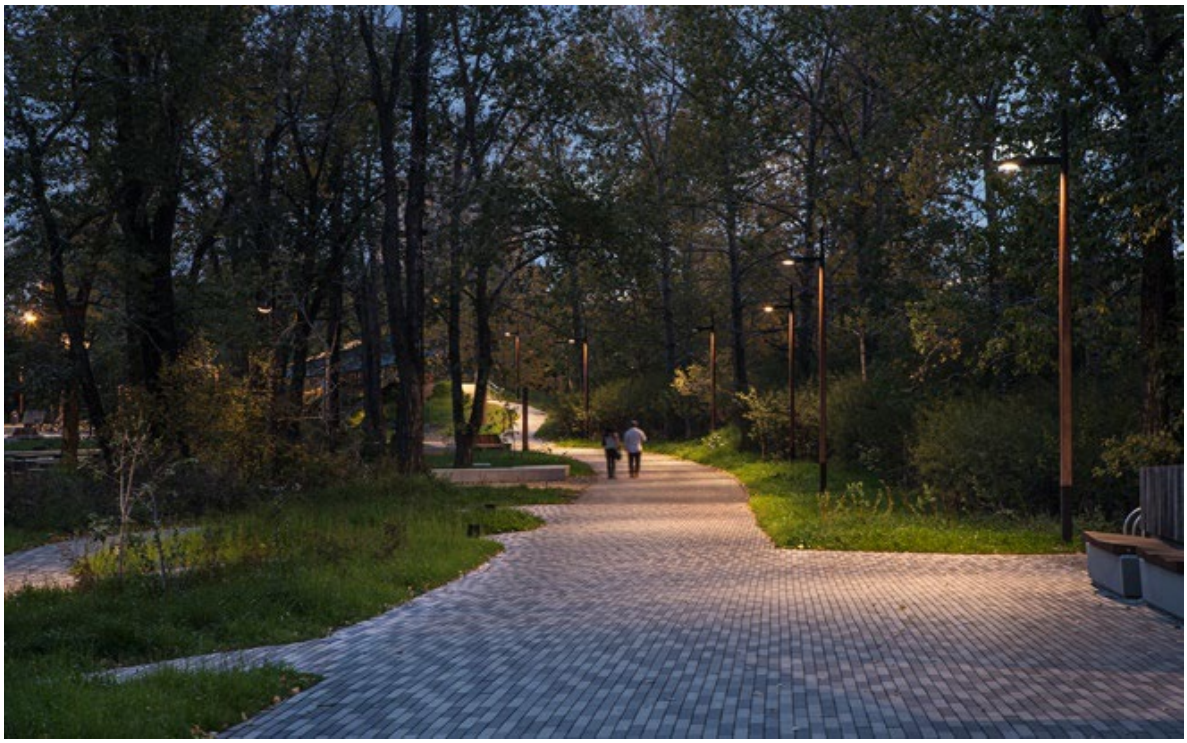


*Photo 4. St. Patrick's Island brings nature into the city to give relief and connect with feelings we only find in nature.*

## Conclusion

We have shown clearly through urban design how we could enhance quality of life and reduce the major causes of so-called lifestyle-related diseases or non-communicable diseases (NCD), estimated to be almost 80% of the total cost of healthcare in USA. We could improve healthy lifestyles with good urban design that increases profitability and work production. Together these examples are just part of a rapidly emerging recognition in America that our cities must be the focus of reinvestment in public health and social capital through interdisciplinary knowledge, to create healthy communities by design. With our new understanding of the role open space, nature and movement play in maintaining individual and group health and wellbeing, this trend to bring threads of nature into the city is about to expand exponentially. The pandemic has taught everyone that the city should be made for people, not for cars or the convenience of government services. It seems unlikely at this time that our culture will accept stepping back into pre-pandemic norms where personal health and needs are put second to the efficiencies of scale of big business or big government. We must consider urban design as an asset of a healthy society. The planning of our cities and urban design must be based on green concepts with smart communication, stimuli and pleasure, easily walkable areas and, above all, urban design with people's health in mind.

# CHAPTER VII

# THE SALUTOGENIC OFFICE: THE ENVIRONMENTAL QUALITY OF INDOOR ARCHITECTURE AND OCCUPANT HEALTH AND WELLBEING

IHAB M.K. ELZEYADI

## 0. Synopsis

How does a state-of-the-art high-performance building impact indoor environmental quality, occupant comfort, productivity, health, and wellbeing? This question highlights an important, yet under-studied objective of high performance and LEED™ certified green buildings. Not only do green buildings propose a solution to combat the building industry's energy addiction, but they also promise better indoor environmental quality and, more recently, a value proposition that they provide better health and wellbeing for their occupants. Despite the favourability of this hypothesis, most recent studies have failed to prove these linkages, leading to inconclusive evidence of green building performance.

This chapter presents a case study of a 36-month comparative Indoor Environmental Quality (IEQ) assessment and a pre/post-occupancy evaluation of a new LEED™ double-platinum certified building, and compares it to a traditional office complex which the LEED building employees occupied previously. The longitudinal study was conducted for 36 months, employing long-term data collection monitoring of IEQ parameters and occupant satisfaction and health before and after. The Space Performance Evaluation Questionnaire (SPEQ™) was administered over the 36-month study to gain further insights into the occupants' perspectives related to their building's indoor comfort, productivity and health perceptions. Results show strong relationships between green design strategies, salutogenic building practices, and occupant health and wellbeing, proving that a well-designed salutogenic environment can provide long-term impacts on the triple bottom-line approach of people, planet, and profit.

## 1. Indoor Environmental Quality and Green Architecture

Employers, building owners, designers, developers, and investors throughout the world are persuaded, in response to an increasing marketing campaign by the building industry, that office design affects the health and wellbeing of occupants in many ways, and so it is a smart business move to create healthy green buildings. With staff accounting for 90% of business operating costs, a 1% improvement in productivity can have a major impact on the bottom line and competitiveness of any business. Building developers, owners, and investors are also discovering the business value of delivering healthy and green buildings to their markets. In a survey of 200 Canadian building owners, for example, 38% of those who reported increased value said healthy buildings were worth at least 7% more than normal ones, 46% said they were easier to lease, and 28% said they commanded premium rents.

An increasing marketing campaign by the green building industry and particularly the Leadership in Energy and Environmental Design (LEED™) certification system promotes linkages between LEED™ certified buildings and indoor environmental quality (IEQ). Despite the favourability of this hypothesis, few studies have empirically proven the linkages between LEED™ certified green

buildings and their verified improvements in occupants' IEQ and multi-comfort experience (Altomonte et al, 2017; Elzeyadi, 2016). Based on several studies on post-occupancy evaluations in green buildings, IEQ variables are rated among the most important parameters that impact occupant satisfaction (Chinazzo et. al, 2016; Gou, Lau, and Shen 2012, Leder et al. 2016). However, a study based on responses from 52,980 occupants placed IAQ second, and thermal comfort last in importance (Heinzerling et al. 2013). Despite this finding, all IEQ weighting schemes stress the high importance of multi-comfort parameters in explaining the occupants' overall perception of health and wellbeing in offices.

Most previous limitations point to methodological deficiencies in quantifying occupant experience, as well as comprehensive measurements of physical and behavioural environmental factors in an integrated and comparative approach. There is consensus among researchers that IEQ plays a role in the overall perception of multi-comfort and could act as a mediational factor that impacts occupant evaluation of other performance indicators, such as productivity and health (Elzeyadi, 2015; Humphreys, 2005). The specific question of this exemplary longitudinal study is whether a well-planned assessment and evaluation with pre/post-occupancy analysis of a retrofitted green-certified building could lead to more conclusive findings related to the impacts of green buildings, in general, and those with specific high IEQ on occupants' wellbeing, health, and productivity. The project builds on a previous interpretation framework of sustainable design as a place experience (Elzeyadi, 2015), thus acknowledging the complex systems of interactions between people and their indoor/outdoor environments on multiple layers relating to multi-comfort parameters, occupant productivity, and symbolic perceptions of their building as a facilitator or inhibitor of performance.

## 2. A Tale of Two Buildings

This chapter reports on an investigation into the relationship between IAQ and thermal-comfort performance concerning occupant perceptions of a longitudinal study comparing a pre/post-occupancy move of 800 office employees from a traditional to a LEED™ platinum-certified building (Figure 1). For this study, we posed a specific question: Would moving from a traditional to a LEED™ certified green building have positive impacts on occupant perceptions of IAQ and thermal comfort? In addition, if proven, what attributes of the LEED™ building have a positive effect on both physical and psychological perceptions of better thermal comfort and indoor air quality? Indoor Environmental Quality (IEQ), multi-comfort metrics, and occupants' perceptions were assessed and measured for both the traditional building campus of four buildings and the new salutogenic double platinum-rated LEED™ building (USGBC LEED v3 Core and Shell and Commercial Interiors) over an extensive 36-month before/after retrofit and pre/post-occupancy period.

### *2.1 Study Context – A Salutogenic Office Building*

A new retrofitted building was stripped down to the steel and concrete structure and enclosed with a high-performance building envelope and glass façade. The interior open-plan office space was designed to maximize occupant comfort, as well as improve the health and wellbeing of employees. The four-storey 25,734 sq. m. headquarters is located on a 263,046 sq. m. mature landscaped site. The corporate site includes 18,000 sq. m. of open-plan office area, 116 collaborative spaces, a cafeteria, pantry areas, a fitness centre, a pond, outdoor workspaces by a rainwater fountain, and 2.1 km of walking trails to further enhance the employee experience (Figure 1). The state-of-the-art facility was designed to promote cross-collaboration, as well as attract and retain talent. Sweeping views of nature and daylight penetration are available to 92% of the interior space. Continuous fresh air ventilation and zero- or low-emitting materials were employed to create excellent indoor air quality. Acoustic comfort at the 800+ workstations was created through thoughtful placement of sound-absorbing surfaces, noise-reducing interior partitions, and an active sound masking system.


*Figure 1. Study Context 1 – A Double Platinum LEED™ All-Glass Office Building.*

### *2.2 Study Context 2 – A 1960s Cellular Private Office Complex*

The comparative traditional environment consists of four traditional buildings that were occupied by the same employees prior to the move to study Context 1. The campus buildings were two to three-storey buildings built in the late 1960s. A typical floorplan comprised of perimeter offices and centrally located cubicle workstations. The offices were separated from the workstation areas by transparent glass partitions with manually operable vertical privacy blinds. The building envelope consisted of a brick façade and large single-glazed fixed casement windows with a solar shading film applied to the exterior glass surface. Daylight glare was controlled using manually operable vertical blinds. Workstations were divided using 60" to 72" tall opaque acoustic partitions. The majority of the surfaces in the building had low light-reflectance values below 50% LRV. During typical workdays, privacy blinds were mostly closed, which did not allow daylight to penetrate far into the workstation space. Space lighting was created using ballasted tube florescent lights integrated into the suspended acoustical ceiling. For a visual comparison of both site locations, see Figure 2.

Both the traditional building and the new buildings are located in typical suburban neighbourhoods of a major metropolitan city in the USA. The climate on-site is representative of ASHRAE climate zone 4a with limited micro-climatic and site obstructions. The new building consists of two office wings: one oriented north and south; the other oriented east and west. There is a newly designed entry zone nestled between both wings. The traditional office consists of four buildings: two u-shaped buildings oriented to the east and west around a central courtyard; two other buildings oriented to the north and south and connected with an indoor atrium (Figure 2).

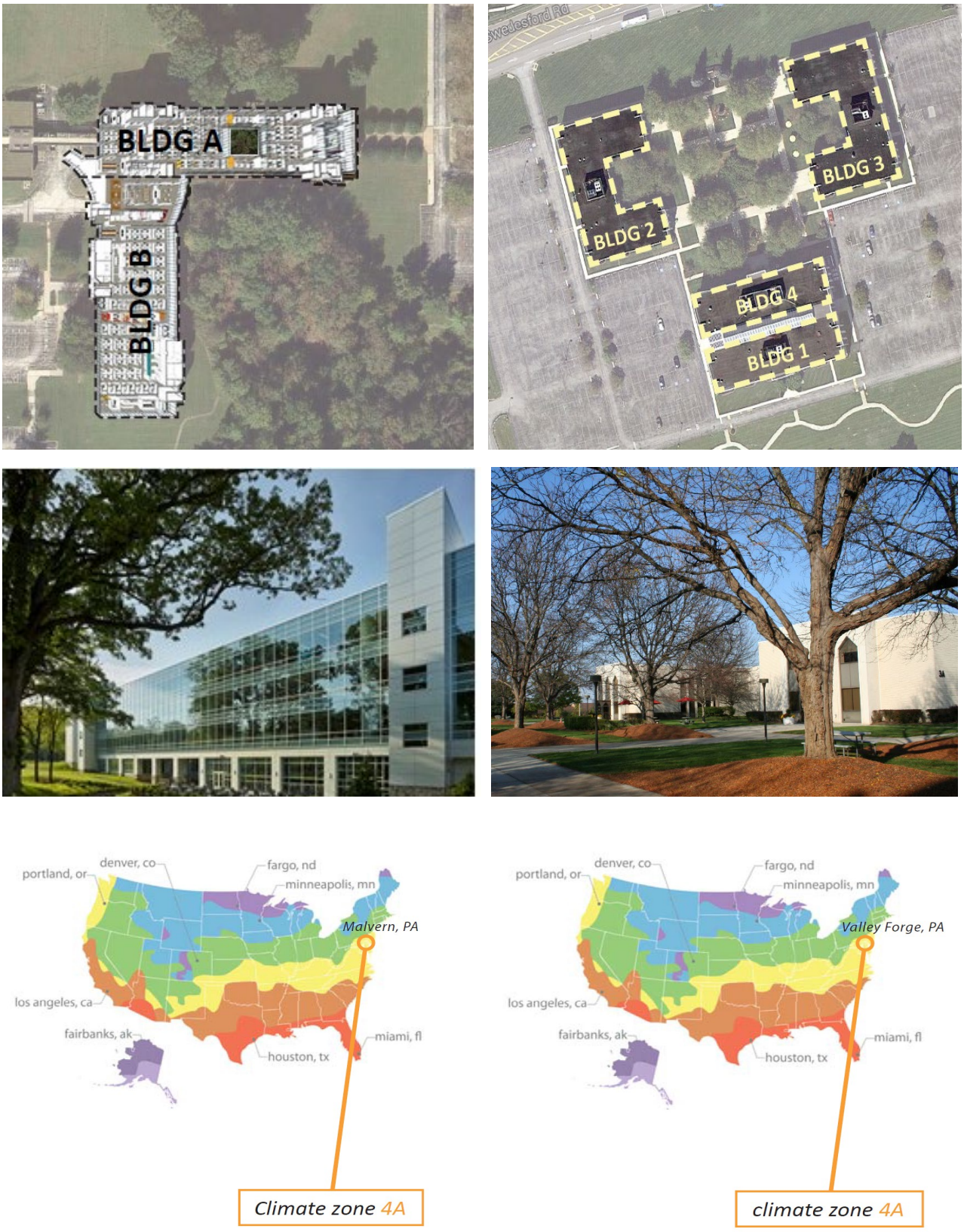



*Figure 2: The study's setting, post- (salutogenic building, left) and pre- (traditional, right).*

### *2.3 Study Phases*

The study was conducted in four phases. In the first phase, IEQ and building performance were assessed for the green salutogenic building in its unoccupied conditions prior to envelope upgrades and design retrofits (pre-retrofit). The second phase assessed IEQ and building performance metrics for the traditional building complex during occupancy prior to the move. In this phase, extensive

seasonal measurements and occupant surveys were conducted with more than 300 existing occupants responding online. The third phase assessed IEQ and building performance of the green and salutogenic building post-retrofit and pre-occupancy of the new building. The fourth phase consisted of an extensive IEQ and building performance assessment of the green salutogenic building post-retrofit/post-occupancy. The assessment and occupant surveys (SPEQ™) were conducted twice: one-year post-occupancy and two-year post-occupancy. All methods, instrumentations, and protocols were kept consistent throughout the four phases of the study to enable comparative analyses for the different phases of the study.

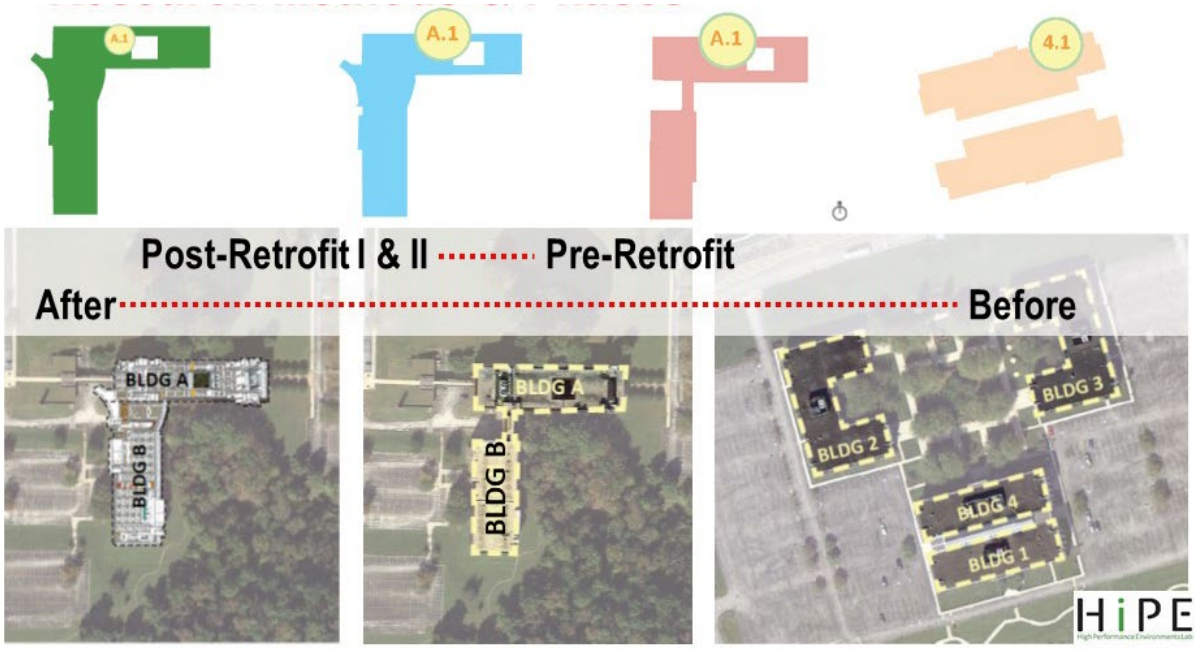



*Figure 3: Study Phases and Context 1*

## 3. Research Methods: IEQ Toolbox™ Assessment and SPEQ™ Survey

IEQ assessment was conducted for sampled spaces in the salutogenic and traditional buildings. The sampled spaces were chosen as representative workstations for the differently-facing orientations and microclimates inside the buildings (Figure 7). A total of 12 sampled workstations were selected to document IEQ parameters in the traditional buildings and another six locations were selected in the salutogenic building. Detailed visual, thermal, acoustical, and indoor air-quality assessments were conducted for sampled zones/workstations in each of the buildings under study. These assessments were further synthesized and combined to compare spaces representative of the four main orientations and microclimates inside the traditional building and salutogenic buildings, and summarised to five sampled work areas representing the main micro-climate zones: north, south, east, west, and internal (Figure 4).

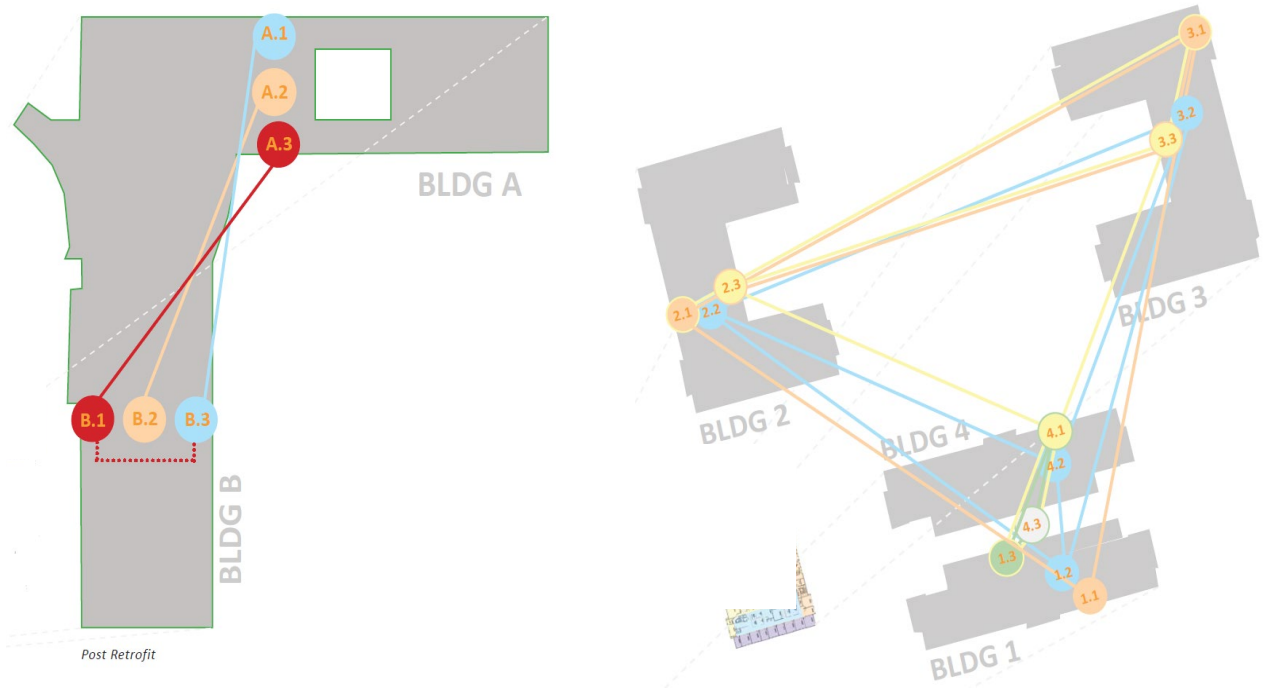



*Figure 4: IEQ Assessment for sampled location inside the salutogenic building (left) and traditional building (right).*

### *3.1 Research Instruments*

Multi-comfort parameters and metrics with the thermal, visual, acoustical, and air quality environment were assessed and analysed for both before and after green retrofitting the building. Both instantaneous and long-term field measurements data of the physical environment and multi-comfort parameters were collected at the level of the building as well as the scale of the occupants' workstation (Figure 5). In addition, occupant satisfaction, comfort, productivity, and wellbeing data was collected using an online Space Performance Evaluation Questionnaire (SPEQ™), as well as through focus groups. All study procedures and protocols were approved by an internal review board (IRB) for the protection of human research subjects, and all occupants participating in the study have signed an online informed consent form prior to their participation. The study collected both objective and subjective environmental data that was cross-referenced and spatially tabulated to ensure data was mapped and tagged to accurately represent occupants' spatial locations and time of collection. All data was tagged with research identification numbers and securely protected to maintain the privacy and anonymity of the responses. Only aggregate data is reported on and statistically analysed to maintain occupant privacy.

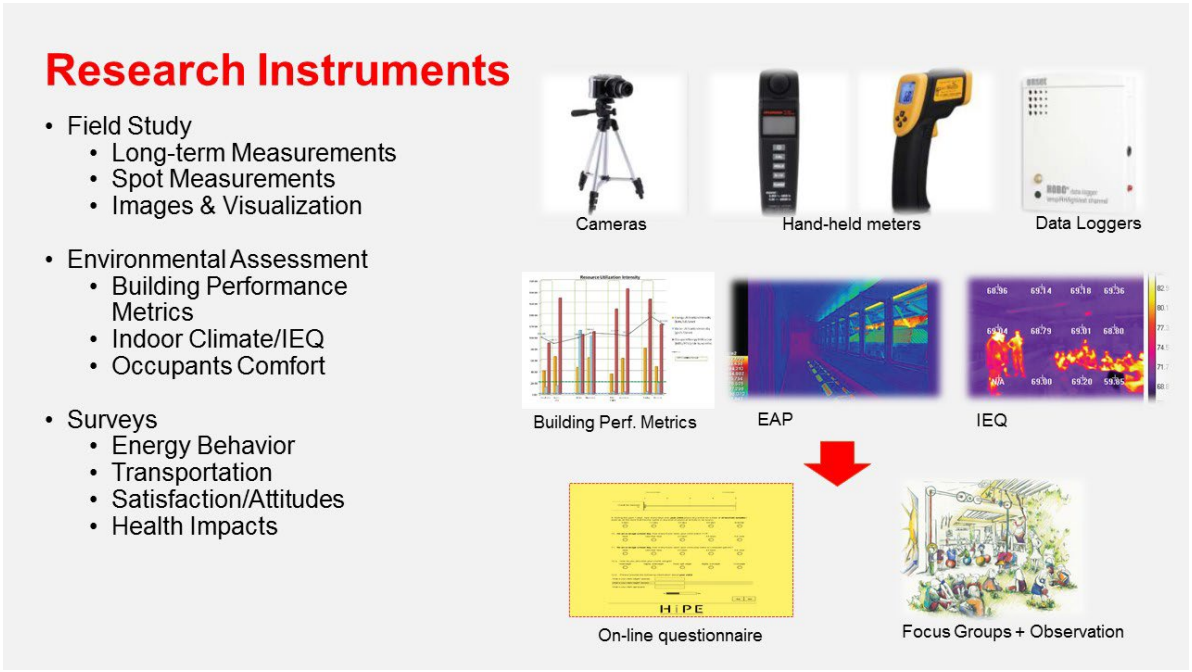



*Figure 5: Research Methods and Instruments.*

### *3.2 Subjective Environment Measurements*

Occupants' perspective and satisfaction data were collected by employing two research instruments: a structured online questionnaire (SPEQ™) and a series of structured and open-ended focus groups.

#### 3.2.1 Focus Groups

Each focus group included 10-15 employees representing different job levels and workstation locations. This was followed by administering an occupant survey to the entire employee population before and one-year after the move into the green-retrofitted office building. Response to the survey was very high with 289 employees completing the questionnaire before the move and 320 completing it following the move. Data tabulation and coding were performed on both the physical and human-response data sets. Physical measurements and survey responses were spatially tagged and statistically analysed using SPSS software. In addition, data visualisations and multi-comfort parameters were computed using a suite of software that spatially analysed the occupants' visual, thermal, acoustical, and indoor air quality (IAQ) across various locations of the building.

#### 3.2.2 SPEQ™ Online Questionnaire

The Space Performance Evaluation Questionnaire (SPEQ™) was developed and tested by Dr. Ihab Elzeyadi in 1998. It has since been applied to evaluate more than 100 buildings with a robust database containing more than 60 LEED™ and other certified green building systems. The online occupant survey has developed categories and scales representative of the most important issues identified by occupants that affect their comfort, satisfaction, performance, and health as perceived and experienced in their work environments. The survey's semantics and linguistics have been designed based on proven language constructs that represent layperson descriptions of the physical environment. SPEQ™ was cross-tested and calibrated in the field and in lab settings. The survey was peer-reviewed by an expert panel of 20 professional building scientists, psychologists, space planners, architects, and physicians. The questionnaire was approved by an IRB in four different institutions of higher education and eight school districts. It is available in four languages: English, Spanish, Italian, and Arabic.

Table 1 outlines the different issues and categories representing the data that is collected by the questionnaire. The SPEQ™ instrument evaluates 30 issues in 76 questions classified into seven main categories. All questions contain a skip-logic approach to skip irrelevant information based on the occupants' responses. This makes the instrument more effective and reduces respondent fatigue. The average response time of the questionnaire is 12 minutes, with a minimum of eight and a maximum of 20 minutes. All answers are recorded on a 5-point Likert scale, sematic-differential scale, a numerical open scale, or a categorized aggregated scale. The scales allow for continuous data that is easily analysed using simple and more complex statistical modelling and regressions. In addition, open-ended responses are encouraged for all questionnaire categories to allow occupants to voice their opinions without restrictions. The questionnaire contains a forced response to a consent form and pre-set reminders for missed question responses. Respondents are allowed to skip questions on the second attempt for most questions with the ability to skip demographic questions to maintain privacy. Neither compensation nor a fee is administered in exchange for responding to the questionnaire. When allowed by the occupants' organisation, respondents can select to enter a draw for a gift-card prize if they answer the questionnaire in a one-time session. The draw entry is set up as a separate portal and is not linked to the respondents' answers in any way. To facilitate statistical analysis, questionnaire responses were recoded into a numerical scale of 1-5 such that 5 was 'strongly agree,' 3 was a 'neutral', and 1 was 'strongly disagree.' Subjective responses from both SPEQ™ and focus-group transcriptions were paired with objective measurements using timestamps for analyses.

**Table 1: SPEQ™ Categories and Questions Scales.**

| Issues/ Questions | Categories | Scale Type | Other/ Open |
|---|---|---|---|
| **4/13** | Workspace Characteristics/ Location/Duration/Type/Views /Comparison to previous ones | - Numerical/aggregate scale<br>- Ranking order scale | Yes |
| **7/8** | IEQ Satisfaction | - 5-point Likert scale (Very Satisfied-Satisfied-Neutral-Dissatisfied-Very Dissatisfied). | Yes |
| **7/24** | Ambient Comfort<br>(Visual, Thermal, Acoustical, Indoor Air, Spatial, Ergonomics, Views) | - 5-point Likert scale (Comfortable-Somewhat Comfortable-Neutral-Somewhat Uncomfortable – Uncomfortable). | Yes |
| **4/20** | Health & Wellbeing | - Numerical/aggregate scale<br>- Frequency, 5-point Semantic Differential (Never-Monthly-Weekly-Bi-Daily-Daily). | Yes |
| **3/4** | Productivity | - 5-point Likert scale (Improved Greatly-Improved-Remained Same-Deteriorated-Deteriorated Greatly). | Yes |

| | | | |
|---|---|---|---|
| **1/3** | **Green Certification/LEED™** | **- Numerical/aggregate scale**<br>**- 5-point Semantic Differential (Strongly Agree-Agree-Neutral-Disagree-Strongly Disagree).** | **Yes** |
| **4/4** | Demographics | - Numerical/aggregate scale | Yes |
| **Total: 30/76** | **7 Main Categories** | **Continuous/Statistical** | **Always** |

## 4. IEQ Analysis and Results

The IEQ framework is developed to guide the IEQ Toolbox™ procedure (Figure 6). It conceptualizes indoor environmental quality (IEQ) in places as a complex system that is composed of different qualities that are grouped under three levels: attributes (instrumental); aesthetics (latent); and symbolic (ambiance). The model proposes the systemic interaction of multiple parameters, people, buildings, and the indoor/outdoor environment resulting in sub-system impacts on building performance, and occupants' productivity, comfort, and wellbeing. These sub-systems affect overall IEQ in buildings and are impacted by its qualities. There seems to be an implicit and, sometimes, explicit view that human comfort occurs in separate envelopes which might be labelled differently as thermal, visual, acoustical, or spatial. Based on our extensive database of post-occupancy evaluation studies we conclude that human comfort is a multi-faceted concept that is affected by the fourfold components of the environment in its physical, physiological, psychological, and social attributes and properties. While one can assume that the environment affects individuals in different ways, their general achievement of multi-comfort, satisfaction, and wellbeing is the result of their overall appraisal of the environment's multiple sub-systems (i.e., thermal, visual, acoustical, indoor air quality, and spatial).

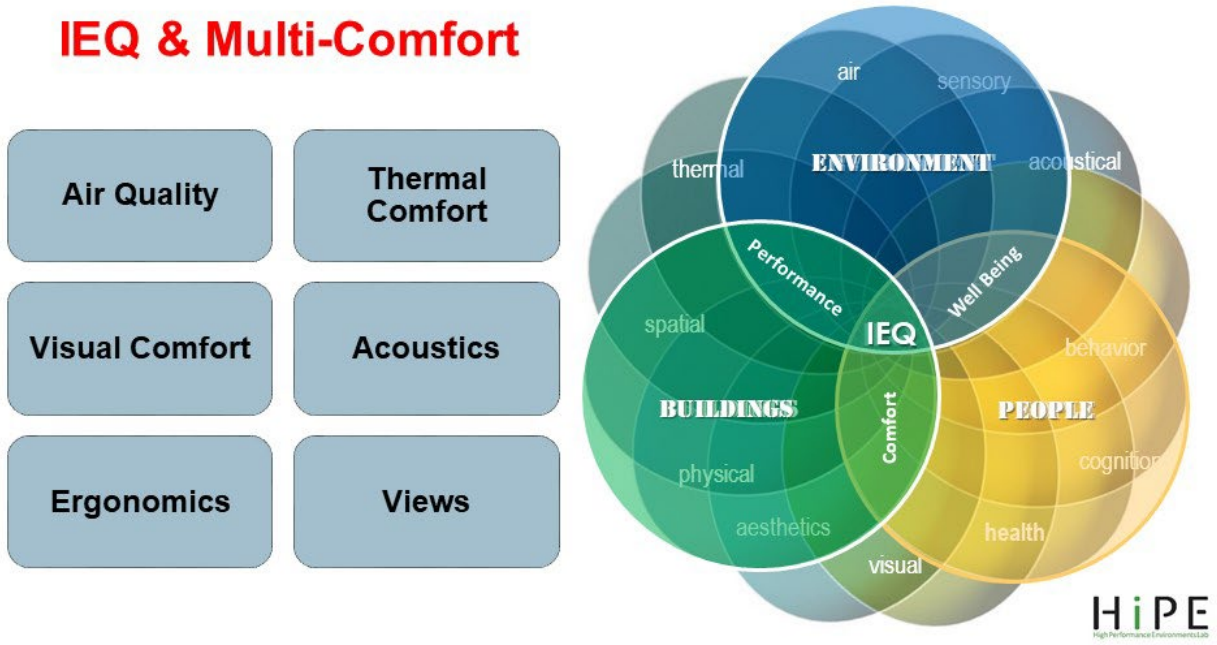



*Figure 6: IEQ Model and Multi-Comfort System.*

### *4.1 Indoor Environmental Quality – Occupants' Perspective Analysis*

In addition to physical assessments and visualisation of the multi-comfort metrics of the environment, an occupant questionnaire was administered to solicit employees' satisfaction with both buildings. An average of 42% of the employees for pre-retrofit and 44% of the employees for post-retrofit completed the questionnaire. Preliminary results of the survey show strong occupant satisfaction with the environmental agenda and green/LEED™ certification of the building. More than 75% of occupants in the retrofitted building agree with the importance to work in a building that is environmentally conscious (Figure 7).


*Figure 4: Heat map indicating the number of completed occupant surveys SPEQ™ in both building complexes.*

The occupant questionnaire was administered to solicit employee perceptions of satisfaction, health, and productivity in relation to both buildings. Questions addressed specific issues such as glare, daylighting distribution, and controls to achieve multi-comfort for the various spaces. A comparative analysis of the occupants' attitudes and perceptions of their satisfaction with the physical environment and IEQ parameters reveal a shift in attitude as to the impact of the building design on their multi-comfort and satisfaction (Figure 8).

### *4.2 Occupants' Satisfaction*

Employees' multi-comfort perception of the visual and acoustical environment of the post-move LEED™ all-glass building is much higher than in the traditional cellular office building (Figure 8). The median response for visual comfort of the lighting system in the all-glass LEED™ building is "+1 to +2" (comfortable to very comfortable) as compared to "0 to -1" (neutral to uncomfortable). Similarly, acoustical quality for the LEED™ all-glass building is perceived as higher than the comparative traditional building (Figure 8). The median response for acoustical comfort in the all-glass LEED™ building is "+1" with a range of "-1 to +2" as compared to "0" (neutral) with a "-1 to +1" range for the traditional office building setting. Further comparative analysis of the quality of the visual environment of the all-glass and traditional building settings reveals a strong correlation of higher satisfaction with the amount of light, daylight penetration, less glare, and more control of the all-glass building (Figure 8). A similar conclusion is true for the noise attributes of the all-glass building with occupants collectively perceiving less noise and more control over their acoustical environments in the all-glass building compared to the traditional cellular offices (Figure 8).

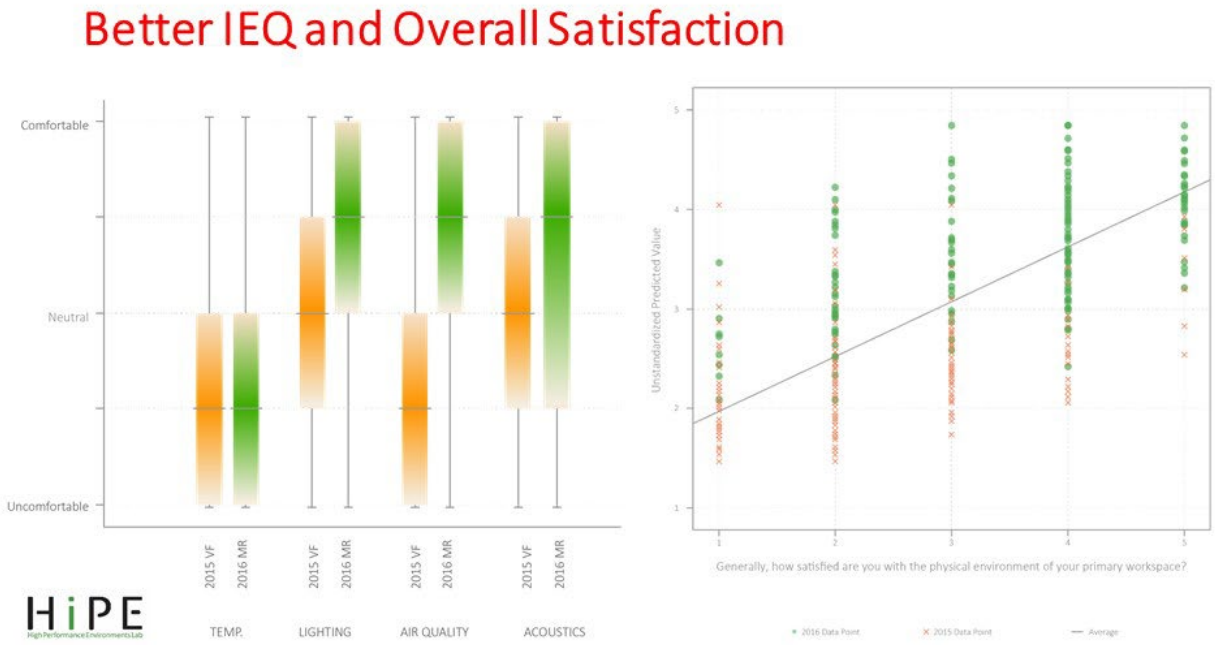



*Figure 5: Comparative analysis of occupants' satisfaction with the IEQ sub-systems of their work environments (green represents the post-retrofit/post-occupancy in the new UQ; orange shows before, in the traditional building).*

## 5. Occupants' Perceptions of Health and Performance Results

The Space Performance Evaluation Questionnaire (SPEQ™) was administered to employees occupying the building over three consecutive years. A total of 319 employees participated in the survey in the first year with a net 275 occupants finishing all questions and evaluating their current work environment in the traditional building complex. The SPEQ™ survey was repeated one year after the employees had moved to their new work environment in the green and salutogenic building. A total of 379 employees participated in the survey with a net total of 356 employees completing all questions and evaluating their new work environment post-occupancy after 12 months in their new environment. This was essential to control for any bias in perceptions related to moving to a new environment and to allow for environmental adaptation and habituation for the new work setting. In the third year, the survey was repeated. This was 24 months after the move to the green salutogenic building. In that year, 358 participated and completed the survey. Data from the survey responses were cleaned and tabulated to ensure complete data sets for all respondents covering all research questions of the survey. This resulted in slight reductions in the number of responses reported for each survey year but these were not drastic in terms of the overall percentage of responses to post any sampling bias. On average, the response rate for the SPEQ™ survey was consistently high, exceeding 40% of the occupants for the three years. The results of this questionnaire are analysed and discussed in the following sections. A complete analysis of each question of the survey is included in Chapter 8 of this report.

### *5.1 Visual Comfort*

Perceptions of visual comfort and ratings of the various parameters of the indoor visual environment are measured by the SPEQ™ survey, using a calibrated Likert-scale. Employees responded to seven different questions that collectively evaluated their visual comfort in the building pre/post-occupancy, compared between the traditional and the salutogenic buildings. Across all questions, employees reported high levels of visual comfort improvements of 56.4% in the salutogenic building, compared to the traditional one (Figure 9). Visual comfort improved across all parameters, 30-60%. The biggest improvement was perceived in the amount of light levels available for working, followed by glare management and daylight availability. The data scale was further normalised to

visualise the magnitude and trend of improvements over the neutral conditions where employees reported neither satisfaction nor dissatisfaction (Figure 9).

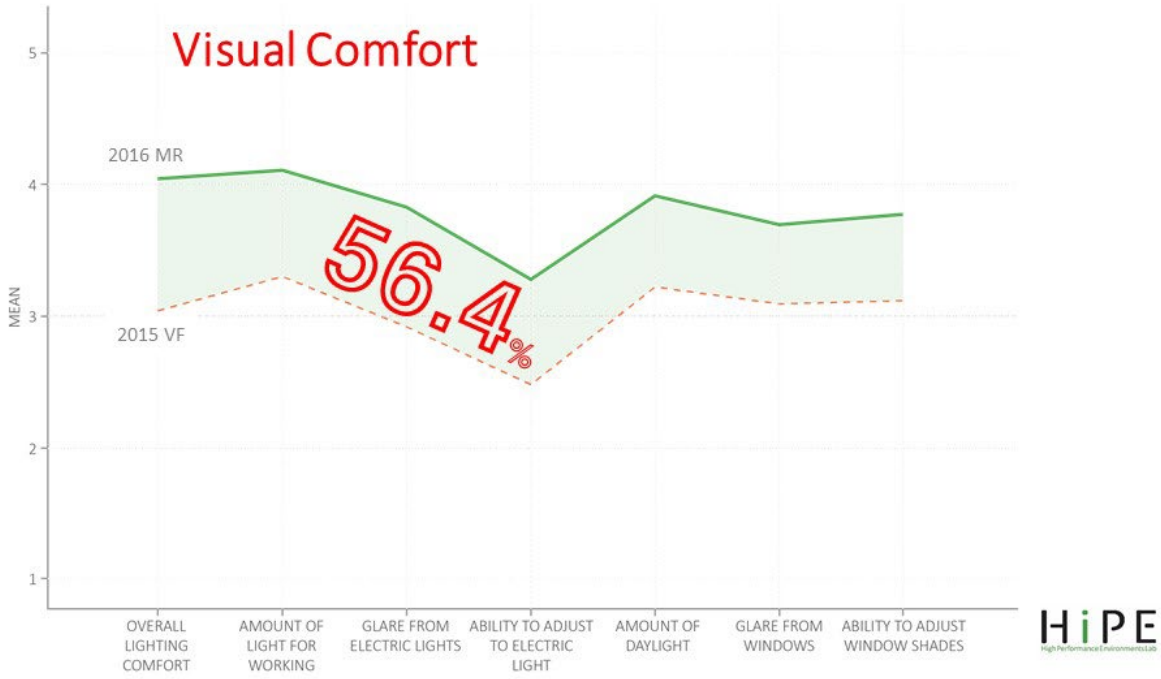



*Figure 6: Visual Comfort Perceptions, Pre/Post-Retrofit and Occupancy.*

### *5.2 Thermal Comfort*

Perceptions of thermal comfort and ratings of the various parameters of the indoor thermal environment are measured by the SPEQ™ survey, using a calibrated Likert-scale. Employees responded to five inter-related questions that collectively evaluated their thermal comfort in the building pre/post-occupancy, compared between the traditional building and salutogenic building, using a skip-logic smart questionnaire technique. Across all questions, employees reported slight to severe dissatisfaction with thermal comfort, with some mild improvements (+4.8%) in the perception of hot and cold at various times of the day, but the overall perception of thermal comfort was neutral to negative. Issues related to the ability to control the thermal environment and perceptions of minimal temperature shifts and radiant asymmetry were better perceived in the traditional building than in the salutogenic building (Figure 10).

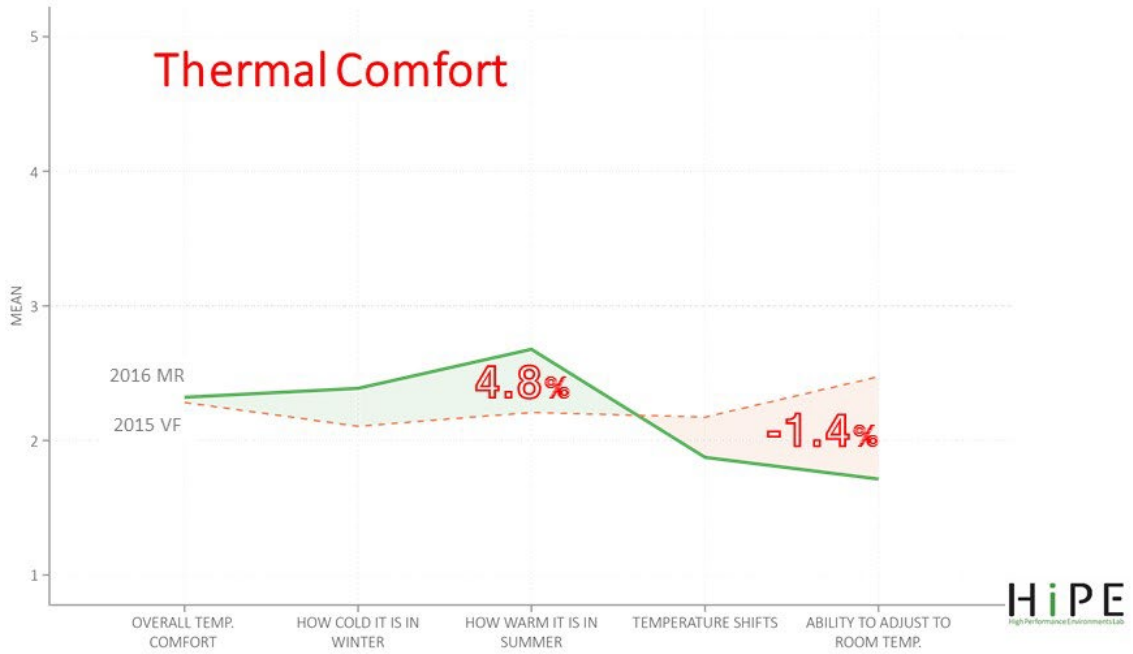



*Figure 7: Thermal Comfort Perceptions, Pre/Post-Retrofit and Occupancy.*

### *5.3 Acoustical Comfort*

Perceptions of acoustical comfort and ratings of the various parameters of the indoor acoustics environment are measured by the SPEQ™ survey, using a calibrated Likert-scale. Employees responded to seven different questions that collectively evaluated their visual comfort in the building pre/post-occupancy, compared between the traditional building and the salutogenic building. Across all questions, employees reported high levels of visual comfort improvements of 56.4% in the salutogenic building, compared to the traditional building (Figure 11). Visual comfort improved across all parameters between 30-60%. The biggest improvement was perceived in the amount of light levels available for working, followed by glare management and daylight availability. The data scale was further normalised to visualise the magnitude and trend of improvements over the neutral conditions where employees reported neither satisfaction nor dissatisfaction (Figure 11).

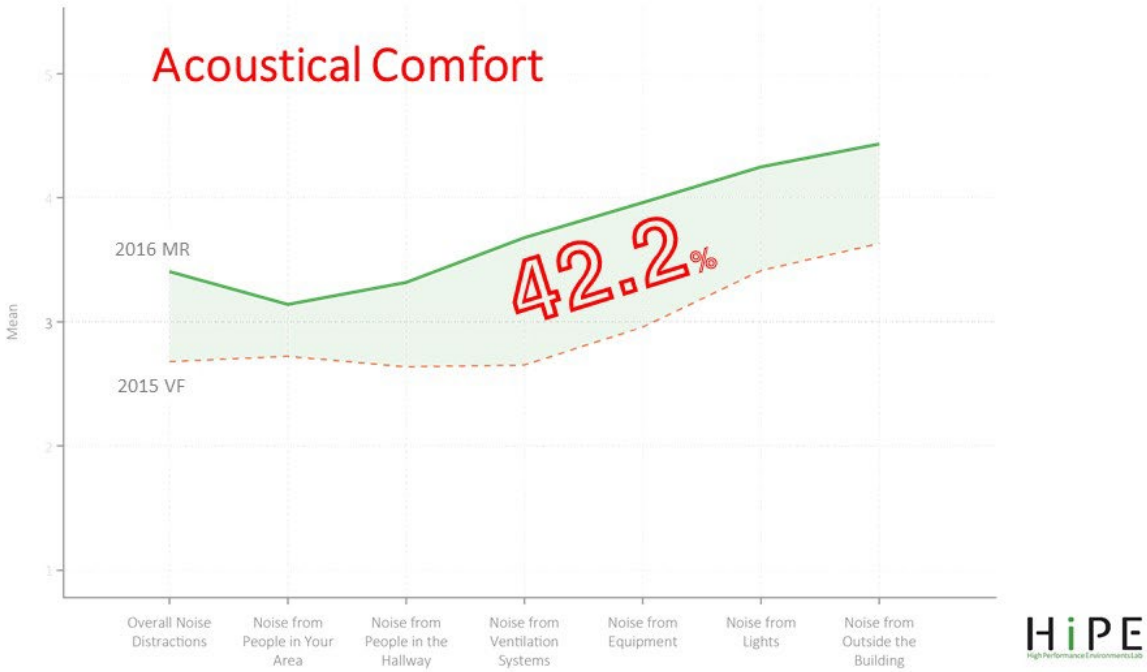



*Figure 8: Acoustical Comfort Perceptions, Pre/Post-Retrofit and Occupancy.*

### *5.4 Indoor Air Quality Comfort*

Perceptions of indoor air quality (IAQ) comfort, and ratings of the various parameters of indoor IAQ environment are measured by the SPEQ™ survey, using a calibrated Likert-scale. Employees responded to four different questions that collectively evaluate their IAQ comfort in the building pre/post-occupancy, compared between the traditional building and the salutogenic building. Across all questions, employees reported high levels of IAQ comfort improvements of 91.6% in the salutogenic building, compared to the traditional building (Figure 12).

### *5.5 Occupants' Multi-Comfort*

Perceptions of multi-comfort and ratings of the various parameters of the indoor environment are measured by the SPEQ™ survey using a calibrated Likert-scale. Employees responded to seven different sub-systems of questions that collectively evaluate their multi-comfort in the building pre/post-occupancy between the traditional building and salutogenic building. Across all questions, employees reported a higher level of visual, acoustical, and IAQ comfort improvement of 26.3% in the salutogenic building as compared to the traditional building (Figure 33). Thermal comfort reported the least improvement and IAQ comfort reporting the most improvement and was statistically very significant as a weighting criterion that defined employees' overall multi-comfort perception inside the salutogenic building (Figure 13).

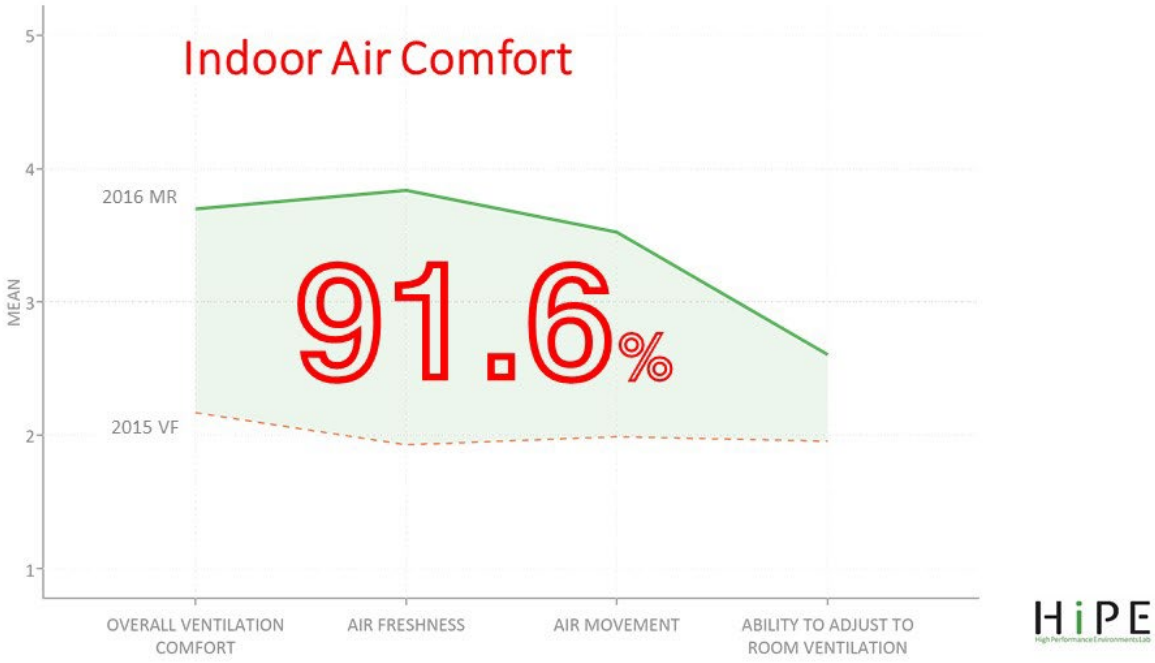



*Figure 9: Indoor Air Comfort Perceptions, Pre/Post-Retrofit and Occupancy.*

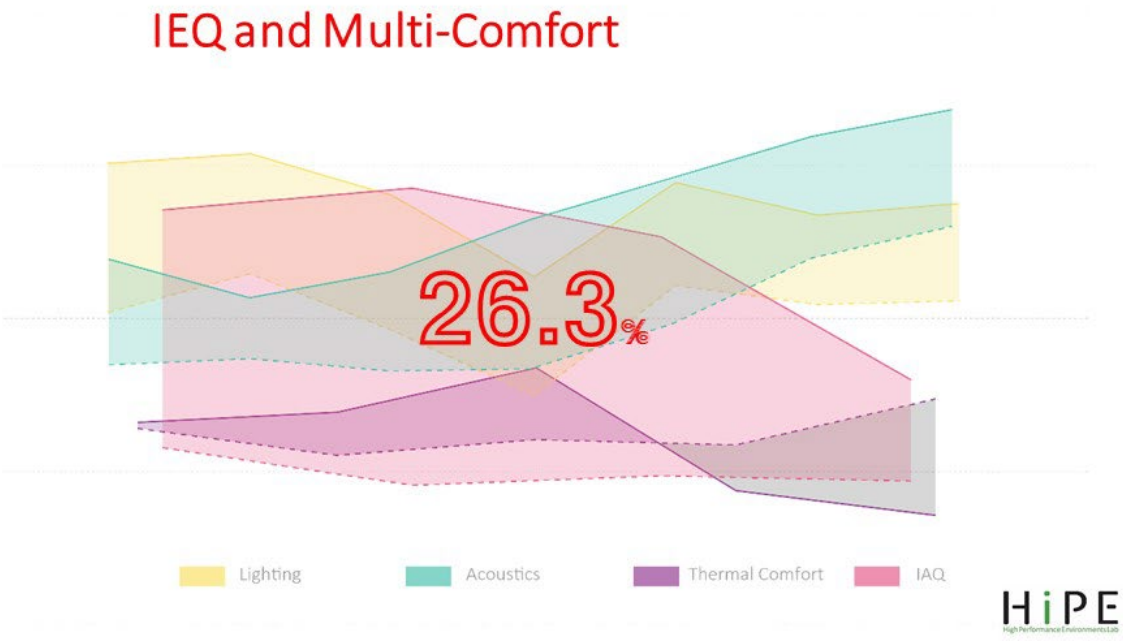



*Figure 10: Overall Multi-Comfort Perceptions, Pre/Post-Retrofit and Occupancy.*

## 6. Occupants' Satisfaction

The following graphs provide a statistical representation of the increase in positive satisfaction indicators and a decrease in negative satisfaction perceptions, showing an improvement in overall occupant satisfaction of 47.9% for the salutogenic building as compared to the traditional building (Figure 14).

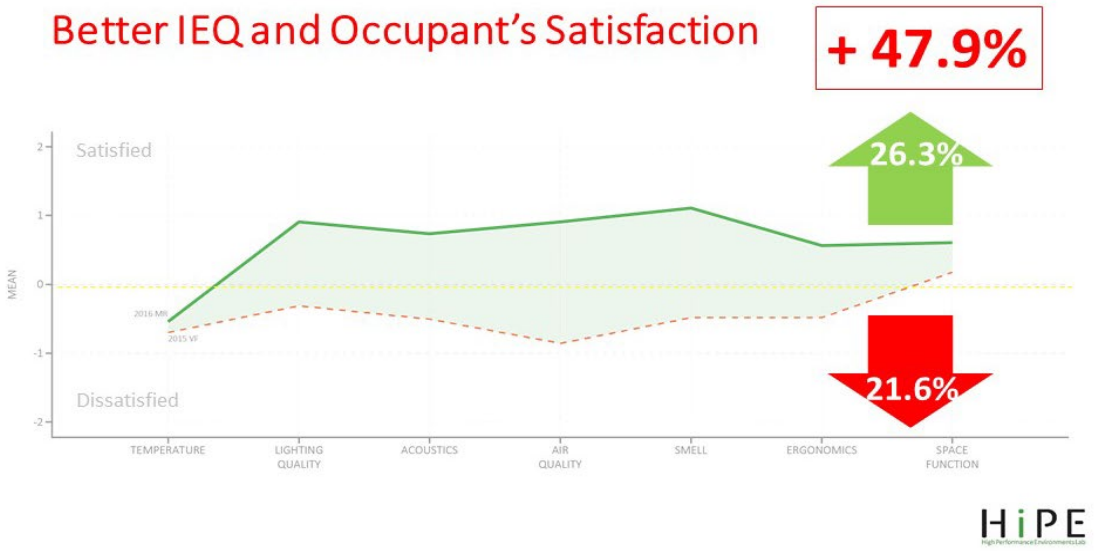



*Figure 11: Overall IEQ Satisfaction, Pre/Post-Retrofit and Occupancy.*

### *6.1 Occupants' Productivity Perceptions*

Similar to occupant satisfaction, improvements to perceptions of overall productivity related to occupying the new building increased by 38.9%, indicating occupants perceive the new environment as making their job easier and being supportive to their productivity (Figure 15).

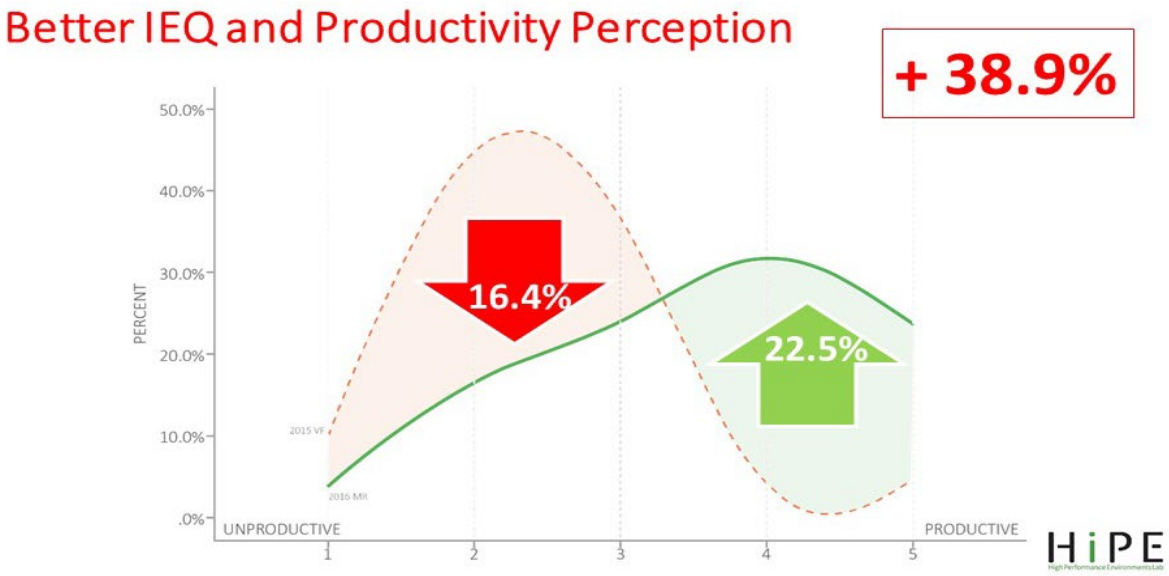



*Figure 12: Productivity Perceptions of the Building Facilitating Work, Pre/Post-Retrofit and Occupancy.*

### *6.2 Occupants' Health*

Similarly, improvements in perceptions of health, related to occupying the new building, increased by 53.7%, indicating occupants perceive the new environment as supportive to their health and wellbeing (Figure 16).

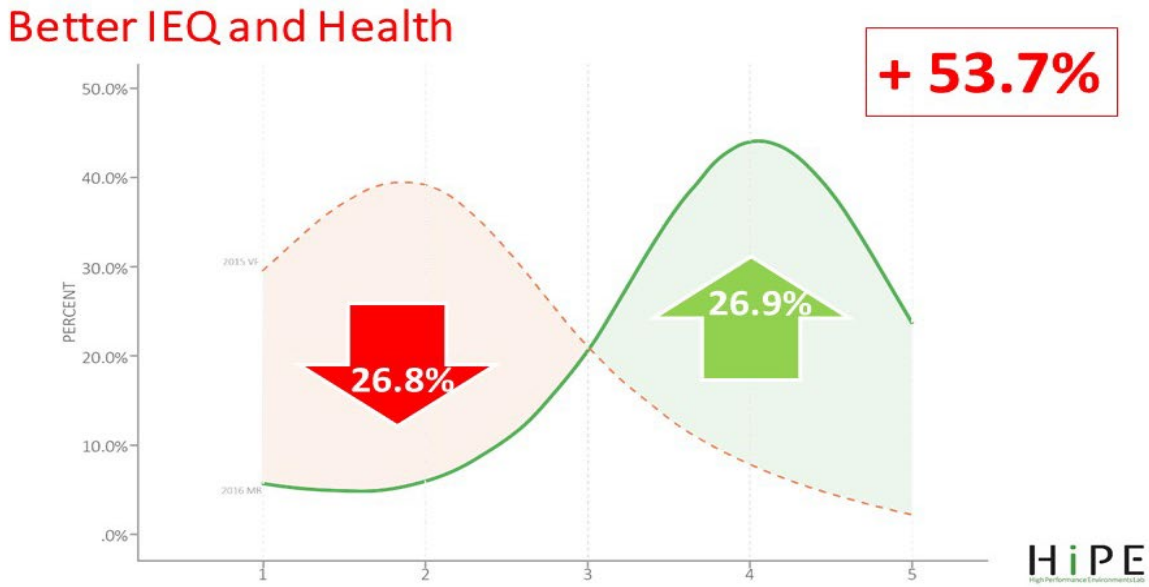



*Figure 13: Health and Wellbeing Perceptions Pre/Post-Retrofit and Occupancy.*

In addition, reported Sick Building Syndrome Symptoms (SBS), as defined by the World Health Organization (WHO, 1984), decreased by 28.6% in the salutogenic building as compared to the traditional building (Figure 17).

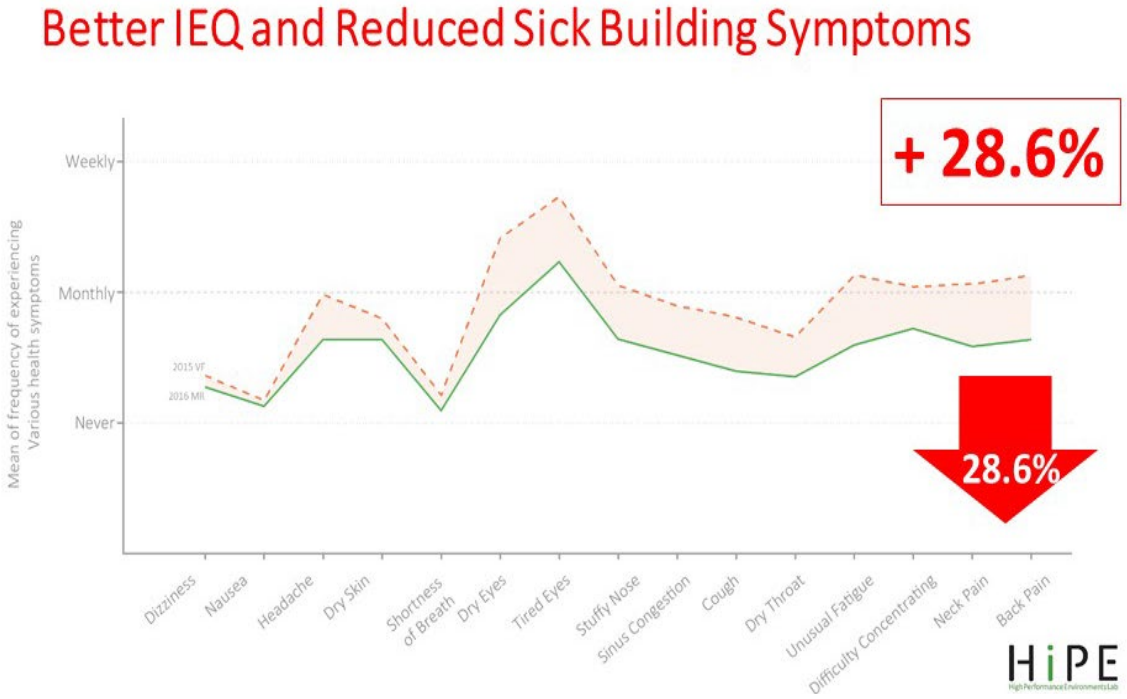



*Figure 14: Health and Sick Building Syndrome Symptoms Pre/Post-Retrofit and Occupancy.*

## 7. Conclusions: Evidence-Based Salutogenic Office Spaces

The project is an exemplary effort and one of the largest studies to date that employed longitudinal IEQ analysis and measurements for both quantitative and qualitative experience, combining both building performance and occupant experience. It employed state-of-the-art methods and protocols to measure IEQ, multi-comfort, health, and productivity between the green salutogenic building and a traditional office building setting. The main objective of this chapter is to provide detailed as well as context-specific information on the impact of a well-designed salutogenic environment on the occupants' health and wellbeing. By establishing a comparative approach between a traditional

building pre-retrofit and a green salutogenic building, the study provides an evidence-based guide of salutogenic building design strategies that impact occupants' health and wellbeing. It is important to note that salutogenic design strategies should not be perceived as "one size fits all," in general, and might not be suitable in all design situations. Designers will need to balance the pros and cons of salutogenic systems as they manage the value proposition of the impact of those systems on IEQ and occupant comfort. This study hopes to inspire future research to apply the proposed model of office spaces and contribute to a better understanding of the dynamic nature of green and salutogenic buildings beyond the fascination with their promised performance and marketing hype. Results show strong correlations between improved IEQ parameters in an all-glass salutogenic building that is well correlated with improved employee productivity and satisfaction, proving that, for high-performance buildings, a comprehensive design and integration of systems is more important than following a strict prescriptive path.

# THEME 4:

# SALUTOGENIC HEALTHCARE DESIGN

# CHAPTER VIII

# THE ROLE OF SALUTOGENIC DESIGN IN MENTAL AND MEDICAL HEALTH-INTEGRATED UNIVERSITY CLINICS

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## Introduction

A university healthcare clinic is an integral part of its academic community and can contribute to the salutogenesis, or health promotion, of the students, staff and faculty in two ways: 1) through its philosophy and protocols as a contributor to the broader campus culture; and 2) through the physical environment of the clinic itself. The notion that a clinic can play a role in supporting health and wellbeing has been explored by previous researchers (e.g., Lindmark, et al., 2018; Rakel, 2008). By facilitating a sense of coherence, a renovated university health clinic can be a salutogenic resource to both students and staff.

The research described here addresses a new medical and mental health-integrated university clinic facility, the design of which includes salutogenic components at both levels. In this study, researchers used interviews and surveys to evaluate the following six primary design goals, established for the clinic during programming: transparency, accessibility, privacy, integration, collaboration, and welcoming (see Figure 1).

Regarding the *physical environment*, the new clinic addresses many of the goals suggested by previous authors (e.g., Abdelaal & Soebarto, 2019; Mazuch, 2017; Wister, 2005). According to Antonovsky (1996), the primary objective of salutogenesis is to provide a sense of coherence (SOC) through comprehensibility, manageability and meaningfulness. A study of the salutogenic model among university students suggests the importance of the college environment in affording SOC (Heiman, 2010).

Of the design goals, mental and physical health integration, a subset of meaningfulness, was the most innovative, and is the focus of this chapter. Supporting mental health is a primary tenet of salutogenic design, and salutogenic design has been shown to be protective against negative mental health outcomes (Gana & Mezred, 2009 and Koleck et al., 2003, as cited in Mathieu et al., 2017). To this end, clinical care can make the difference between severe mental illness and successful treatment. Coping with mental health challenges and dealing with mental illness is demonstrably more effective when medical morbidities are considered at the same time.

The integrated primary care model proposed by Blount (2003) suggests three goals of medical and mental health collaborations: produce healthier patients; reduce cost; and improve patient and provider satisfaction. Indeed, numerous studies have found financial and clinical benefits from this type of integration (Walker & Collins, 2009). Integration has proven beneficial among unified systems like health maintenance organisations (Cummings & Follette, 1967; Follette & Cummings, 1968) and the Veterans Administration (Druss et al., 2001).

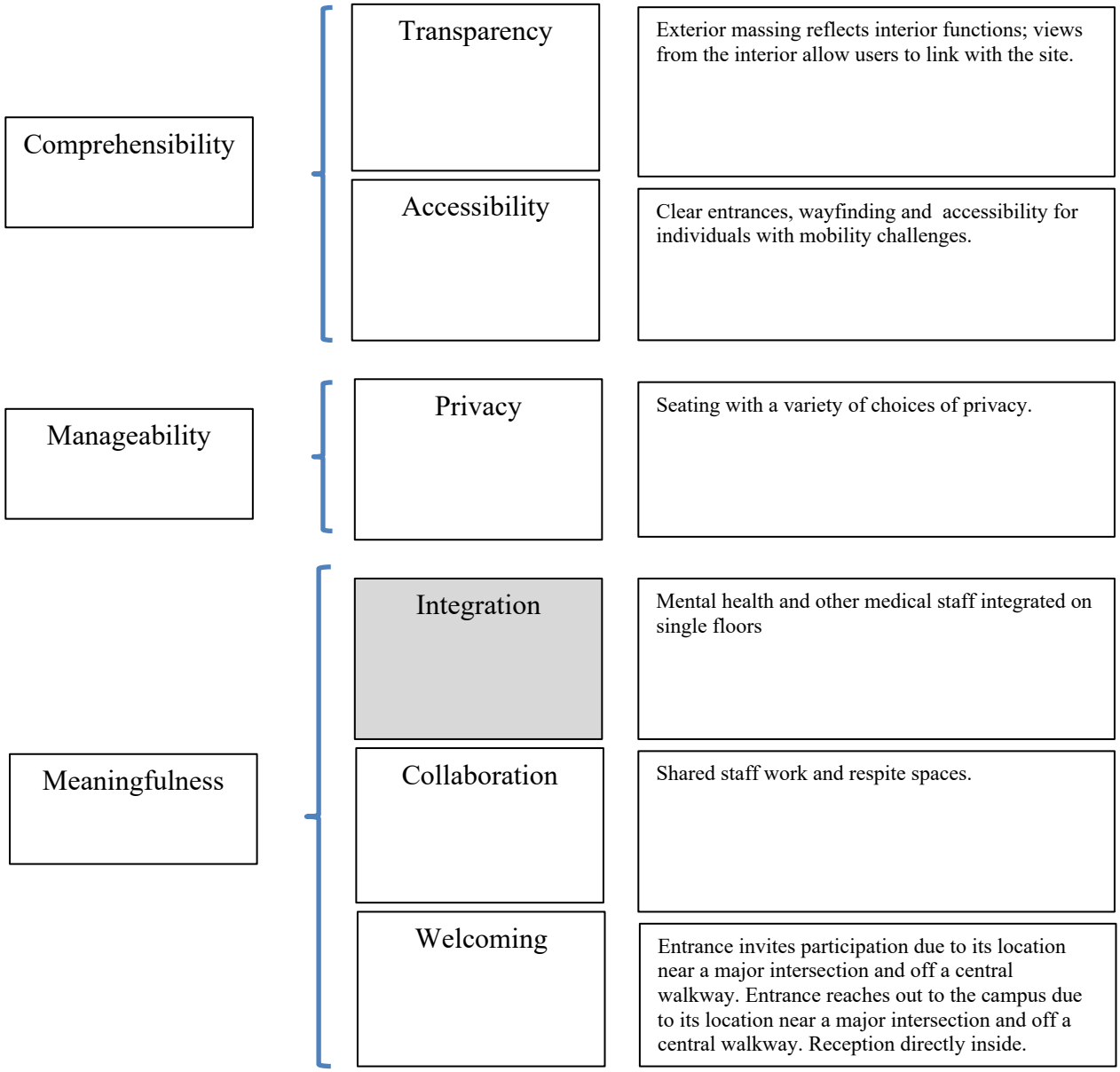


*Figure 1: Design goals for the clinic in relation to Antonovsky's three characteristics, contributing to a sense of coherence.*

As unified systems, university health centres may expect similar benefits from integration, though the university student population requires unique considerations in the provision of primary care and mental health services. With mental health treatment among the top public health concerns for late adolescents and young adults, some universities, such as the facility that was the focus of this study, have extended the concept of integration across campus services by combining somatic medical and mental and behavioural health (MBH) services.

## University Health Services and Salutogenesis

The literature on salutogenesis in university environments is limited (Dooris, Doherty & Orme, 2017). However, the need to conduct such research is driven by contemporary society. Dooris, Doherty and Orme (2017) note that university student populations are becoming more diverse, and campuses have responded by addressing issues of student engagement, support and wellbeing, all concepts associated with salutogenesis. Universities are the focal point of life transition and development of citizenship for both students and staff (Dooris et al., 2012). They are the primary

venues for making sense of one's life, and need to be designed to support coherence (Dooris, Dojerty and Orme (2017). A sense of coherence predicts mental health among college-aged students (Carlén et al., 2020; Tóth et al., 2020). Lastly, universities provide the context for developing an understanding of health goals (Holt et al., 2015). Salutogenic approaches must be employed to address transitioning cultural complexity and the development of healthy behaviours.

## University Mental Health Services and Salutogenesis

In addition to these contemporary challenges, university student mental health is a concern. In a 2019 international survey involving over 500 universities, 87% of campus psychological service directors reported an increasing demand for mental health services (LeViness et al., 2019). Between 2007 and 2018, rates of depression, anxiety, self-injury, and suicidal behaviour significantly increased among US college students and, in some cases, these rates have even doubled over the last decade (Duffy et al., 2019). While part of this growth is due to an increase in help-seeking behaviours (Hunt & Eisenberg, 2010), at least a portion must be attributed to an increase in disorder prevalence.

Though students are seeking more mental health services, they are not receiving adequate treatment. In 2018, a substantial percentage of students reported a disruption in their academic performance due to stress, anxiety, or depression (American College Health Association, 2018). Integrating counselling/psychological services and somatic health services may increase early detection and treatment for these college students (Alschuler et al., 2008).

Several studies have identified barriers to MBH treatment among young people, including societal stigma (Corrigan, 2004), a lack of awareness about treatment (Edlund et al., 2002) and lengthy provider waitlists (Wisdom et al., 2011). Integration of somatic services with counselling and psychological services seeks to address these barriers.

With more students entering college with a diagnosed disorder or seeking first-time treatment for a disorder during college, the burden on university health centres has increased. Primary care is often the first place an individual will seek treatment for mental health issues. Between 1990 and 2003, nearly 75% of primary care visits involved a mental health concern (Kessler et al., 2005). Yet, primary care providers on college campuses report a lack of resources, education and confidence in treating mental health disorders (Pratt et al., 2012). Integration can improve willingness among university primary-care providers to collaborate and refer patients to behavioural health practitioners (Funderburk et al., 2012).

Antonovsky's salutogenic model has been adopted by positive psychologists as a framework for mental health counselling (Mayer et al., 2019). Improving a sense of coherence (SOC) can result in improved academic functioning among college students (Feldman et al., 2012), positive adjustment during the first year of university (Davidson et al., 2012), and effective career thinking (Austin & Cilliers, 2011).

Beyond students, the salutogenic model has also been applied to educators and mental health staff. A study of employees at a university in the United States (US) showed significant associations between SOC, stress, and wellbeing (Ryland & Greenfield, 1991). More recently, employees at a university in Germany showed similar improvements in both physical and mental health outcomes as SOC improved (Graeser, 2011). A study of a salutogenic employee intervention program at an Israeli psychiatric inpatient facility suggests links between employee SOC and patient health and wellbeing (Idan et al., 2013).

## Service Integration and the Built Environment

In the only comprehensive report of integration among university health centres that we uncovered, an American College Health Association (ACHA) task force surveyed staff members at academic

institutions across the US, ranging from 0-40,000+ undergraduates (Anderson et al., 2010). Respondents included physicians, care providers, and members of the counselling and psychological services teams. Survey results from the 92 integrated university health centres describe several factors driving the change to integration, including improved continuity of care, philosophy of care, and directives from upper administration. The least influential factors included physical facilities (18.5%). In a brief discussion of the physical space, results indicated that reception/check-in areas are shared less than 50% of the time in service-integrated facilities. This was the only environmental characteristic mentioned in the ACHA report, although there is a substantial body of literature connecting the built environment to physical and behavioural outcomes in health care facilities (Devlin & Arneill, 2003). For example, providing patients with an opportunity for privacy in a university setting is believed to improve mental health (Evans, 2003).

Relevant to an integrated university health setting, an off-stage area or a casual room for staff members has been shown to improve collaboration among nursing staff (Gum et al., 2012). Full-time university counsellors spend 20% of their time in indirect service, including consultation and case conferences with other professionals (Gallagher, 2009), and providing a space for these inter-professional conversations is a key consideration in the built environment. Though there are no existing studies on salutogenic design in university health facilities, researchers have explored salutogenic design for psychiatric health, namely the qualities influencing comprehensibility, manageability, and meaning (Golembiewski, 2010).

Given the very limited research investigating the built environment and integrated health facilities, the current research sought to address the following questions: (1) How successfully were the client-designer goals implemented in the renovation of a university health clinic? (2) Does integration of medical and MBH services improve other environmental qualities, like privacy and collaboration? (3) What environmental features and characteristics support or hinder integration? While mental health outcomes per se (i.e., changes in levels of pathology) were not measured, surrogates for these outcomes, such as a sense of privacy, were included.

The three questions resulted in three hypotheses:

- Hypothesis 1: The facility successfully achieved the design goals established prior to construction.
- Hypothesis 2: Students will report an increased sense of privacy as a result of service integration.
- Hypothesis 3: Ratings of integration will be associated with ratings of collaboration.

## Methods

Two tools were used to explore these questions using the format associated with a practitioner-focused facility evaluation (PFE), which emphasises using the design goals as research hypotheses (Shepley, 2011). The setting was a new university healthcare clinic in the United States.

## Setting

The university's original clinic facility was built in 1956. Between then and the time of this study, the number of visitors increased by 250%, the size of the staff doubled, and the number of mental health visits tripled. The facility accommodates approximately 500 patient visits per day during the peak period and provides clinical primary care, counselling and psychological services (CaPS), and nutrition and wellness counselling to all students throughout the year. To address the needs of the growing student body and to provide a facility that meets current codes, the university initiated a capital improvement program involving the renovation of portions of the existing facility and the construction of an addition. In Phase 1 (between 2015-2016), the addition was built, and all operations were moved into the new building. The medical and counselling services, which had been segregated within the building, were first integrated within the same floor at this time. Phase 2,

completed in Fall 2017, involved renovating the existing structure and connecting it to the new structure.

The design team was interested in several goals that are often associated with salutogenesis, such as acknowledging the role of nature in promoting health and wellbeing. The clinic participates in the ParkRx program in which students are given a prescription to interact with nature as part of their treatment (see Kondo, et al., (2020) for a description of the ParkRx program). Figures 2, 3, 4 and 5 provide a site plan and exterior views.

*Figure 2: Clinic site plan showing entrance on right, off the pedestrian promenade (source: authors).*

*Figure 3: Approach to health building adjacent to pedestrian promenade (source: authors).*

*Figure 4: Approach to health building from the south (source: authors).*

*Figure 5: Pedestrian plaza showing bike racks and pedestrian seating (source: authors).*

## Staff Interviews

The research team employed a semi-structured interview approach utilising a set of 17 open-ended questions involving 13 interviewees (five in Phase 1, eight in Phase 2). The interview structure was designed to gain a design practice-focused impression of the six pre-established renovation design goals. Parallel question formatting ensured consistency across participants, and printed floor plans were made available for visual reference. Two researchers were present for each interview, lasting about 30 minutes each. All interviews were audio-recorded with permission to use mobile phones or computer applications for transcription.

The research team utilised the naturalistic inquiry method (Lincoln & Guba, 1985), a grounded theory approach that allows researchers to gain a holistic understanding of thoughts, feelings, values, and perceptions of interviewees. Naturalistic inquiry proceeds by converting interview transcriptions into distinct concepts written on index cards (or a computer-based equivalent). These index cards are then sorted into broad themes. Index cards were created to represent each new concept mentioned by interviewees. The cards were then sorted into broad themes during a group discussion involving the research team. The naturalistic inquiry process was completed twice, after both the Phase 1 and Phase 2 interviews.

In a typical naturalistic inquiry exercise, individual researchers would create notecards (codes) and identify themes separately before collaborating with other researchers. In the current study, because the research team had already identified six *a priori* themes from the design goals, analysis immediately proceeded to group discussion.

## Staff and Student Questionnaire

After examining the predetermined design goals, the researchers created a draft questionnaire, which was revised based on the feedback from the health centre representative and interviewees. The feedback did not address the six themes specifically but clarified room and title designations and expanded upon definitions.

University undergraduate and graduate students (the "patients") and university health clinic staff participated in the Phase 1 and Phase 2 questionnaires (see Table 1). Staff members responded to the questionnaire online through an email sent out to all university health centre staff in both 2016 ($n$ = 58) and 2019 ($n$ = 90). Students responded online and through paper questionnaires in both 2016 ($n$ = 132) and 2019 ($n$ = 36). Student questionnaires were placed in waiting rooms with signage directing students to complete the questionnaire. To increase participation, team members visited the waiting rooms to distribute questionnaires in person. Team members also distributed links to the online questionnaire through their personal student networks.

In addition to basic demographic questions, the questionnaire asked for a level of agreement with the design goals on a 5-point Likert-type scale. The questionnaire defined each design goal before asking for a response. The last quantitative question asked participants to rank the importance of the different design goals. An open-ended question at the end of the questionnaire asked for comments about the new facility. The staff questionnaire differed from the student questionnaire in the demographic questions (e.g., job title versus student year) and the inclusion of "collaboration" as a design goal, as collaboration specifically involved staff interactions.

**Table 1.** *Frequency Statistics by Demographic Variables: Questionnaire.*

| *Student – Designation* | *n* | % |
|---|---|---|
| Freshman | 17 | 5.4 |
| Sophomore/Junior/Senior | 112 | 35.4 |
| Graduate student | 35 | 11.1 |
| Professional student | 2 | 0.6 |
| Other | 2 | 0.6 |
| *Student – International Status* | | |
| International student | 43 | 25.9 |
| Domestic student | 123 | 74.1 |
| *Staff – Length of Employment at Facility* | | |
| 1 year or less | 31 | 21.1 |
| 2 to 5 years | 39 | 26.5 |
| 6 to 10 years | 25 | 16.9 |
| More than 10 years | 52 | 35.1 |
| *Staff – Professional Grouping* | | |
| Administrative services | 37 | 25.2 |
| Counselling and psychological services | 27 | 18.4 |
| Medical services and occupational medicine | 46 | 31.3 |
| Nursing / nutritionists | 12 | 8.1 |
| Clinical support services | 3 | 2.0 |
| Other | 22 | 14.9 |
| *Staff – Age* | | |
| 30 or younger | 16 | 10.9 |
| 31 to 40 | 29 | 19.7 |
| 40 or older | 102 | 69.4 |

## Results

### *Staff Interviews*

**Integration.** During Phase I, all interviewees agreed that integration was important in the redesign. Interviewees discussed how the new building's physical environment allowed staff to become more integrated and collaborative, something that was lacking previously because departments were physically separated. Phase 1 interviewees suggested the health clinic is still adapting to this model after the integration of the physical environment.

During Phase 2, integration of the counselling and medical staff was discussed mostly in a positive light, although some lingering challenges were mentioned. Many staff members shared the opinion that having mental and physical health departments combined was better for patients. The most frequently cited reason for this opinion was that integration facilitates the mind-set of "whole-person" care, while also removing the stigma surrounding mental healthcare by anonymising the visitor's reason for sitting in the waiting room. Many noted that departmental integration has helped

with more frequent and effective interdepartmental collaboration for patients who receive both primary care and psychological care, although it is worth noting that the mechanism of practitioner collaboration was not clearly specified (e.g., running into one another in the hall scheduling meetings).

One area of challenge with the integration goal was a loss of specialised expertise for front-desk staff. The front-desk staff had previously developed expertise in either psychological services or primary care and, post-integration, were expected to have dual competency. As an additional source of possible tension, the cohesiveness within counselling staff had been somewhat compromised due to the department being split into multiple floors. This fact was mentioned in the context of trade-offs benefitting the design goal of integration.

**Collaboration.** Several building features were considered as fostering collaboration. Multiple staff members expressed appreciation for larger individual offices that provide adequate space for small meetings. The office furniture (small tables and seating) is perceived as ideal for meetings of two to three people. Some offices also feature television monitors, so individuals are not required to book meeting spaces to accommodate technological needs. One staff member commented that many employees utilise the consultation rooms as a break area rather than for meetings. In addition, the consultation rooms are thought to be beneficial for collaboration. Circulation spaces, such as hallways and reception areas, were viewed as fostering collaboration as well. As an example, chairs are situated at the end of some hallways. These areas function as impromptu meeting locations and are greatly appreciated by the medical staff. Additionally, hallways are seen as spacious enough that CaPS and medical staff may cross paths at unplanned times, providing opportunities for impromptu conversations.

In Phase I, some interviewees felt that some collaborations between departments had been enhanced while others felt that collaboration within departments had been reduced. One interviewee predicted that the way staff approach integration and collaboration will evolve as people adjust to the move from temporary to permanent offices. Phase I interviewees also reported challenges, which were not completely anticipated, to staying connected in the new space. People were closer and easier to find in the old building, simply because the building itself was smaller.

During Phase 2, some of the same concerns were echoed. In speaking with primary care staff members, there was a sense that moving into a larger facility led to both positive and negative outcomes in the day-to-day work experience. All three primary care staff mentioned the increased facility size as a potential challenge to collaboration: “Now we’re so spread out that sometimes it’s hard” and “We don’t see each other as much.”

The increased size in the exam rooms, however, was unanimously praised using terms such as “wonderful” by these individuals. One primary care staff member stated: “You have a space where you can actually physically do the things that you’re supposed to be doing,” as compared to the pre-renovation space which “was almost like a closet; you had to do a little dance to get around each other.”

**Privacy.** During both phases, many interviewees mentioned the positive benefits afforded by the integration of primary care with counselling and psychological services. All interviewees agreed that privacy was a priority in the redesign.

The reasons cited for the improved privacy were threefold: (1) an individual’s particular health concern remains private as everyone waits together; (2) having the waiting area tucked behind the check-in area may deter non-patient lingering; and (3) privacy dividers that extend upward from the back of some of the waiting room furniture pieces provide visual enclosure. Having a large waiting area was also mentioned as possibly contributing to privacy because visitors have more space. One interviewee, however, mentioned a student who felt more exposed in the larger waiting area when compared to the previous smaller waiting room.

Sound-proofing was thought to have improved dramatically when compared to the old facility and contributed to a sense of privacy. This observation was made by both mental health and primary care staff: "People can't hear from room-to-room, which used to happen." Specifically, the material-based dampening and the integrated white noise from the air conditioning vents were each seen as contributing factors.

### *Questionnaire – Staff and Students*

All six dimensions were rated positively ($M > 3$ on a 5-item Likert scale) by staff and students, suggesting successful implementation of the design goals. Mann-Whitney tests revealed significant increases in student and staff ratings of welcoming, transparency, and accessibility between 2016 and 2019 (see Table 2).

Ratings of integration were significantly correlated with all other environmental qualities, but were most closely correlated with ratings of privacy and collaboration (see Table 3). The correlation between these qualities is a testament to the relationship between design interventions that support salutogenesis.

**Table 2.** *Mann-Whitney Tests for Differences Between Survey Years*

| | | | | 95% CI of Difference | | | |
|---|---|---|---|---|---|---|---|
| | Survey Year | *N* | *M* | Lower | Upper | *U* | *p* |
| Welcoming | 2016 | 189 | 3.70 | -0.64 | -0.26 | 8539.0 | < .001* |
| | 2019 | 126 | 4.15 | | | | |
| Transparency | 2016 | 190 | 3.38 | -0.63 | -0.22 | 9076.0 | < .001* |
| | 2019 | 126 | 3.81 | | | | |
| Privacy | 2016 | 190 | 3.92 | -0.04 | 0.36 | 11006.5 | .176 |
| | 2019 | 126 | 3.76 | | | | |
| Accessibility | 2016 | 190 | 3.26 | -0.63 | -0.16 | 9213.0 | < .001* |
| | 2019 | 126 | 3.65 | | | | |
| Integration | 2016 | 190 | 3.57 | -0.35 | .07 | 10871.0 | .142 |
| | 2019 | 126 | 3.71 | | | | |
| Collaboration^ | 2016 | 58 | 3.33 | -0.47 | 0.28 | 2587.5 | .925 |
| | 2019 | 90 | 3.42 | | | | |

* indicates statistically significant difference

^ only staff respondents provided ratings for collaboration

**Table 3.** *Correlations between Ratings of Integration and Other Design Goals (Phases 1 and 2 combined).*

| | *r* | *p* |
|---|---|---|
| Integration & Welcoming | .391 | < .001* |
| Transparency | .399 | < .001* |
| Privacy | .420 | < .001* |
| Accessibility | .292 | < .001* |
| Collaboration^ | .482 | < .001* |

* indicates statistically significant difference
^ only staff respondents provided ratings for collaboration

## Discussion

While this study focused on the impact of the physical environment on integration (student privacy and staff collaboration), a primary objective was to examine the success of the six design goals established during programming. The results of the questionnaire suggest staff and students reacted positively to the new facility, particularly in the dimensions of welcoming and privacy. Staff interviews further illuminate the positive results, unintended consequences, and continued challenges of service integration. Transitions in opinions/perceptions were noted between the two phases, likely due to staff growing accustomed to the new facility, and reductions in overcrowding as a result of moving from the small, renovated facility to a larger expanded facility. Previous researchers have noted differences in the responses of users in facilities providing mental health services (de Vries et al., 2016; Papoulias et al., 2014; Rose et al., 2015; Sachs et al., 2019).

The quantitative and qualitative results suggest **Hypothesis 1** was mostly supported, as the facility successfully achieved the design goals established prior to construction. Lingering challenges included the separation of co-workers in similar departments, loss of specialised front-desk staff, and lack of perceived solidarity between students seeking mental health services. Future research may further explore the trade-off between the privacy afforded to students when medical and behavioural health services are co-located, and the loss of solidarity reported by students when they previously sought care together on a designated counselling floor.

**Hypothesis 2** was also supported, as students reported an increased sense in privacy as a result of service integration, a potential contributor to the salutogenic experience. Staff interviews supported the findings from the questionnaire. Several dimensions of privacy were improved due to integration, including both auditory and visual, and the social protection of personal motivations for seeking healthcare. As the stigma of mental health services remains a barrier to seeking treatment for young people, integration serves a vital role by eliminating potential opportunities for privacy violations in the waiting room. Previous research has explored this idea of social privacy in MBH treatment. Multiple facilities have been successful in improving referral rates by requiring universal MBH screenings, thus eliminating the stigma of screenings (Wissow et al., 2013). Previous research reveals a number of spatial characteristics of privacy that should be explored in future research (Alalouch et al., 2016).

**Hypothesis 3** was only partially supported – ratings of integration were significantly associated with ratings of collaboration on the questionnaire, though integration was also significantly correlated with the other dimensions, suggesting some dimensional overlap between the design goals. Staff interviews also suggested some overlap, as questions regarding integration often prompted responses involving collaboration, communication, and privacy. Hudson and colleagues' model of collaboration in primary care may explain these intersections: they propose a four-point continuum ranging from isolation to communication to collaboration to integration. This model suggests collaboration and integration represent different magnitudes of the same dimension (Hudson et al.,

1997). Future research should be explicit in defining integration as it relates to the built environment and distinguishing it from other measures of collaboration or communication.

## Conclusion

This study invites designers to consider an expanded definition of salutogenesis. Mazzi (2020) suggests that, in addition to enhancing a sense of cohesion (SOC), the definition can more pointedly include other means of stress reduction such as prospect and refuge, biophilia, relaxation response, and personal empowerment. Dilani (2008) cites specific qualities that reflect this and other theories, such as social interaction, choice and control, support of wayfinding, and the role of landmarks. Golembiewski (2010) also contributes to this discussion by recommending deinstitutionalised environments that reinforce understanding of distance and time. Building standards supporting the features mentioned by Mazzi, Golembiewski, and Dilani are evolving. For example, many of the topics advocated by the International WELL Building Institute emphasise the importance of good air quality, light and water, appropriate nutrition, comfort, and mindfulness as contributors to wellness (International WELL Building Institute, 2019).

The research team conducted a practitioner-focused facility evaluation (PFE) (Shepley, 2011) of a renovated university health facility to evaluate the six primary design goals drawn from the original planning documents, which support the salutogenic goals of comprehensibility (transparency and accessibility), manageability (privacy), and meaningfulness (integration, collaboration, and welcoming). Student and staff responses suggest these design goals were, for the most part, successfully achieved, though these goals were not achieved without trade-offs, and lingering challenges remain to be addressed in future PFEs. Integration and co-location of medical services with MBH services resulted in increased collaboration among staff and increased privacy for students. Privacy was also supported by several other elements of the built environment, including the use of white-noise machines and visual barriers.

Though this was a case study evaluation of a single facility, there are still implications for design professionals and future researchers. With no existing research on successful service integration in a university setting, this study offers the following takeaways:

1. Practitioner-focused facility evaluations (PFEs) can be a valuable tool for evaluating the success of salutogenic-related design goals in a health facility.
2. When constructing a university health facility and to achieve salutogenic design, the provision of multiple dimensions of privacy should be prioritised. This includes auditory privacy through white-noise machines, visual privacy by using barriers, and social privacy by co-locating primary care and MBH services within a single floor.
3. Co-locating services within a single floor may improve collaboration between primary care and MBH staff in a health facility, but steps should also be taken to ensure limited disruption within staff units.

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# CHAPTER IX

# HEALTHCARE DESIGN FOR A HEALTHY POST-PANDEMIC SOCIETY

ANGELA LEE AND BRINDA SENGUPTA

Over the last decade, there has been a significant focus on sustainability within the building industry. Green building technologies and green materials have become the buzzwords in every project narrative. Designing for wellness has also come to the forefront with the recent WELL accreditation, but it is at a relatively nascent stage for healthcare. COVID-19 and some of the other recent pandemics and natural disasters have forced us to think about "health" and salutogenic design more holistically and sustainably.

The future state of healthcare should cater to our entire spectrum of needs. Health must be embedded in how we live, work and play, and go beyond the hospital or clinic. The design of healthcare environments needs to leverage technology and big data to inform the plan to help shape healthy behaviours and lifestyles. The vision for salutogenic design needs to build community and enhance our resilience at all scales of the urban environment. Here, we outline some strategies that could be adopted to achieve this vision, using case studies and best practices from research and practices worldwide.

1. **Integrate health and wellness into the public realm and outside of the hospital's building envelope.**

    - *During master planning, ensure planning for pedestrian-friendly environments that promote engagement with nature.*


*Figure 1: Health and wellness at an urban scale.*

Architects, medical planners, and designers need to understand the impact of their design beyond the building envelope. Healthcare buildings need to be viewed in the overall urban context, plugging into the more extensive urban infrastructure and giving back to its immediate environment.

A case in point is the Taikang Tongji International Hospital. The design offers fluid pedestrian access through the site and public amenities that engage local communities and the adjacent neighbourhoods. It appropriates the aesthetic and purpose of Wuhan's magnificent bridges to highlight movement through the hospital and clinics, while improving the flow and efficiency of operations.

*Figure 2: Taikang Tongji International Hospital.*

The Children's Hospital of Richmond at Virginia Commonwealth University is now the largest and most advanced outpatient health facility dedicated to children in its region. With an emphasis on physical, visual, and abstract connections to nature, the pavilion has a calming, therapeutic effect on all who experience the building, reducing anxiety and stress and promoting health and healing.

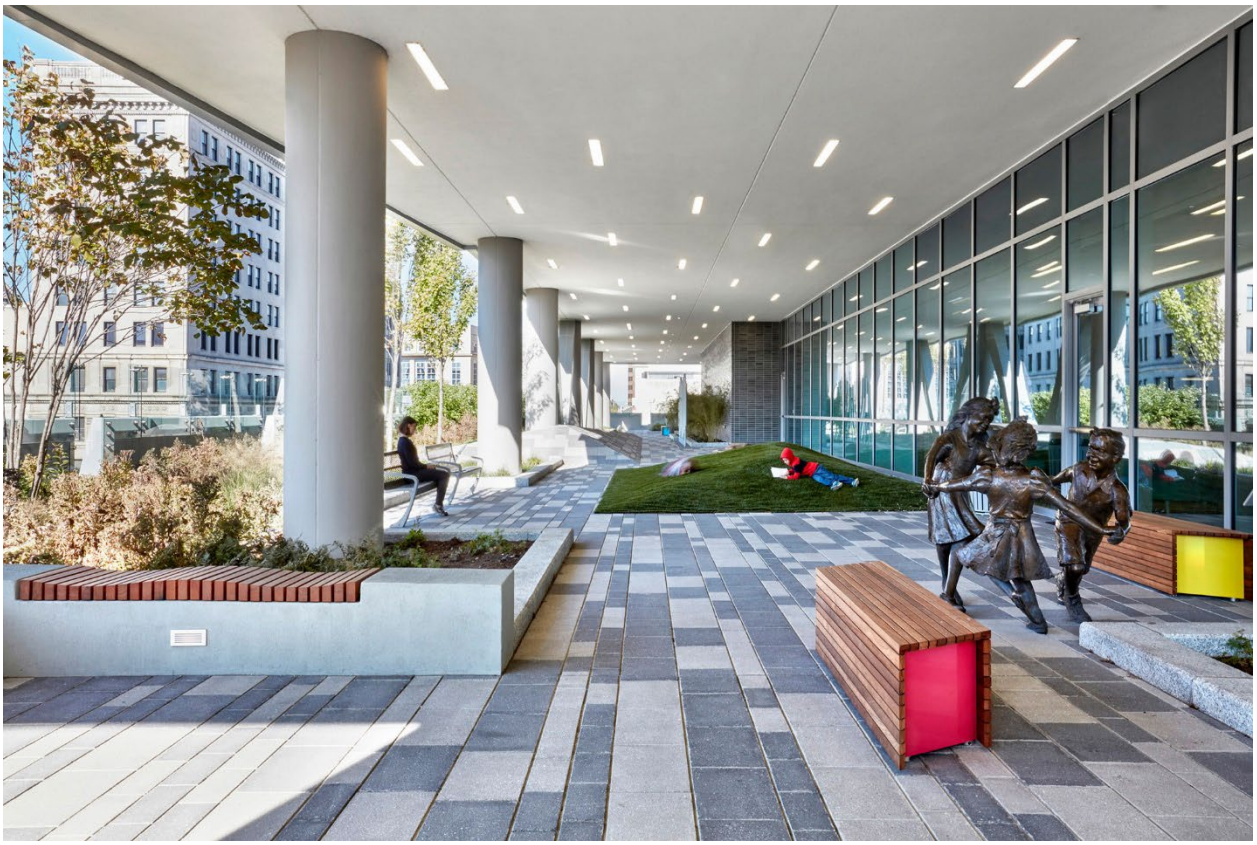

*Figure 3. Pedestrian connectivity for the Children's Hospital of Richmond, at VCU Patient Tower.*

- *Consider creating a "health neighbourhood" around healthcare facilities, especially those in the community, so it can become a health destination rather than a "sickness" destination.*


*Figure 4. Healthcare needs to address various scales of the built environment.*

> "The health system of the future is less an institution for the sick, and more central as a catalyst for community renewal, both economically and as a change agent in creating healthier populations." (Shannon Kraus, Principal and Executive Vice President at HKS and Regional Director of Washington, D.C.).

We need to understand healthcare from a more holistic perspective. We need to integrate healthcare into all aspects of our lifestyle and help build healthy and sustainable communities.

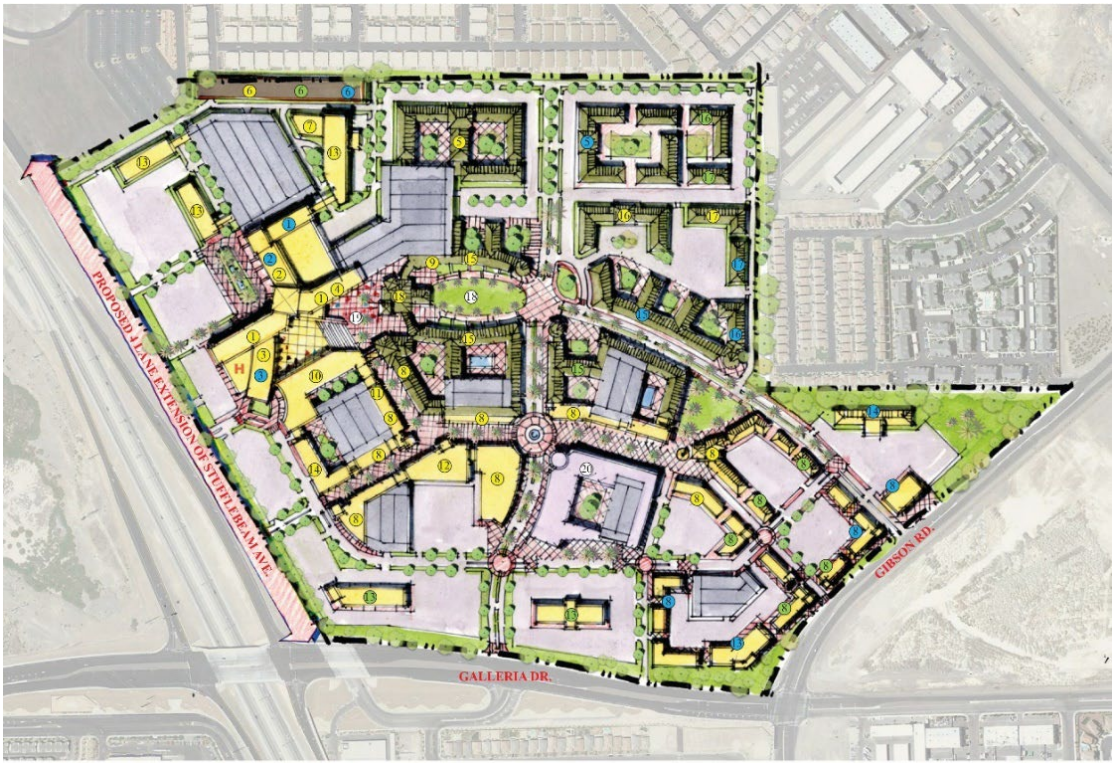


*Figure 5. Union Village Masterplan.*

To illustrate this, we can look closely at Union Village, where the goal is to create a live-work-play environment that integrates world-class healthcare with retail, entertainment, cultural and residential centres. Its medical facilities will provide all levels of healthcare, whatever the age of the patient. Union Village will be one of the world's first integrated health villages – a mixed-use development anchored by a hospital and senior retirement community. The 161-acre site will have the Union Centre as the focal point of the development, with a 214-bed replacement of St. Rose Dominican Hospital, the Rose de Lima Hospital; a rehabilitation hospital; senior wellness centres; speciality care facilities; and space for a future children's hospital. Union Plaza is a mixed-use development featuring 300,000 square-feet of retail space, 300,000 square-feet of medical office space, residential apartments, and a mid-range hotel.

- *Carefully consider diet choices and healthy food availability in designs. Create appealing environments around healthier options and provide sensory cues at crucial points of decision-making for healthy lifestyle changes.*

The Healthy Choices = Healthy Campuses: Point of Decision Design research study was conducted by HKS, CADRE, and Planning4Health Solutions in 2016. This research was funded by an AIA Upjohn Grant, with additional support provided by Patcraft, DuPont, and McCarthy. The study explored the critical challenge for students in campuses: poor decision-making regarding healthy physical activity and diet choices. Our findings call for designers to take a person-centred approach to designing campuses and consider the design continuum that spans from information design, environmental graphic design and product design, to interior design, architecture, and urban design.

Current literature on designing healthy campuses focuses more on movement and physical activity than on diet. We see this gap as an opportunity for future design research. Current thinking on healthy colleges focuses on urban design and campus planning strategies. In contrast, our findings show that students could make decisions about activity/diet before ever stepping onto campus. Leveraging technology/smartphones as part of the design solution is imperative. The research suggests that, at every point of a decision, and from the scale of the campus to the scale of a handheld

device, design can promote healthy choices. Many of the findings of this research were then applied to the University of California, San Diego, and this project and research are part of an ongoing study.

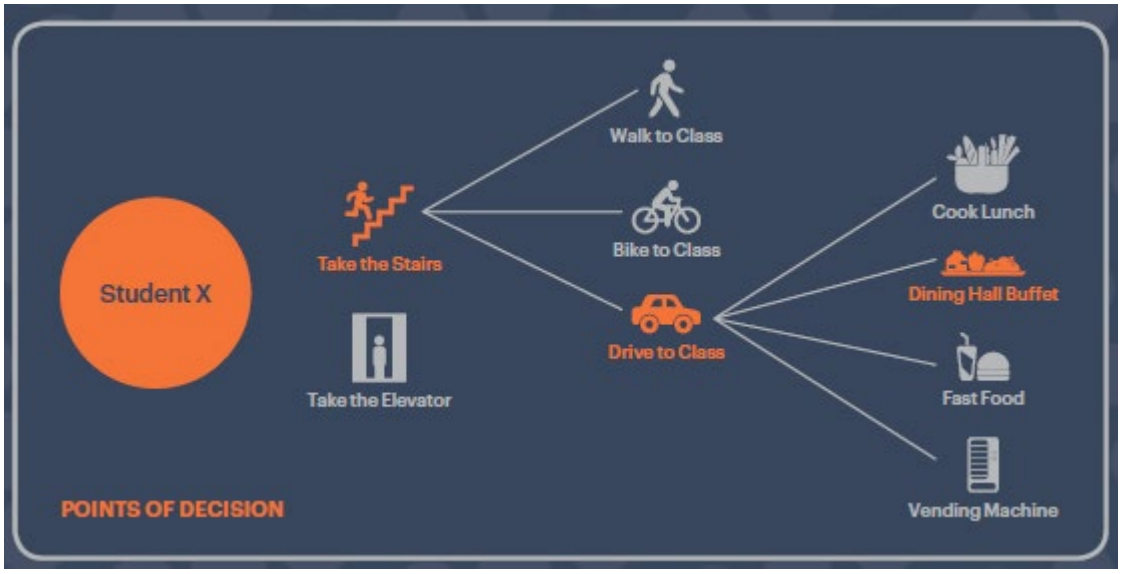


*Figure 6. PODD Research for Healthier Campuses.*

*Figure 7. Pro Medica Headquarters.*

Another project, ProMedica Headquarters, is an adaptive re-use of two buildings. Unlike other riverfront buildings, this project embraces its public presence. This building does not gate itself off but rather encourages Toledoans to amble through its riverfront campus, enjoy a concert on the lawn, and grab some apples at a farmer's market. ProMedica takes its role as an urban anchor very seriously and they are actively looking to improve Toledo's civic health.

**2. Planning for sustainable wellness within the healthcare facility's building envelope.**

- *Make health and wellbeing a core focus of healthcare facilities by designing facilities that are warm, environment-friendly, well-lit, integrated with nature, and actively promoting healthier choices.*

The plethora of research available on biophilic design in healthcare settings clarifies that connecting with nature during treatment and recovery is of great benefit to patients. Allowing for a more holistic healing process, access, and visibility to nature helps in the human body's circadian rhythms and mental wellbeing.

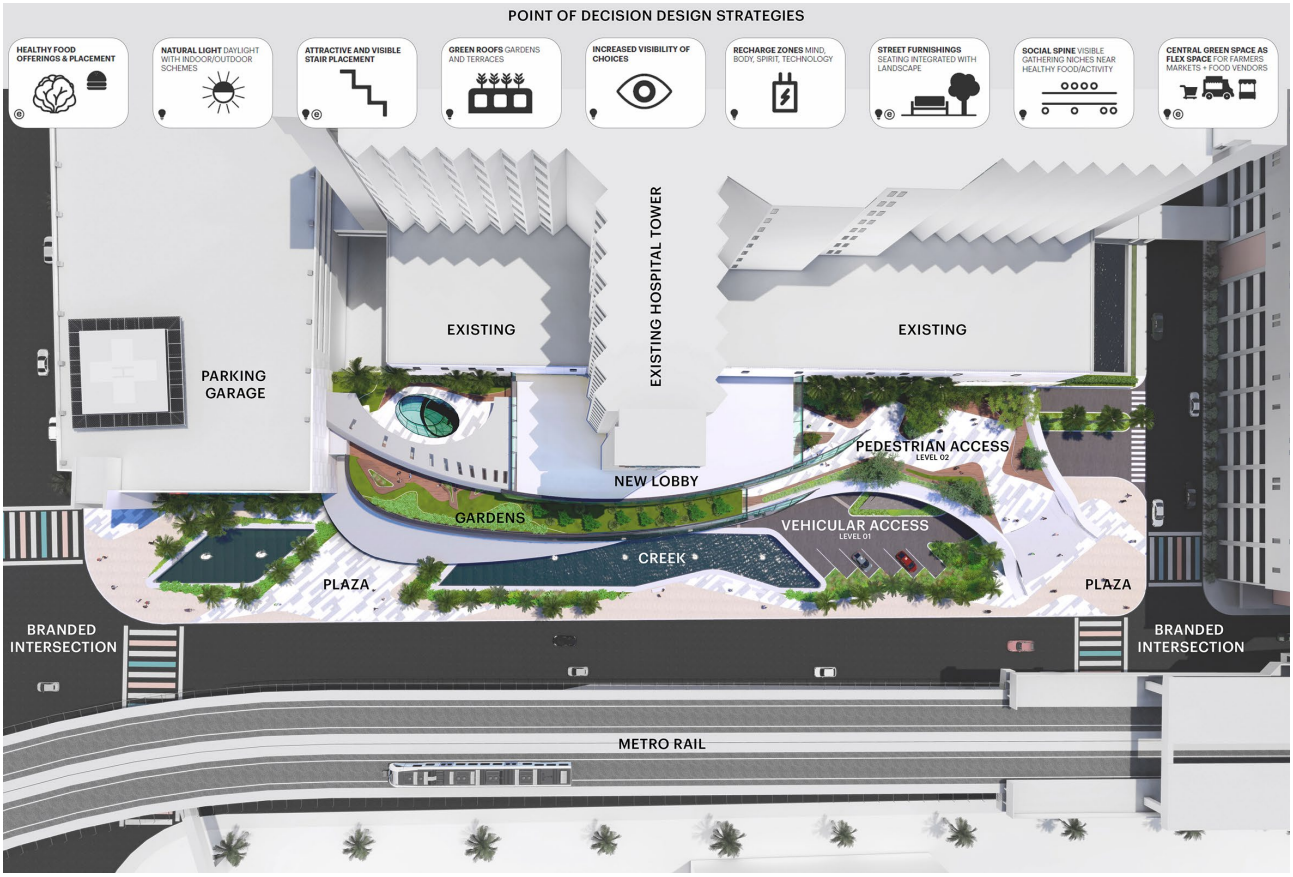


*Figure 8. Design strategies for the healthcare facility's building envelope and beyond.*

- *Integrate ecological principals.*

It is essential to integrate sustainability and high-performance design into the designing of our buildings. The design of our built environment needs to include a healthy materials analysis, design for wellbeing, energy analysis, ventilation, computational fluid dynamics, carbon accounting, and project sustainability assessments (such as LEED, BREAM, WELL).

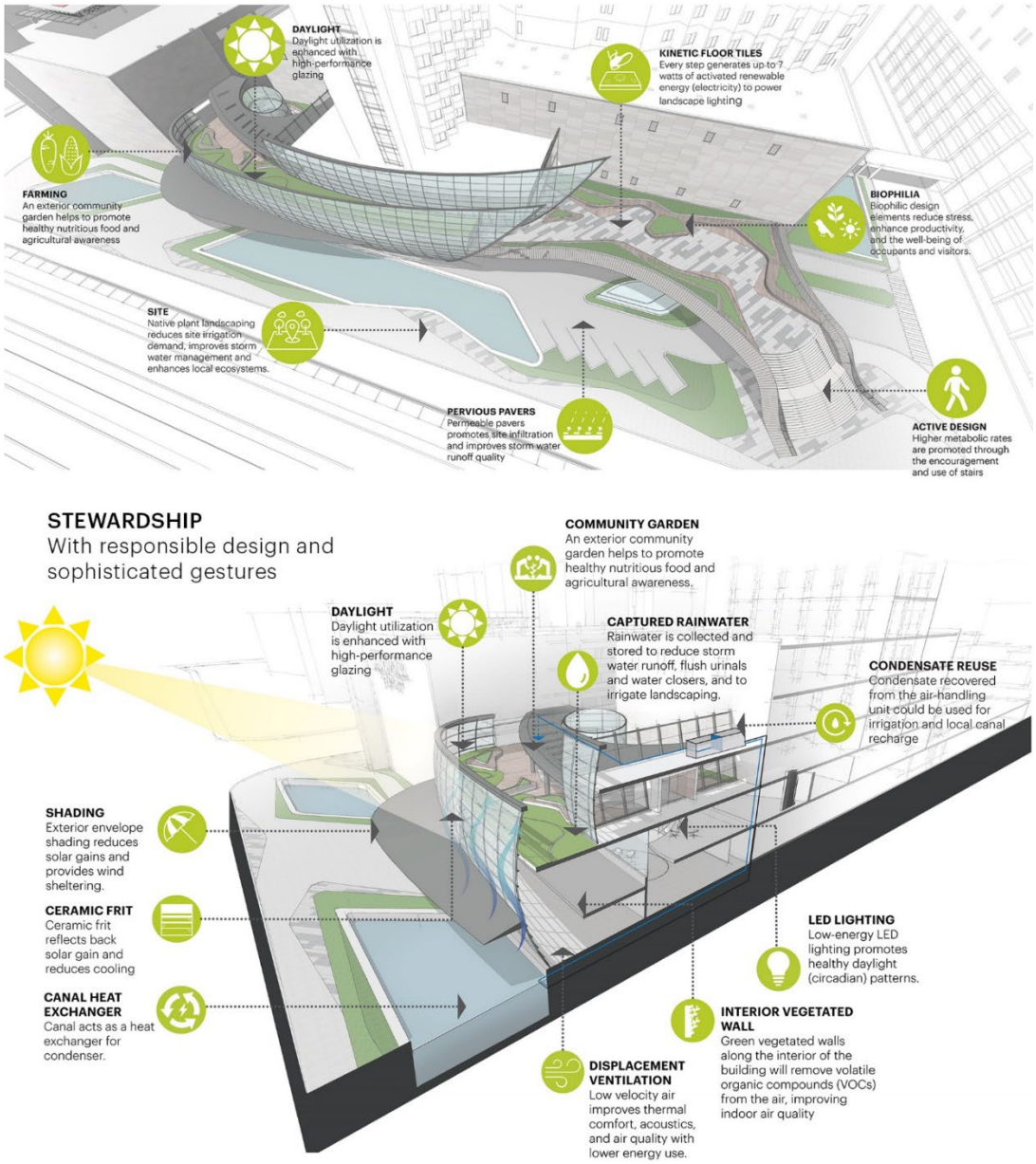


*Figure 9. Diagram illustration of ecological principles that can be incorporated.*

- *Promote stair use for ambulatory patients by creating attractive, accessible stairs strategically positioned at critical decision points.*

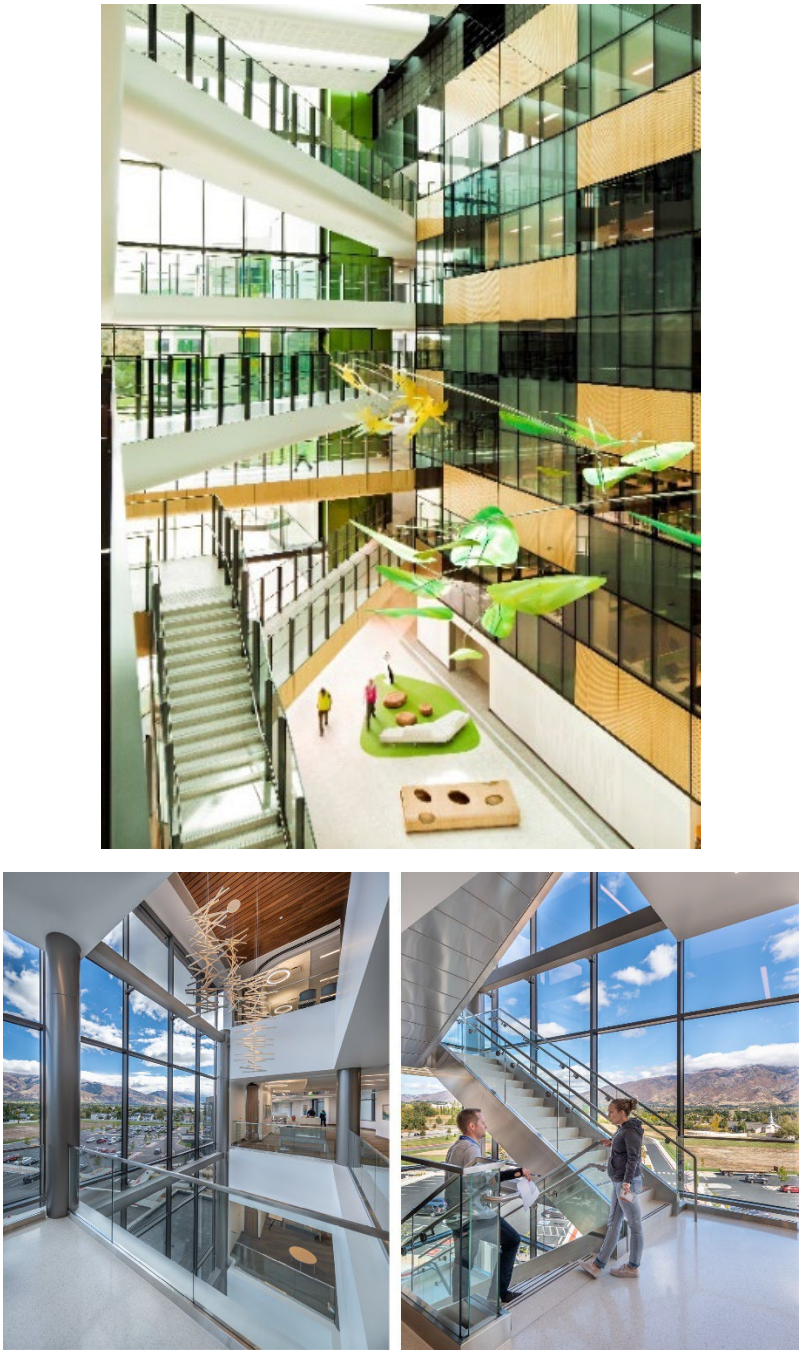

*Figure 10. Well-lit and easily accessible stairways in HKS projects promoting stair use.*

Apart from making stairways well-lit and easy to access, point-of-decision prompts and motivational signs that encourage stair use are also a great way to promote stair usage for hospital staff, visitors, and ambulatory patients. Placing signs at the places where people choose between the stairs and the elevator is a key aspect of encouraging people to use the stairs. It will also remind employees that there are stairs for them to use.

The CDC StairWELL online toolkit lists several low-cost ideas for physical alterations to stairwells to help make it safer and more attractive for employees to use the stairs, including:

- Use creative lighting.
- Create themed stairwells (e.g., transport stair users to a Hawaiian beach or tropical rainforest during their trip up or down the stairs).
- Create a catchy rhyme with several lines. Put the first line of the rhyme on the first floor, the second line on the second floor, etc., all the way to the top to finish the entire rhyme.
- Add footsteps that lead from the elevators to the stairs and have a message spelled out along the way.
- Put numbers on the doors to let users know which floor they are on.
- Start at the bottom floor and give each stair a number so that users can easily track their progress.

- *Choose materials and systems that are sustainable yet do not compromise on infection control.*

As architects and designers, it matters that we are making informed choices that not only meet baseline performance criteria for durability and aesthetics, but environmental and human health impacts carrying equal weight. From the air we breathe and the water we drink to the people who construct and occupy the buildings we design, material transparency — much like food-packaging nutrition labels — helps designers make responsible decisions to protect the health and wellbeing of people and the planet. When it comes to healthcare design's material selection, it becomes even more critical, as the wrong material decision will harm not only the occupants but also the environment. These bad decisions would also continue to aid the endless cycle of ill patient visits to healthcare facilities.

*Interior finishes*

Healthcare-associated infections (HAIs) have always been a significant challenge in hospitals and are major causes of morbidity and mortality today. In the wake of the Covid-19, there is an even greater need for and focus on infection control in hospital environments. For many years, anti-microbials on hospital furnishings, countertops, and even paints and ceilings have been part of the response to reduce microbial burdens on product surfaces. However, some recent studies have shown that there may not be conclusive evidence that anti-microbials effectively prevent HAIs. Additionally, anti-microbials like triclosan and triclocarban have been identified as chemicals of concern in the built environment. They are associated with the disruption of hormone functioning, adverse reproductive and developmental defects, and antibiotic resistance. Hence, as we put more stringent infection control measures in place, it should be treated as a delicate balancing act with long-term repercussions on occupant health.

The recommendation would be a two-pronged approach where design addresses user behaviour-change by integrating more hand-washing sinks across facilities and ramping up the cleaning procedures. Also, instead of selecting interior finishes with anti-microbials, it is wise to question their effectiveness. Do not specify anti-microbials in furnishings unless they have undergone EPA (United States Environmental Protection Agency) evaluation and registration under FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)) and have been shown to help reduce HAIs (hospital associated infections) in a clinical setting as part of an integrated infection-control program. Facilities may be better off specifying wipeable/easily cleanable furnishings and stand up to these rigorous procedures. They should choose PVC (Polyvinyl Chloride) alternatives for upholstery like silicone/silicone-hybrids or polycarbonate based polyurethanes. Asking suppliers to disclose any anti-microbials added to materials and products and addressing infection control from a more systemic perspective rather than a reactionary one should be the way of the future.

With a wide flow of materials in the market, it becomes important for a designer to recommend the materials that are not of concern to the environment under the pretext of “infection control”.

*Exterior finishes*

Paints and primers generally include anti-microbials, bisphenols, and phthalates, while adhesives and sealants have highly fluorinated chemicals. These materials leak into the air, water, and soil, polluting our surroundings, and can now even be found in new-born babies.

A favourable material for cladding is NSC/ANSI certified natural stone or FSC certified wood. Terracotta and bricks are suitable cladding materials, too. However, they have high embodied energy w.r.t to their manufacturing and transport.

Cladding or any old cracks in a building need to be tested for Radon (radioactivity), as no amount of radioactivity is good and is highly carcinogenic. The other main element of the exterior is the insulation that maintains the thermal comfort inside the building. Insulations are rated very highly as flame retardants. However, recent studies show that they delay a fire by a few minutes, and once they catch fire, they release highly toxic smoke, which is the major cause of casualty in the building. Therefore, insulation with non-toxic flame retardants is recommended. Insulation is also prone to damage caused by moisture. In a healthcare facility, a moisture retardant exterior is vital from an infection-control perspective.

Other than cladding and insulations, window selection is vital for a balance between health and the environment, as windows are the bridge between outdoor and indoor. The main elements to check in window frames are the u-value and solar heat gain coefficient (SHGC). For glass, in addition to the u-value, the SHGC visual light transmittance value is important as it contributes to decreased energy consumption and gives access to natural light. If VLT (visual light transmittance) is low and makes the indoors darker, it can impact the circadian rhythms of occupants in the long run and may impact their mood. Less opaque films and different colours are recommended for glass, especially in healthcare, to increase recovery rates. Research shows that patients who have a view of outside and access to natural light recover faster.

*Mechanical Strategy*

Airborne Infection Isolation (AII) environments control the airflow in a room and reduce the levels of infectious particles to avoid making other people sick. All the attributes below are necessary to ensure that an AII room serves its protective function:

- Negative air pressure. Maintaining air pressure differentials between adjacent spaces prevents cross-contamination from room to room, allowing airflow into the isolation room and preventing escape into surrounding spaces. Negative-pressure rooms mitigate aerosolised virus transmission to other spaces by promoting airflows from clean to contaminated spaces in the facility, improving the safety of other occupants.
- High air volume. Increasing the air changes per hour (ACH) will dilute the infectious particles in the room.
- HEPA filtration, A HEPA (high-efficiency particulate air) filter traps 99.97% of particles that are as small in size as 0.03 microns, described as “the most penetrating particle size.” This filtration removes harmful particulates and biological contaminants that enter the space.
- 100% exhaust. Air exhausts, properly separated from external air intakes, remove contaminated particles.

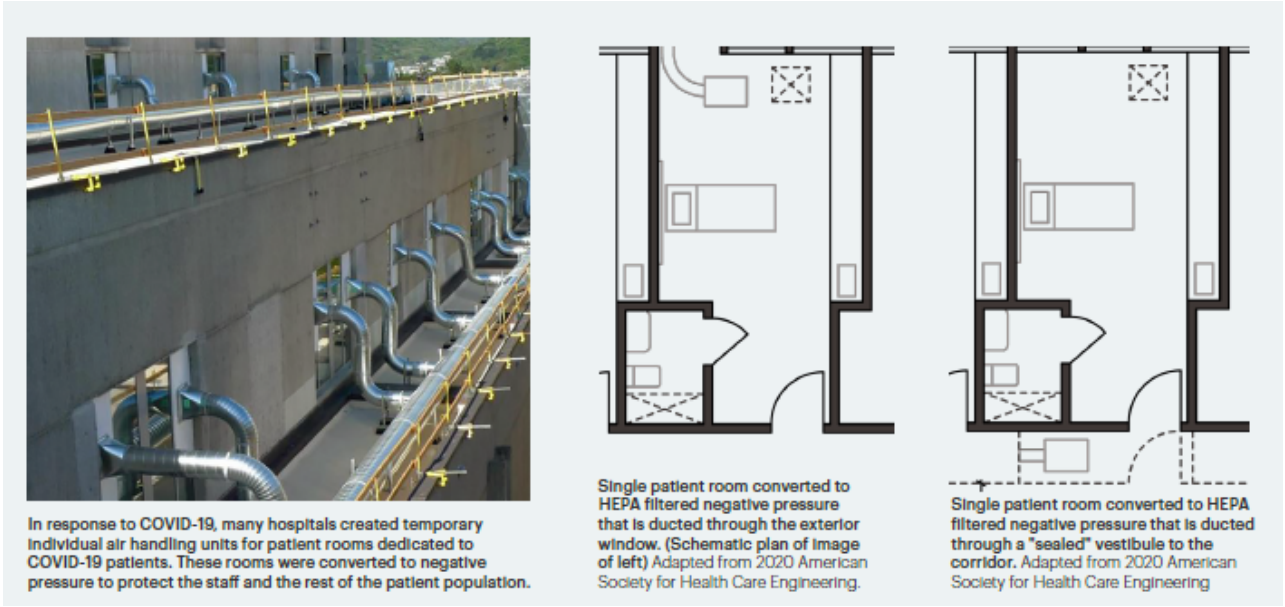


*Figure 11. the picture of individual air handling unites and single patient room for covid.*

### 3. Ensure disaster preparedness principles are integrated within design for resilience and future-readiness

Emergency and disaster preparedness have become significant drivers affecting crisis and hospital design across the world. The current outbreak of COVID-19 has given all countries a jolt and made them think about their healthcare facilities in a new light. Most countries are struggling with a lack of isolation wards and adequate decontamination facilities. It is the need of the hour for health professionals, operators, and government departments to implement disaster preparedness within existing and new hospitals. While healthcare policy, governance, and operations will play a significant role in planning and management, healthcare design professionals have a substantial task of leading a radical shift in the design of hospitals. Here we outline a few design strategies for hospital design to address disaster preparedness.

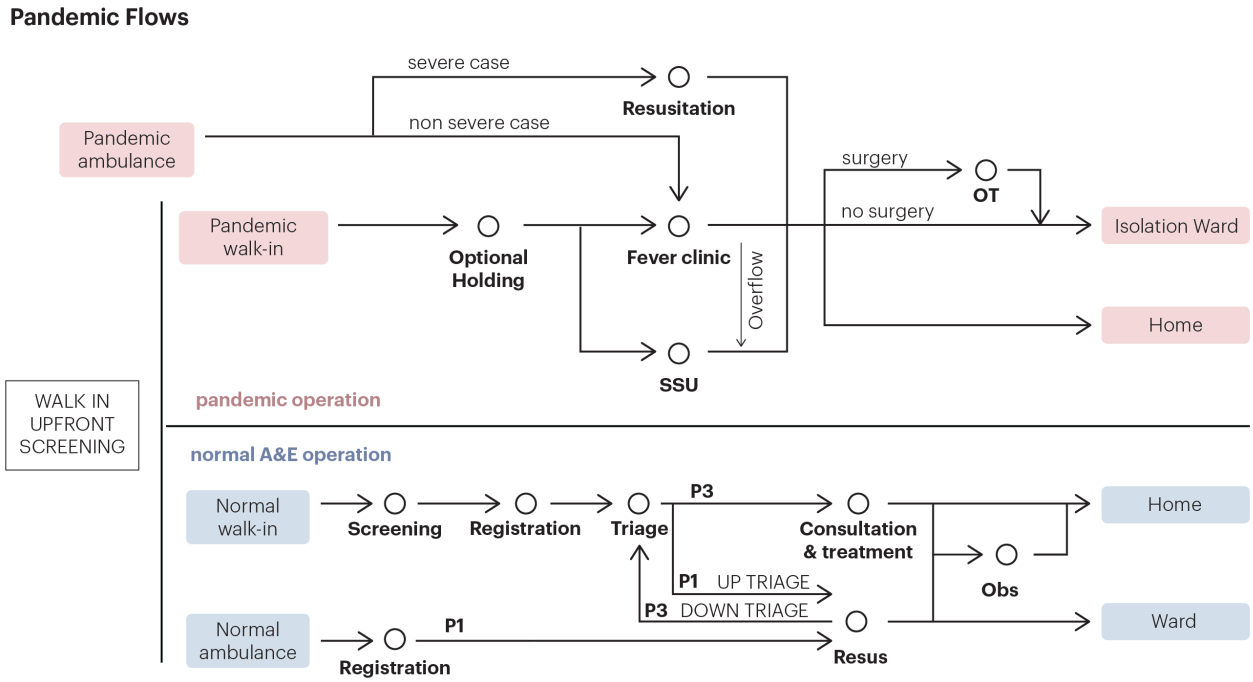


*Figure 12. Pandemic response.*

**1. Allow compartmentalisation for isolation**.

For Macau Island Hospital, the Emergency Department was designed in such a way to allow for a portion of it to be isolated for a mass casualty or contagious outbreak, while at the same time allowing for the main emergency department to remain operational. The Emergency Department is designed to operate under normal circumstances with six key zones, including a fever clinic, multiple floors with 23-hour emergency observation, level 1 trauma/ resuscitation rooms, levels 2 and 3 emergency-room beds, levels 4 and 5 fast-track/triage area, and dedicated CT and radiology imaging services.

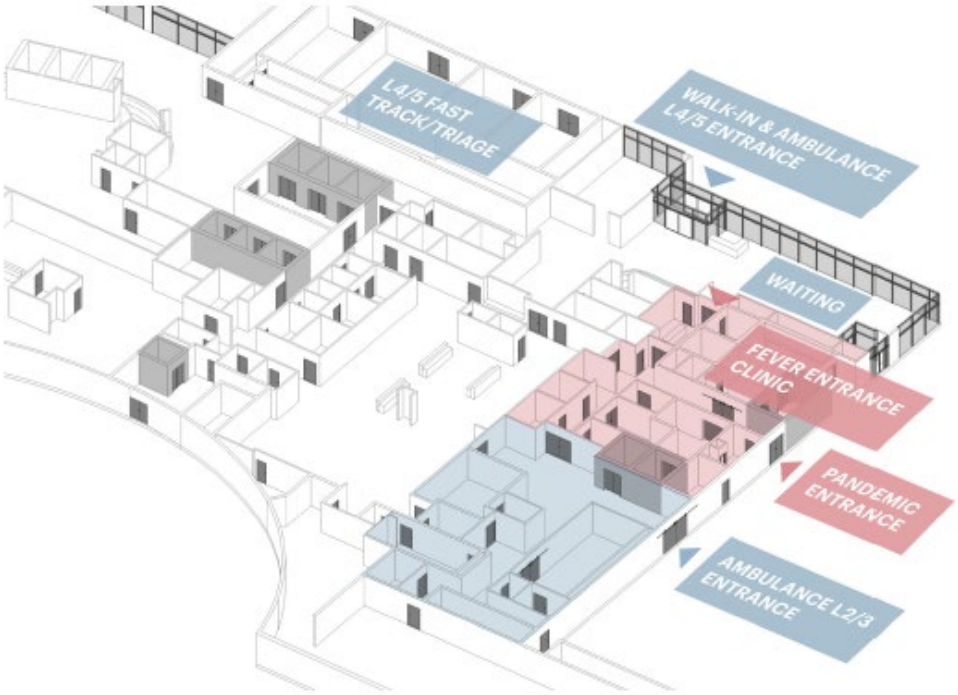


*Figure 13. Emergency department isolation diagram.*

**2. Remodel existing emergency departments to be pandemic-ready**

The remodelling of the Emergency Department at Changi Hospital is currently ongoing, with the participation of the hospital's emergency team at an early stage. The workflow of the pandemic is introduced and incorporated into medical planning with several key planning points to ensure the hospital's ability to respond to a pandemic event effectively within a short timeframe.

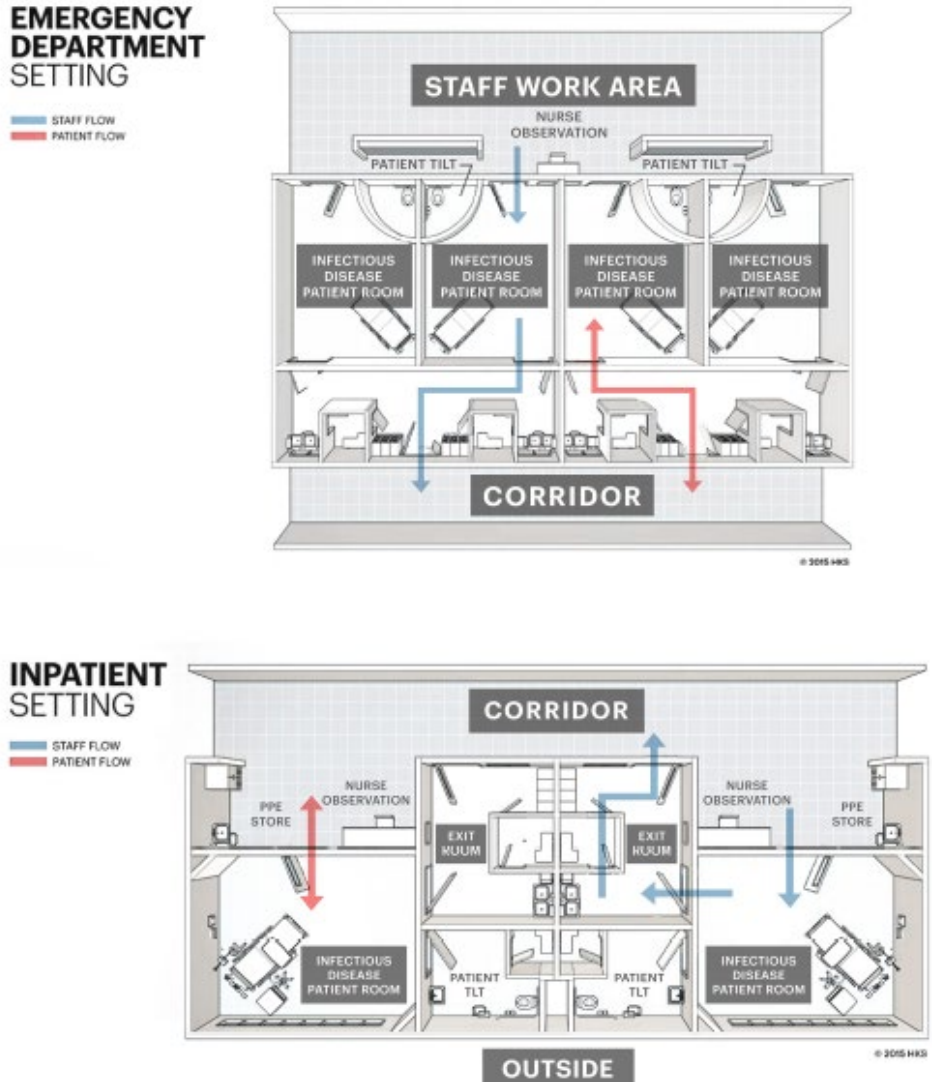


*Figure 14. Enhanced infection control with unidirectional flow.*

### 3. Plan for exterior expansion of emergency department.

To ensure higher footfalls can be accommodated during an outbreak, creating a larger department for pandemic readiness is imperative. In Macau Island Hospital, several design features are integral to allow for the expansion of the exterior emergency drop-off area into a temporary triage area and separate decontamination area that allows for the treatment of potentially contagious or contaminated patients. Structural davit connections or permanent ceiling-mounted tracks can be provided to accommodate temporary fabric partitions or curtains. Strategically located hose bibs with shower heads for the decontamination of patients are also a feature of the design. Trench drains with dedicated plumbing are diverted for decontamination.

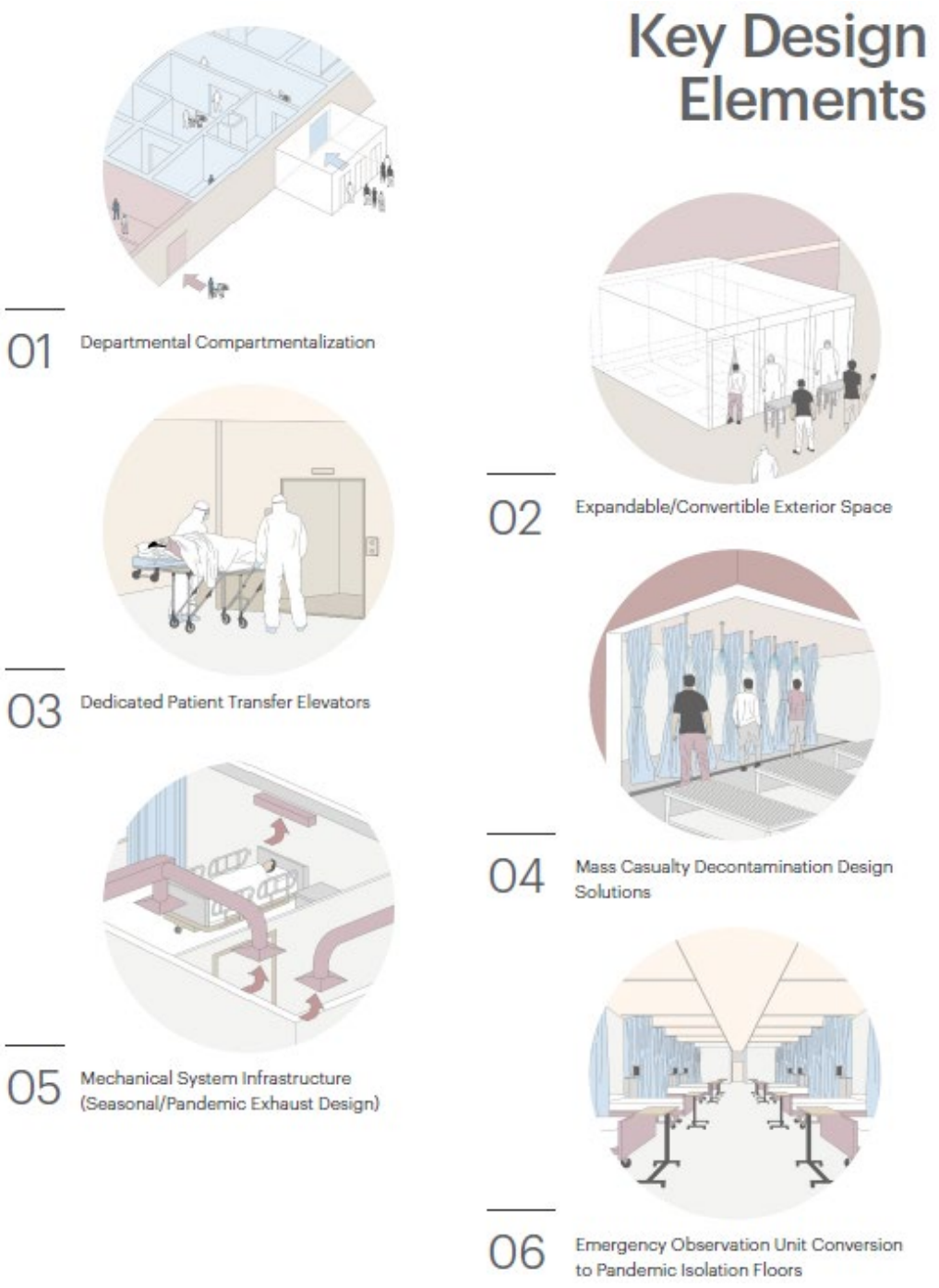


*Figure 15. Key design process*

**4. Ensure dedicated vertical circulation during an outbreak.**

To provide enough accommodation for the isolation of large patient populations during quarantine events, it is necessary to provide dedicated vertical circulation access to multiple facility levels. This access should be coordinated to allow for the segregation of these isolated floors while maintaining vertical circulation capabilities for the remainder of the hospital tower, to allow normal operations to continue during quarantine and pandemic events. The AGV supply and soiled- service elevators should be temporarily quarantined to isolate infectious patient movement from the emergency department to the isolated emergency observation floors.

## 5. Design of Isolation Room Suites: Isolation Patient Room Suites.

In Queen Mary Hospital, Hong Kong, these suites are areas where isolation patient rooms have been consolidated along a dedicated corridor with two entrances: one from the ward they are associated with and a secondary entrance from outside the ward. This will allow utilisation of these rooms both as part of the department and as a free-standing infectious patient suite.


*Figure 16. Schematic design*

## 6. Devise a sound mechanical engineering strategy.

The physical design of isolation facilities needs to be complimented by a sound mechanical strategy. This requires mechanical systems designed to allow for the compartmentalisation and isolation of several zones during seasonal flu season or potential pandemic events. While providing the flexibility to convert patient care areas into negative pressure zones during mass quarantine or pandemic events is crucial, the solution must also conserve energy during regular use. Areas programmed for quarantine isolation zoning are typically areas that are not thoroughly exhausted during normal operation. Operating these areas with full exhaust during normal operation would increase the energy required to condition the necessary extra outside air. Using strategically-placed dampers and direct digital controls, energy can be conserved, and the isolated areas can be converted to negative pressure with minimal effort or disruption. At the Macau Island Hospital, during normal operation, the return air damper is open. The exhaust damper is closed, and the air handling unit only brings in the minimum amount of outside air required for the space. However, when the area is under isolation, a command can be sent from the controls system to close the return air damper, open the exhaust air damper, and open the economiser damper in the air-handling unit. When the exhaust fan's controls confirm the damper positions, the area becomes active pressure and is isolated from spreading contamination to adjacent patient care areas.

During times of disaster, hospitals play an integral role in the healthcare system by providing essential medical care to the community. Without appropriate emergency planning, health systems can easily become overwhelmed in attempting to provide care during a critical event. It is time that hospital design and engineering professionals work together with healthcare operators, government officials, and the community at large to be prepared for future disasters. Learning from international best practices and case studies would help to create a shared knowledge platform on disaster preparedness, which would help control outbreaks in a more timely fashion.

## Conclusion

It is imperative to think of health beyond the traditional settings of hospitals, nursing homes, and clinics. The current pandemic has strengthened our belief in understanding how public health and urban planning need to be integrated at various levels. The health of the environment is closely intertwined with the health of human beings. Infection control cannot be merely looked at in isolation. Resilience is what we all need to strive for in designing our homes, clinics, hospitals, and extended habitats, in order to cope with natural disasters, pandemics, and other emergencies.

# CHAPTER X

# FINISHING MATERIALS AS HEALTH PROMOTERS IN HEALING SPACES

STEFANO CAPOLONGO AND MARCO GOLA

## Introduction

*According to the World Health Organization, every year in the European Union, four million patients acquire a healthcare associated infection (HAI). The risk mainly affects the patients, being more vulnerable due to their precarious health conditions. Implementing control and prevention measures is essential to mitigate an increasingly growing phenomenon. In addition to the contact between people, transmission can take place through surfaces, which play an important role in the propagation of microorganisms, but they are very often neglected with few guidelines on microbiological evaluations. In general, the analysis of the regulatory framework shows a great lack of strategies in the selection of finishes. Therefore, it is clear that designers have a great responsibility in creating healthy spaces, and that finishing materials play a particularly strategic role within healthcare settings, although they are often considered to be the final layer of a confined space. However, they are in need of greater attention, especially with respect to the activities carried out within healing environments. In fact, they can influence the transmission of hospital infections and have a strategic role to play in spaces becoming more hospitable for their users' wellbeing. Finishing materials can also affect indoor air quality. This chapter investigates several finishing materials and several studies taken from the scientific literature, to look at how they can be health promoters.*

## Soft qualities in healthcare

Soft qualities include all those soft design aspects that can significantly influence the perception and quality of spaces directly affecting care processes and a service's efficiency (Capolongo et al., 2014). They are related to several design factors such as natural and artificial lighting, internal and external views, finishing materials and furniture, colours, cleanliness and hygiene, etc. All of these become factors that create welcoming, harmonious, and reassuring spaces. In particular, the presence of natural lighting and external views play a key role in creating the conditions for physical, psychological, and visual-perceptual wellness, especially if designed in synergy with finishing materials and colors (Spinelli et al., 1994; Del Nord and Peretti, 2012).

Finishing materials have a strategic role within healthcare facilities, but they are often considered the final layer in a confined space. However, they are in need of greater attention, especially with respect to the activities carried out within healing environments. In fact, they can influence the transmission of hospital infections and have a strategic role to play in making spaces more hospitable for users' wellbeing. They can also affect indoor air quality (Gola et al., 2019). Even from a regulatory point of view, there are no prescriptions for the choice of finishing materials. Starting from this deficiency, designers adopt standard and consolidated solutions, but the introduction of innovative systems can direct us towards new proposals which, through their potential, can emerge as active tools.

## Surfaces and hospital-acquired infections

As the scientific community has already investigated, hospital-acquired infections (HAIs) are a very important public health issue: they are due to critical issues related to the design of the environments and the clinical processes, rather than being clinically linked to hospital admissions (WHO, 2011). HAIs include exogenous and endogenous factors (Italian Ministry of Health, 2019). In fact, they are defined as the most frequent and serious complications in healthcare settings. As the European Center for Disease Control and Prevention (ECDC) highlights, they affect 6.3 out of every 100 patients in healthcare facilities and the incidence is equal to 1 in every 100 cases of home-care (Italian Ministry of Health, 2012). Many HAIs are related to the urinary and respiratory tracts; surgical infections; invasive medical devices; complex surgical interventions; the body's natural defence system (immunosuppression) or serious concomitant diseases; inadequate infection prevention and control measures in healthcare settings; and the new presence of bacterial strains resistant to antibiotics (Italian Ministry of Health, 2019). Although many studies have shown that inanimate surfaces play an important role in the endemic and epidemic transmission of some pathogens that cause HAIs, contaminated equipment is classified as an indirect means of contagion, with the staff's hands as the most common vehicles. The literature highlights that hospital surfaces are constantly touched by sanitary staff, thus becoming potential reservoirs of microbes and spores (CHD, 2019). Kramer et al. (2006) evidenced the duration of pathogen persistence on inanimate surfaces, regardless of the material, subdivided into three issues: bacteria, fungi, and viruses.

The most used finishing materials for floors, according to the study conducted by Dixit et al. (2018), are rubber, PVC and linoleum coatings. A report by Lavy and Dixit (2012) showed that vinyl coatings, water-based or latex paints, and rigid fiberglass panels are preferred for walls.

## Finishing materials and furniture

It is clear that designers have a great responsibility in creating healthy spaces, starting from the localisation and orientation of buildings, the choice of appropriate technical solutions, responding to the regulations, strategies for reduced building-energy consumption, and the use of healthy materials in interior design, etc. Building materials, finishings and furniture containing VOCs include resilient floorings, rugs, wall-coverings, fabrics, furniture, ceiling tiles, composite wood products, insulation, paintings and coatings, adhesives, stains, sealants, and varnishes. Typically, formaldehyde is used in composite wood and batt insulation, as well as in manufacturing processes, to protect fabric against shrinking and improve crinkle resistance, dimensional stability, and colour-fastness. Zuraimi et al. (2007) demonstrated that building decorations are important sources of TVOCs and formaldehyde in indoor spaces. As Oberti (2014) studied, in some cases it is used for finishing treatments to improve stain resistance.

These components are absorbed in high quantities and are subsequently released in different ways over time. The harmful substances are usually released in large quantities as soon as they are applied and, as time goes on, this tends to decrease. In fact, they are also used in detection and sampling, depending on the materials adopted. These substances can affect health: the harmful effects range from discomfort to severe health impairment, if present in high concentrations in indoor environments. Some of them are recognised as carcinogenic, such as benzene, carbon tetrachloride, chloroform, trichloroethylene, and tetrachloroethylene, etc.

As Tucker (2000) demonstrated, VOCs emit high levels of compounds when a product is installed, and its emissions diminish gradually over time. Semi-volatile organic compounds are used in building materials to afford flexibility, stain repellence, water resistance, etc. Among them, there are phthalates in PVC, building products, upholstery, wall coverings, hospital and shower curtains, etc. but they are also used in non-building materials, such as those found in medical devices (Wang et al., 2015). In conclusion, perfluorochemicals are used in carpets, upholstery, textiles and furniture

and, in other cases, as halogenated flame retardants for furniture, electronic equipment and foam pillows, etc., when stain resistance or water repellence are required.

In addition, physical contaminants such as fibrous insulations could be responsible for releasing mineral fibres into the air when they are under certain conditions of stress. They so much more dangerous to health, because their diameter is shorter and more easily breathable (Oberti, 2017). Further to this, heavy metals are used as stabilizers in vinyl plastic materials and can be found in a variety of other uses in roofing, solder, radiation shielding and in dyes for paints and textiles. Heavy metals can be considered dangerous: belonging to the group of metallic elements, they can be highly toxic and includes substances such as arsenic, antimony, cadmium, chromium, copper, cobalt, lead, mercury, and zinc. Many materials used during the construction phase and in finishing materials can emit radon (Wienke, 2004), although these are used less frequently in healthcare environments.

Several companies have recently been using materials with noble metal nanoparticles. Titanium dioxide ($TiO_2$) is one of the most popular photocatalyst to reduce VOC concentrations in air and it works with UV light ($\leq$ 387nm), which oxidizes molecules (Bianchi et al., 2016). These technologies are not well known for their limited absorption of visible light (400-700nm); the use of these noble metals increases titanium dioxide activity in a visible light range (Bianchi et al., 2016).

In conclusion, as a number of scholars state, material selection could affect comfort and wellbeing (Salonen et al., 2012). As Ulrich (2000) suggested, comparisons of the patient advantages of different types of flooring materials, including carpet and hard or glossy materials (linoleum, vinyl composition, etc.), found that carpet is better from the standpoint of certain user-centred considerations. Therefore, for this reason it is necessary to apply appropriate cleaning strategies (Anjali, 2006). The following paragraphs look at specific considerations around materials analysed and tested by several international scholars.

*Figure 1. View of the waiting area of Fundación Santa Fe in Bogotà.*
*SOURCE: El Equipo Mazzanti.*


*Figure 2. Interior of the Great Ormond Street Hospital in London (LLEWLEYN DAVIES).*
*SOURCE: Marco Gola.*

## Flooring

Healthcare facilities are required to respond to hygienic requirements. Floors and walls need to be durable and easy to clean. Currently there are several design strategies around this. Among the finishing materials for floors and walls, linoleum is a material composed entirely of natural raw materials (wood flour, flaxseed oil, jute and natural resins) and which requires the installation of solvent-free adhesives (Baglioni and Piardi, 1990). It is the most suitable material for use in inpatient rooms. Linoleum, such as rubber and PVC, responds to the safety and hygienic requirements of healthcare settings. However, it differs for the naturalness of the other components. This material is applied directly to the floor using special bonding products. In addition, it is among the most harmless vinyl adhesives in terms of water dispersion. Once the linoleum is laid, the final surface is obtained by spreading a specific metallic wax. This process can be considered a disadvantage as it must be repeated periodically throughout the life cycle of the material (Baglioni and Piardi, 1990).

In the case of scratching or wearing of the surface layer, the lower layer is hardened by restoring the surface qualities of the coating and by smoothing the irregularities of the surface. This is achieved with the use of linseed oil which, when it comes into contact with the air-absorbing oxygen, cures and increases the volume. In general, the use of this material is recommended for inpatient rooms but it does need regular maintenance. Another material for an easy cleaning and maintenance, and for its durability and safety features, is PVC. However, although it does not have a natural composition, it releases a wide range of VOCs, including plasticizers and solvent residues. In addition to the emissions, due to its composition, the adhesives used for the commissioning are one of the main sources of VOC emissions. PVC coating products that are currently on the market vary considerably, and it is therefore necessary to consider the specific features of these products (Oberti, 2014).

It is well-known that carpets and rugs in healing environments are not recommended because they accumulate bacteria and dust and are not quick to clean. According to Kemper et al. (2005), microbial colonisation in indoor environments, especially carpeting, is well-known, and several

studies have showed that a variety of fungi and bacteria can be aerosolized from these microbial reservoirs (Mitchell, 2006). In other words, carpets generally cover expansive horizontal surfaces and they are accumulators of harmful microbes, in the form of airborne particles, as stated by Pereira et al. (2017).

Studies conducted in hospital settings have confirmed this issue. In fact, Pereira et al. (2017) and Bhangar et al. (2016) investigated the concentration of total and fluorescent particles of carpeting respectively in hospital environments and office facilities, demonstrating that the proportion of fluorescent in total airborne particle concentration increased during walking, in comparison to the times when the room was unoccupied. Previously, Anderson et al. (1982) also associated high levels of microbial contamination with rugs in inpatient rooms. The microbiological and epidemiological investigation analysed hospital rooms with and without carpets.

In conclusion, currently there are some innovations in healing environments with the introduction of materials with bactericidal proprieties, self-cleaning features, anti-odour efficiency and effectiveness against nitrogen oxides (NOx), etc. In particular, as Bianchi et al. (2014 and 2016) highlighted: (a) a bactericidal effect through the oxidizing power of photocatalytic action means it is possible to remove bacteria (photo-catalysis does not really kill the bacteria but it decomposes them, irretrievably damaging their cells and causing their death); (b) self-cleaning properties through photocatalytic activity. It is possible to guarantee a dual effect on the daily dirt on floors and walls (powder, organic residues, etc.); (c) anti-odour efficiency degrades the most common organic molecules that cause smells; (d) effectiveness against NOx through the photocatalytic process (i.e., deposits of titanium dioxide). It is possible to reduce and transform a lot of pollutants and toxic substances in harmless compounds such as nitrates, sulfates and carbonates. Some companies have recently introduced materials such as porcelain grés tiles, with titanium dioxide.


*Figure 3. View of the hospital street of the Hospital Sant Joan de Reus in Tarragona (Spain).*
*SOURCE: Corea & Moran Arquitectura and Pich-Aguilera Architects (photo by Pepo Segura).*

## Paint

Currently, there are numerous non-toxic paints with zero or low VOC emissions. The current standards define that a paint can be labeled with low VOCs if levels are lower than 250 g/l, while those with zero VOCs must respond to a value lower than 5 g/l. In any case, the release of VOCs, despite the use of a low or zero release paint, depends on the amount of product used and the painted surface.

However, the VOC content of paints is generally evaluated only for the base paint (Naddafi et al., 2010). Coloring can significantly increase potential emissions, so it is advisable to request data emissions for the formulation of the final paint that will be applied.

The United States Environmental Protection Agency (US EPA) provides guidelines for applying paint to indoor environments that can also be used for hospital settings: (a) painting must take place in the absence of users; (b) natural ventilation (and/or regular ventilation) for the environment during and after painting.

Recent and innovative solutions in paint are the integration with silver particles. As Kyung-Hwan et al. (2005) stated, silver at nano-levels has great antimicrobial properties (99%), as well as antifungal and antiviral effects. Naddafi et al. (2010) have investigated the performance of ordinary and nano-silver paint in some hospital rooms in Tehran University of Medical Sciences. The analysis was applied to rooms in an infectious diseases unit with the same environmental features (two beds with patients and frequent cleaning activities, temperature, day-lighting, ventilation conditions, etc.). One of the healing spaces was painted with ordinary paint. The other two rooms were painted with two different nano-silver paints (2%), provided from two companies, to examine the effect of nano-silver paint on decreasing the microbial burden in indoor air. To understand the possible effects on patients, the samplers were located with a distance of about 1.2 m to 1.5 m from the patient's breathing zone. The results, from a biological point of view, showed that both nano-silver paints had no statistically relevant effects on the burden of bacterial contamination. In fact, the sampling method did not assess the ordinary paint.

Although the results are positive, Kaiser et al. (2013) stated that paint factories consider the use of nano-silver, as well as photocatalytic-active nano-titanium dioxide or nano-silica dioxide as additives for the protection of indoor and outdoor surfaces against physical, chemical and microbial deterioration, as alternatives to conventional additives. Currently there are not any scientific demonstrations of nanoparticles in paint which achieve the proposed effects during the allotted time and take into account the potential risks for the environment and human health.

*Figure 4. View of the internal corridor of the outpatient area of Zaans Medical Centrum in Zaandam (Mecanoo Architecten).*
*SOURCE: Mecanoo Architecten.*

## Wood

As a natural material, wood has a positive influence on wellbeing, although it is not widespread in healing spaces for hygiene reasons (Kellert, 2005). As Bringslimark (2007) demonstrated, there are beneficial outcomes of indoor natural elements for hospital users.

Wood contains numerous organic and inorganic compounds (Kirkeskov et al., 2001). In fact, analysis by Kirkeskov et al. (2001 and 2008) investigated the chemical concentrations in wood products. Ten types of wood imported into Denmark, with product groups widely used, were monitored. Typically, these products have a surface treatment, which can either contribute to compound emission or reduce the emission from the wood by creating an impermeable sealing (Kirkeskov et al., 2008). The investigation was able to carry out a toxicological evaluation of compounds emitted from wood and wood-based materials, furniture, and finishings, and was developed by Jensen et al. (2001). The analysis was applied to some inpatient rooms with specific thermos-hygrometric conditions (Kirkeskov et al., 2008). The results obtained, based on random samplings, registered low concentrations of 25 chemical compounds.

Several studies have confirmed that untreated wood species have the same low emission rates as those confirmed by Jensen et al. (2001) and Nyrud et al. (2012). The latter carried out in-depth monitoring for quantifying the possible psychological benefits of wood use and measuring the effect on the healing process of exposure to different wood interiors. The analysis considered eight inpatient rooms with different wood panels. During the investigations, temperature and relative humidity were monitored continuously. Neither of the parameters have any significant variation, so the HVAC system guaranteed good performances. The final outcomes reported a range between 115–170 ng/l, which are values significantly lower than newly-furnished buildings (Nyrud et al., 2012). Looking at the results, it is possible to suggest wood finishing materials in inpatient rooms that do not have any substantial effects on the indoor air.

In general, the emissions of chemical compounds from products are very low. This could be due to several reasons, as Kirkeskov et al. (2008) listed: (a) during drying, many compounds are emitted;

(b) during processing, further emission takes place and some of the surface treatment will contribute to confining the compounds in the wood, thereby limiting emission; (c) transportation allows the further dispersion of chemical compound emissions. In conclusion, the measurements and toxicological evaluations highlight that emissions from individual compounds of the examined wood species or their surface treatments are not expected to cause adverse health effects.

*Figure 5. Interior of the Bart's Maggie Centre in London (Steven Holl Architects).*
*SOURCE: Marco Gola.*

## Cleaning and maintenance activities

As defined by Salonen et al. (2012), cleaning is the process of identifying, removing, and properly disposing of contaminants from a surface or environment. Disinfectant activities are crucial, even if source management, management activity, design intervention, and dilution ventilation have all been used optimally to control infectious aerosols (Cole and Cook, 1998).

Healing spaces should be cleaned regularly. As several authors have highlighted, cleaning and disinfectant activities when it comes to floors, walls, furniture and equipment can increase humidity and, as a consequence, facilitate the growth and survival of microorganisms.

In considering the selection of surfaces and materials, design teams should consider their maintenance and cleaning, due to some factors such as the nature of the objects to be cleaned (i.e., according to Spaulding's classification), the quantity of microorganisms on the surface, their potential for resistance, and the level of disinfection required (high, medium or low).

Nowadays, many hospitals use cleaning solutions and detergents to reduce the risk of infection, thus increasing the levels of TVOCs (Bessonneau et al., 2013). In fact, as several scholars have observed, airborne exposure from cleaning and disinfectant products are challenging to quantify because they are composed of mixtures of ingredients that have a range of volatilities and other physicochemical properties, and thus require multiple monitoring techniques (Bello et al., 2009 and 2010; Wolkoff et al., 1998). An emblematic case study by Llamosas et al. (2006) highlighted the inadequacy of air quality in a dialysis centre: an inadequate ventilation system and the incorrect use of cleaning products highly affected the performance of indoor air.

| CLEANING ACTIVITIES in INPATIENT WARDS | FLOORS | FURNITURE | WINDOWS | BATHROOMS |
|---|---|---|---|---|
| |  |  |  |  |
| **DETERGENTS for ORDINARY CLEANING** | neutral detergents, weakly alkaline | neutral detergents for dusting | neutral detergents | detergents, weakly acid |
| | ph: 8.5-10.0 dilution: 1-3% | PVC, wood, steel, etc. | alcohol-based, self-drying | sanitary ware, ceramics, coatings, chrome, etc. |
| **DETERGENTS for EXTRAORDINARY CLEANING** | waxing, after laying - if required | degreasing - if necessary | external and internal maintenance | descaling anti-scaling treatments with strong acids |
| **DISINFECTION of SURFACES** | • chlorine-derivatives<br>• quaternary ammonium salts<br>• phenol | • quaternary ammonium salts<br>• phenol<br>• alcohols | • alcohols<br>• phenol | • chlorine-derivatives<br>• quaternary ammonium salts<br>• phenol |

***Table. Main procedures and considerations for optimal cleaning activities in inpatient wards. Table taken from Cantagalli (2017).***

In healthcare organizations, the purchases of detergents, disinfectants and hydro-alcoholic solutions are managed through a call for tender (for many functional units of hospitals), although the variety is relatively limited. An investigation around the chemical composition of cleaning products by Berrubè et al. (2013) identified 112 commercial products and 125 distinct substances used in French hospitals. The analysis listed 16 detergents and disinfectants, 4 hydro-alcoholic solutions, and only 25 medicines and antiseptics for inpatient wards (they usually consist of several substances; the number of substances is about twice that of commercial products). The analysis emphasized the products for inpatient rooms because, in the departments investigated, the drugs administered in aerosol form are mainly prepared directly beside the patient's bed (Berrubè et al., 2013).

Another research project by Bello et al. (2009) identified the cleaning and disinfectant products used for common cleaning activities in six hospitals in Massachusetts in the US. A set of frequently used products was selected for further quantitative exposure characterisation. The specified selection criteria were: (a) at least one volatile ingredient should be identified as a potential respiratory hazard based on previous qualitative assessment; (b) be task specific; (c) be available via commonly used distributors. The analysis of material-safety data sheets observed that 2-buthoxyethanol, ethanolamine, ethanol, ethylene glycol, and propylene glycol mono-ethyl ether were the main components in all the products selected, with a range concentration of between 0.5% and 10%.

Another specific investigation on the effects of detergents in healthcare facilities was carried out by Bello et al. (2010). They developed simulations of cleaning tasks in bathrooms in different hospitals in Massachusetts (US). The aim of the investigations was to control task frequency, duration, and environmental conditions. To investigate the feasibility of analysing a wide range of airborne concentrations, cleaning tasks were simulated in different conditions (a room's volume, ventilation system, concentrations of the volatile components in the products, etc.). The simulations showed TVOC concentrations steadily increasing with time during task performance, peaking at the end of

the cleaning activities. TVOC concentrations after the tasks declined exponentially to the previous concentrations in 20 minutes (Bello et al., 2010).

Moreover, a systematic review by Gola et al. (2019) revealed some specific case studies and suggestions for good practice. In particular, in South Korea, many types of disinfectants have been widely applied in humidifiers for the last few decades to prevent microbial contamination, but their use has been banned since 2011 due to concerns about health effects, as the Korean Society of Environmental Health reported (KSEH, 2012). The investigation evidenced the use of humidifier peaks during the winter and spring seasons in healing environments, with more than 70% in atopic dermatitis patients (Kim et al., 2012). Several epidemiological analyses in South Korea have, in fact, highlighted that humidifier disinfectants can cause lung diseases, wide spread lung fibrosis, and interstitial pneumonitis, necessitating lung transplantation (Park et al., 2015).

The scientific community has also investigated the role of vacuum cleaners. Although there are now some vacuum cleaners with high-efficiency particulate-arrest (HEPA) filters and synthetic or double-bag collection systems, some authors, such as Clark et al. (1985), demonstrated an increase in airborne bacteria during cleaning procedures. In fact, as Veillette et al. (2013) showed, vacuum bags can accumulate bacteria, molds, endotoxins and allergens.

As a final consideration, cleaning should be done regularly and accurately. Irregular cleaning and floor-sweeping cause continuous deposits of particles. As Gulshan et al. (2015) stated, if cleaning activities decrease over time, particulate matter levels increase considerably; the deposited dust is re-suspended due to the movement of people, as there is no removal process, as well-evidenced by Tormo-Molina at al. (2009).

Airborne particulate matter, bio-chemical aerosol and dust concentrations are usually higher during the cleaning and disinfectant activities, although cleaning procedures are generally effective in reducing microbial contamination (Moscato et al., 2017). Thus, inpatients should not stay in hospital areas during the cleaning procedures and, as Ahmad et al. (2001) stated, the cleaning staff should wear protective suits and masks to protect themselves from bio-chemical contaminated air.

## Conclusions. Innovative Finishing Materials and Furniture: learning from the COVID-19 pandemic

As has emerged in the last few months, HAIs have a relevant strategic role in the management of the COVID pandemic. In synergy with monitoring and risk management activities, it is necessary to use high-performance, long-lasting and easy to clean materials in relation to specific medical needs. Innovative materials must be introduced to reduce the bacterial and viral load on finishing surfaces (van Doremalen et al., 2020), among which could be included eco-active and photocatalytic paints (Gola et al., 2019; Bianchi et al., 2018), characterised by high performance and flexibility of use. It is also necessary to investigate solutions used in emergency contexts, such as washable textile materials: their application could be extended in different sanitary areas for social distancing; they can also easily be cleaned and replaced and/or removed to guarantee the resilience and adaptability of settings (Zanelli et al., 2020). With an integrated coordinated application of best practice in terms of ventilation, cleaning products must be defined in relation to the finishing materials and furnishings in the environmental unit, taking into account the peculiarities and features of each surface (Kampf et al., 2020).

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# THEME 5:

# SALUTOGENIC LEARNING ENVIRONMENTS

# CHAPTER XI

# SALUTOGENIC DESIGN GUIDELINES FOR SCHOOL ENVIRONMENTS AND HEALTH OUTCOMES

PARUL MINHAS AND KARAMJIT SINGH CHAHAL

*Health is a prerequisite for all human pursuits. The environments in which we live, work and play have a direct impact on our health. It is uncommon to ask architects and urban designers to put health promotion as design criteria when they shape our built environment. With the onset of a pandemic into a world already burdened with persistently rising lifestyle-related diseases, it is crucial to support our over-stressed healthcare systems. Not only adults but even school children are prone to lifestyle diseases like obesity, hypertension and depression, leading to the poor overall health of society. Even though life expectancy has increased in the past few decades, the quality of life and health seems to be constantly deteriorating. Holistic health is an approach that seeks a complete mind-body-spirit balance to maintain overall health and prevent diseases. This chapter explores the effects of a built school environment on children's health and wellbeing. The aim is to identify the health-promoting components of the built school environment through the lens of salutogenic design. The study advises that children's experiences in the salutogenic school environment could affect their ability to create positive emotions and experiences that may lead to a heightened sense of coherence and improved holistic health.*

## 1.0 Introduction

'The true measure of any nation's standing is how well it attends to its children - their health and safety, their material security, their education and socialisation and their sense of being loved, valued, and included in the families and societies into which they were born' (UNICEF, 2007).

The World Health Organization has illustrated in its Ottawa Charter for Health Promotion, a holistic approach to health, stating, 'to reach a state of complete physical, mental and social wellbeing, an individual or group must be able to identify and to realise aspirations, to satisfy needs, and to change or cope with the environment' (WHO, 2016). Emphasising the link between health and education, the Incheon Declaration states that quality education 'develops the skills, values, and attitudes that enable citizens to lead healthy and fulfilled lives, make informed decisions, and respond to local and global challenges' (UNESCO, 2016).

We cannot realise all of the health and education goals without an appropriate environmental set-up. Even in the 4th century B.C., Hippocrates knew that the physical environment in which people live affects human health. With lifestyle-related diseases rising (NCMH, 2005) among adults and children, the environment in which we spend most of our time needs to be studied as a prerequisite to realising health-promoting architecture. A healthy built environment is multi-dimensional: it is more than just adequate light and ventilation. Research has now proved that physical spaces have the potential to induce certain moods in their habitants (C. Day, 1990). Moods induced by places have psychosomatic tendencies towards health and sickness, hormonal balance and the vigour with which our bodies fight pathogens. Psychoneuroimmunology (PNI) explains how places and ambience nurture people. According to Christopher, 'sensory aesthetics' also have a significant impact on health and wellbeing (C. Day, 2007). In a similar vein, Churchill (1943) remarked that 'we shape our buildings; thereafter, they shape us'. Children, like wet clay, are more quickly shaped by the environment where they spend most of their childhood years. School is next only to

home and neighbourhood when it comes to the built environment for children. The current figures for rising suicide and depression cases among Indian students show the high levels of stress they are experiencing. The 'yearly figure of suicide rates by students turned out to be the highest in a decade — over 10,000 in 2018. Twenty-eight students on average committed suicide every 24 hours during 2018, according to NCRB data. India saw 1.3 lakh suicides in 2018, of which students made up 8%, almost the same in the farming sector. A quarter of the student suicides in 2018 were because of failure in exams. Experts said causes ranged from drugs to depression, to broken families, and break-ups' (The Economic Times, Jan 11, 2020).

It therefore becomes pivotal to decipher the attributes of a built school environment that may enhance the health and wellbeing of children and lead to a healthier society. To create supportive physical environments, it is crucial to understand an individual's fundamental needs (Heerwagen et al., 1995). This study begins by understanding the holistic health perspective and identification of the holistic health needs of children. It then focuses on identifying attributes of a health-promoting built school environment based on the theory of salutogenesis (Antonovsky,1979) and salutogenic design (Alan Dilani, 2008). Further, after reviewing and analysing the literature, this study aims at formulating salutogenic design guidelines for a built school environment which is used by academic architects for listing appropriate design criteria besides the varied contextual needs. This chapter is, however, limited to literature review only. 'Much of architecture affects people from beyond the focus of awareness. People are not sure what it is about a building or room that affects them, nor are they able to express how they feel in different surroundings' (Sommer, 2007).

### 2.1 Holistic Health: Definition, Meaning and Attributes

'It is easier to build strong children than to repair broken men', said Frederick Douglass in 1885. Over 150 years later, 'building strong children' remains as crucial as ever. Claiming a demographic share of approximately 40%, children (0-18 years) form a significant segment of India's population and, therefore, a momentous determinant of its growth and development narratives (India Child Wellbeing Report 2019).

The Oxford Dictionary defines 'health' as 'the state of being free from illness and injury'. This, however, defines what health is not. The English term 'health' derives from the Old English 'hælth', which is related to 'whole' and 'a thing that is complete'. In 1948, the WHO adopted the following definition of health: 'Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.' According to the Merriam-Webster dictionary, wellbeing is the state of being happy, healthy, or prosperous. Various terms related to health like wellness, wellbeing (Aristotle's hedonia and eudaimonia) and quality of life are used in different contexts but with a common aim.

Two mainstream philosophies define health in their own way, the first being the bio-statistical or the medical approach (Boorse, 1997). According to this approach, there is nothing evaluative or subjective about health and diseases. Health is the absence of disease and disease is a type of internal state which is an impairment of normal functional ability or a limitation on functional ability caused by environmental agents (Nordenfelt, 1987). The second mainstream approach is the holistic approach that considers health and disease as two value-laden concepts. The holistic method refers to an overall approach to the health and wellbeing of the whole person, rather than focusing on illness or specific parts of the body. It considers how an individual interacts with his/her environment and emphasises the connection between mind, body and spirit to achieve an utmost level of wellbeing. The holistic approach encourages people to accept responsibility for their health and wellbeing as opposed to the medical approach that relies on the healthcare system to maintain the health and wellbeing of people (Sainju N. K, 2018). According to Hembree & Sholder (2013), the physical body is a factor of holistic health defined by the balance and communication of physical activity, nutrition, genetic composition, and coordination. The mind is

a factor of holistic health defined by the balance and communication of the ability to learn, retention of knowledge, and capability of abstract thought. The spirit is a factor of holistic health defined by the balance and communication between self-esteem, self-empowerment and self-identity concerning social communities.

Some definitions of health, wellness, and wellbeing related to the holistic approach are:

- Health is a state of complete physical, mental and social wellbeing and not the absence of disease or infirmity (WHO, 1948).
- Wellness is an integrated method of functioning which is oriented toward maximising the potential of which an individual is capable (Dunn, 1961).
- The extent to which an individual or group can realise aspirations and satisfy needs and change or cope with the environment. Health is a resource for everyday life, not the aim of living; it is a positive concept, emphasising social and personal resources, as well as physical capacities (Health promotion: a discussion document, Copenhagen, WHO, 1984).
- Health is the capability of individuals, families, groups, and communities to cope in the face of significant adversity or risk (Vingilis & Sarkella, 1997).
- It is a way of life oriented toward optimal health and wellbeing in which the integration of an individual's mind, body and spirit allows them to live life fully within the human and natural community (Witmer & Sweeney, 1998).
- Wellbeing is a complex construct that concerns optimal experience and functioning (Ryan & Deci, 2001).
- Health is a condition where resources are developed in the relationship between humans and their biological, chemical, physical and social environment (Lawrence, 2002).
- Wellbeing is the state of successful performance throughout the life course integrating physical, cognitive and social-emotional functions that result in productive activities deemed significant by one's cultural community, fulfilling social relationships, and the ability to transcend moderate psychosocial and environmental problems. Wellbeing also has a subjective dimension in the sense of satisfaction associated with fulfilling one's potential (Bornstein, Davidson, Keyes, & Moore, 2003).

The law of nature states that the whole comprises interdependent parts. This is the basis of holistic health. All the above definitions clearly state the following characteristics of holistic health:

- It is person-oriented rather than disease-oriented.
- Its aim is full, vibrant health (positive wellness), not symptom amelioration.
- It is three-level (physical, emotional, spiritual), not uni-level (physical only).
- It is a long-term, ongoing and continuous lifestyle.
- It focuses on primary prevention rather than crisis intervention.
- It aims towards achieving full human potential (self-actualisation).
- It focuses on building resilience and building better coping mechanisms.
- An individual's experiences and environment are the basis of holistic health.

The goal of holistic health, therefore, is to achieve a purposeful, vibrant, and healthy lifestyle by emphasising the connection between mind, body and spirit. A healthy person is a person in balance, normally meaning that different parts and different functions of the human body and mind interlock harmoniously and keep each other in check (Nordenfelt, 1987). The idea of balance is strong in most non-Western medical traditions. Ayurveda, an Indian holistic health system, places great emphasis on maintaining health through a balance of body, mind and spirit by making appropriate lifestyle changes according to one's constitution (Lad, 2002). Ayurveda considers the surrounding environment and society as part of the broad concept of health. Many other ancient schools of thought have insisted upon the relevance of holistic health. The concept of health as a balance between a person and their environment, along with the unity of 'soul' and 'body', was the basis of the perception of health in ancient Greece (Svalastog et al., 2017).

The above discussion leads us to this definition of health: the ability to maintain a state of equilibrium and balance between genetic factors and environmental conditions, mental-spiritual and bodily functions along with the interaction between individual and community, together leading to the attainment of full human potential (self-actualisation) and the building of a sound coping mechanism (resilience).

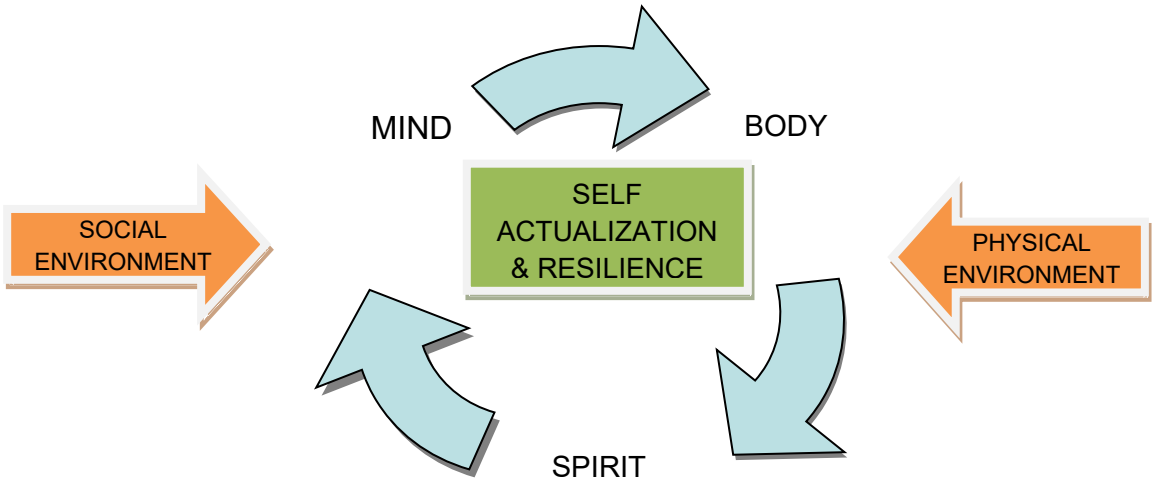



*Figure 1.0: A model of holistic health with self-actualisation and resilience as the ultimate goals to be achieved through mind-body-spirit balance, in the presence and under the influence of physical and social environmental conditions.*

Considering the various studies in children's health, child psychology and environmental psychology {Ex. Maslow (1943), India Child Wellbeing Report (2019), Ryan & Deci (1985), etc.}, 'holistic health needs' associated with overall mind-body-spirit balance are:

- Habitable environment (clean air, water, shelter, thermal comfort, natural light, etc.).
- Safety & security.
- Self-esteem/personal growth/self-acceptance.
- Autonomy/psychological freedom.
- Positive relationships with people and places.
- Rich experiences leading to positive emotions.
- Competence/capability/accomplishment/mastery.
- Engagement/purpose in life.

## 2.2 Child Health and the School Environment

'When you pay attention to the beginning of the story, you can change the whole story'.
—Raffi Cavoukian

The school environment is one of the primary influences for most school-going children, next only to the home and neighbourhood environments, because children spend nearly half their waking hours in school. Health problems developed at a young age usually affect a child's social, behavioural, cognitive and physical processes and get compounded as the child grows. A sedentary lifestyle causes many health problems, such as obesity, which are easily preventable in childhood. The way a child deals with internal health factors, external environmental factors, and issues of self-identity plays an important role in the development of holistic health (Hembree & Sholder, 2013).

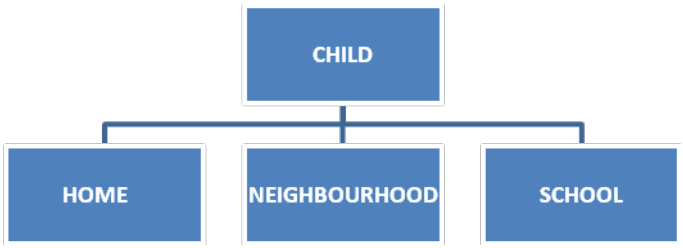



*Figure 2.0: Primary environments for children.*

All aspects of holistic health — mind, body and spirit — gather to form a child's identity. Social interactions shape a child's perception and understanding of incidences in their own life at home and school. Socio-economic issues affecting lifestyle, opportunities and primarily the built environment also have a considerable impact on one's holistic health. It is crucial to decipher the characteristics of the school environment (physical) that may assist children in reaching their full potential (self-actualisation) and effectively managing stress (resilience). The theory of salutogenesis addresses both the above factors and is the basis for further research.

### 2.3 Salutogenesis: The Theory and its Relation to Holistic Health

> *'To ask about health ease, instead of asking about the disease, is to search for weapons that may be far more potent in decreasing human suffering'.*
> —Antonovsky,1979

Salutogenesis is a medical approach focused on factors that support human health and wellbeing, rather than on factors that cause diseases (pathogenesis). To be more specific, 'salutogenesis' is a health-promoting model concerned with the relationship between health, stress and coping. Aaron Antonovsky, a professor of medical sociology, coined the term in 1979. The word 'salutogenesis' literally means 'origin of health' and comes from the Latin word *salus* (health) and the Greek word *genesis* (origin). According to Antonovsky (1979), health and wellbeing are related to our ability to cope with the stressors of human existence by seeing the world as making sense, cognitively, instrumentally, and emotionally. Following are some important definitions that can assist in better understanding Aaron Antonovsky's perspectives on holistic health:

1. **Stress:** 'Stress is the condition that results when person-environment transactions lead the individual to perceive a discrepancy — whether real — between the demands of a situation (stressor) and the resource of a person's biological, psychological, or social systems' (Turner-Cobb,2008).
2. **Stressor:** 'A demand made by the internal or the external environment of an organism that upsets its homeostasis, restoration of which depends on non-automatic and not readily available energy expanding action' (Antonovsky, 1979). 'The difference between the terms stress and stressors is stressors are agents with potential stress-inducing abilities and stress results from the potential stressor' (Turner-Cobb, 2008).
3. **Coping:** 'Coping is an attempt to deal with stress by trying to change the load, and to reduce the symptoms caused by the stressor by increasing resources bound to the environment' (Netterson). 'The tension level (stress) experienced by people depends upon how they cope with the stressors' (Antonovsky,1979).
4. **Generalised Resistance Resources (GRRs):** Generalised Resistant Resources (GRRs) are 'any characteristic of the person, the group, or the environment that can facilitate effective tension management' (Ziegler, 2009).
5. **Sense of Coherence (SOC):** 'Sense of coherence (SOC) is the global orientation based on a person's confidence that stimuli are structured and predictable, the resources needed to meet these demands are available, and these demands are challenges, worthy of investment, and

engagement' (Antonovsky, 1979). 'It is the capability to perceive that one can manage in any situation independent of whatever else is happening in life' (Mittelmark et al., 2017).

Antonovsky described health as a dynamic process and stated that everyone finds themselves on a continuum between 'maximum health' and 'maximum disease'. He intended to shift the focus away from the risk factors to a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that one's internal and external environments are predictable and there is a high probability that things will turn out as well as can reasonably be expected (Krause, 2011).

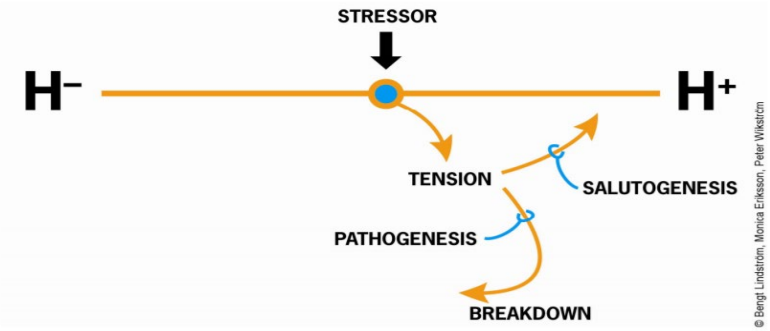



*Figure 3.0: Antonovsky's own way of explaining the health continuum and the salutogenic direction.*

In his theory, Antonovsky (1979) insisted that stressors are indispensable parts of our daily lives and it depends on our sense of coherence whether we allow these stressors to break us down or strengthen us. Antonovsky referred to SOC as a resource that enables people to manage tension, reflect on their external and internal resources, identify and mobilise them, promote effective coping by finding solutions, and resolve the tension in a health-promoting manner (Serbast Essa, 2020). Research has shown that it is possible to measure a person's sense of coherence and predict an individual's health (Suominen et al., 2001). A strong sense of coherence predicts good health and a low sense of coherence predicts poor health. In his study, Heiman (2004) showed that students with an elevated sense of coherence did not experience increased levels of stress. Antonovsky considered 'generalised resistance resources' as the cornerstones of the development of a strong 'sense of coherence'. These resources are of different types: genetic and constitutional, psychosocial, cultural and spiritual material (Lindström & Eriksson, 2005).

Antonovsky defined the core notion of SOC with the following three dimensions:

- **Comprehensibility.**
- **Manageability.**
- **Meaningfulness.**

**Comprehensibility:** Comprehensibility is a belief that events in one's life can be understood, including challenges (Jensen, 2017). The comprehensibility component contains items to the degree a person experiences internal and external stimuli as cognitive, comprehensible, orderly, cohesive, structured, and clear (Eriksson & Mittelmark, 2017). We may also see it as the ability to find order in chaotic situations. Only if one can comprehend a situation will one be more likely to manage the stress caused by it. We may therefore see comprehensibility as the ability to comprehend the situation/change/environment without an unhealthy increase in stress. A person with strong comprehensibility perceives the world as coherent.

**Manageability:** Manageability is a belief that there is ample availability of resources needed to take action and that things are manageable and under one's control (Jensen, 2017). In the words of Antonovsky (1987), manageability is the extent to which one perceives that resources are at one's disposal which are adequate to meet the demands posed by the stimuli that bombard one, and that

they also have the resources under control or feel that resources are controlled by legitimate others like spouses, friends, colleagues, God, etc. A high score on manageability shows that a person is managing adversities without feelings of being a victim or being treated unfairly (ibid).

**Meaningfulness:** Meaningfulness is a belief that things in life are interesting, motivating, and a source of satisfaction (Jensen, 2017). Meaningfulness is a desire to resolve difficulties and a willingness to invest energy to get through experiences of stress that have the potential to cause distress (Eriksson & Mittelmark, 2017). Meaningfulness is about to what degree life is emotionally understandable and about demands and challenges being appreciated, commitments and efforts handled directly without being bothersome.

Therefore, it can be concluded that people with a strong sense of coherence meet challenges with a desire to be motivated to cope (meaningfulness), they believe that challenge is understandable (comprehensibility) and they believe that resources to meet challenges are available (manageability). The aim is the development of a sense of coherence and to have life experiences that lead to a strong SOC (Similia, 2015).

### 2.4 Salutogenic Design and the School Environment

'Architecture can be psychologically manipulative. Salutogenic architecture is believed to accomplish this manipulation by providing a narrative context that affects a person's behaviour, neural and endocrine systems, and through its influence on the brain and the body' (Golembiervski, 2017 & Mazuch, 2017).

Alan Dilani conceived the idea of salutogenic design, or what he calls 'psychosocially supportive design,' with an intention to promote health. According to Dilani (2001), salutogenic design not only defines the causes of stress but also introduces wellness factors that can strengthen health. 'The theory suggests that we not only design for stress reduction but focus on salutary rather than risk factors'. Dilani raised the question of how the shift from a pathogenic approach to a salutogenic approach manifests in a built environment: 'The basic function of psychosocially supportive design is to start a mental process that […] may eliminate or, at least, reduce anxiety, bringing about positive psychological changes.' Dilani refers to the stress theory model founded by Levi (1972) based on a system that points to a deeper understanding of the physical environment and different human components. According to Dilani (2008), the model describes how the physical environment is the foundation on which we build a societal organisation and, in the long run, promote health or disease.

In 1997, the World Health Organization identified that any health 'arena' should include these frequently used priority spaces: the workplace, schools, hospitals, correctional institutions, commercial offices, public spaces within our towns and cities, and homes. This is the apex of health promotional activity in the 21$^{st}$ century (Dilani, 2001). Adopting a salutogenic approach as a vital part of the building design process creates a preventive care strategy that might shift the focus from the factors that cause illness to the factors that lead to a healthier society.

Salutogenic design, in an educational context, aims at identifying the elements of physical school design that can contribute towards the development of a strong sense of coherence, leading to the improved holistic health of children. Dilani (2001) created a list of architectural characteristics that he argues can strengthen an individual's sense of coherence. He states: 'Physical elements in an organisation can contribute to stress, and therefore are essential design factors that can equally increase comfort as well'.

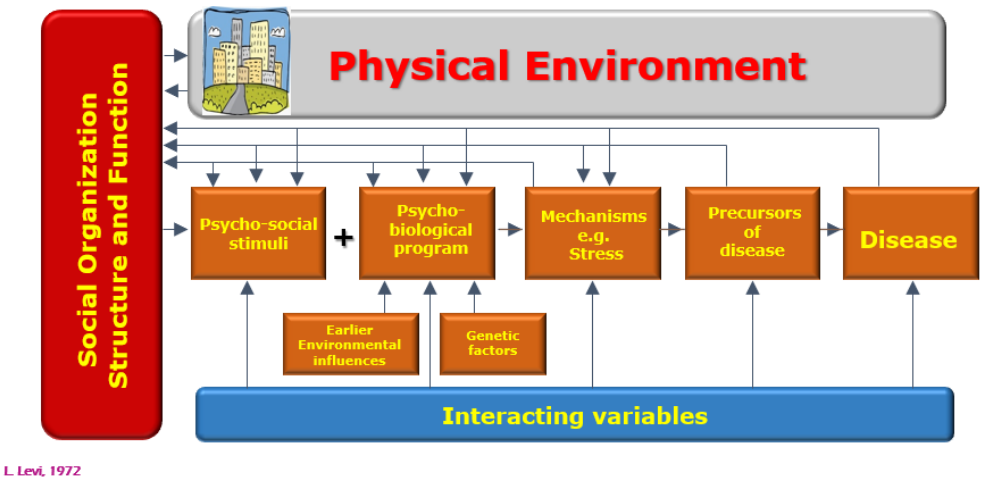



*Figure 4.0: Stress theory developed by Lennart Levi at the Karolinska Institute, Sweden, 1972.*

A salutogenic design bridges the gap between architectural design, neuroscience and psychology. According to Krause (2011), the two primary GRRs (generalised resistance resources) that need to be activated to strengthen a child's sense of coherence in school are 'sense of self-worth' and a 'sense of belonging'. Emotions and experiences are central to the building of a strong sense of coherence (Dilani, 2001). The idea here is to create experiences in the built environment that may lead to positive emotions, further leading to a strong sense of coherence. Fredrickson (2001) states that positive emotions are much more than a few momentary experiences and can also contribute to holistic health. A sense of self-worth and sense of belonging may be broken down into multiple psychological experiences to connect them with their spatial counterparts in school design.

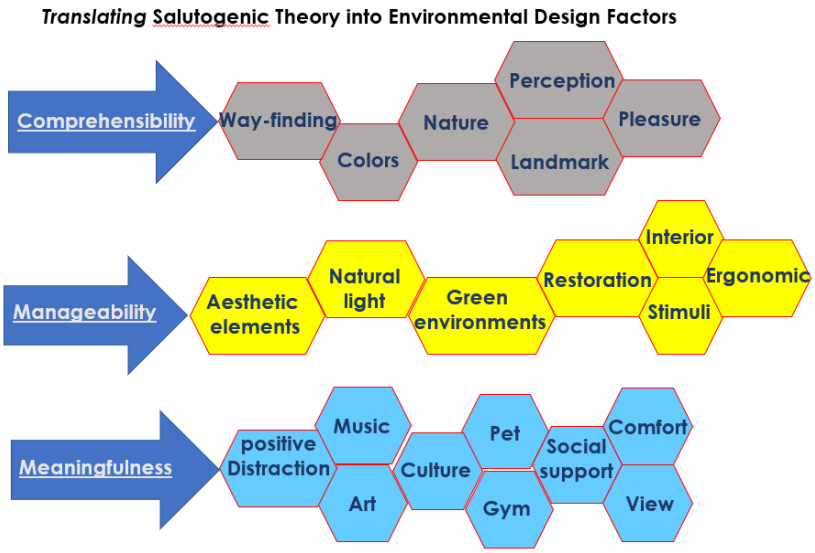



*Figure 5.0: Design factors in relation to a sense of coherence. Developed by Alan Dilani (2008).*

The psychological experiences of security, knowledge and freedom in a built environment can help make that environment more comprehensible. Experiences of self-efficacy and balance can lead to stronger manageability, and comprehending a sense of place and purpose can strengthen meaningfulness in school children.

| GRRs That Need to Be Activated by/for a High Sense of Coherence at School | | |
|---|---|---|
| **Sense of Self Worth** | | **Sense of Belonging** |
| Sense of Security & Sense of Knowing | Sense of Self Efficacy | Sense of Place |
| Sense of Freedom | Sense of Balance | Sense of Purpose |

***Table 1: Simplifying the GRRs (Source: Author).***

| **Comprehensibility (Sense of Security, Sense of Freedom, Sense of Knowing)** | **Manageability (Sense of Self-Efficacy & Sense of Balance)** | **Meaningfulness (Sense of Place & Sense of Purpose)** |
|---|---|---|
| Safety/Security | Self-Esteem/Personal Growth/Self-Acceptance | Place attachment in school |
| Autonomy/Psychological Freedom | Competence/Capability/Accomplishment/ Mastery | Engagement/ Purpose in Life |
| | Habitable Environment (clean air, water, shelter, thermal comfort, natural light, etc.) | Positive relationships with people and places |

***Table 2: Sense of coherence in the school environment (Source: Author).***

Addressing the sense of coherence in school design, we can elaborate on the three attributes of a sense of coherence.

## 2.5 Comprehensible School

According to Krause & Lorenz (2009), experiences of consistency are the basis for the development of comprehensibility. In positive cases, children have feelings of security and acceptance in social relations. Consistency in experiences comes when most events in daily lives are predictable. Though it's neither possible nor desirable to predict every experience as it may lead to monotony, human beings flourish when most of their experiences are consistent so that they can spare more time to pursue what they want to rather than adjusting to unpredictable events/experiences. When translated to a built school environment, experiencing consistency would mean being able to comprehend the connection between the various spaces and having confidence that they all connect to form a unified whole, leading to a sense of security and coherence.

A secure environment must therefore possess the qualities of being decipherable (C. Day, 2007) and transparent (LOSD, 2009). These environments orientate and reassure children by using familiar elements and special features that may assist way-finding and legibility (Dilani, 2001). It requires an optimum organisation of space to control density and assure personal space for everyone. Comprehensible environments are authentic, genuine, and honest, and these qualities may be conveyed through the use of natural materials and construction methods, usually avoiding superfluous decoration and detailing (Franz, 2019). According to Ken Yeang (2015), 'environmental comprehensibility' requires environmental orderliness, predictability, and legibility. This may refer to the relevance of visual order in the built environment with legibility, intuitive way-finding, and the elimination of visual chaos. The following design guidelines can therefore enhance comprehensibility in a school environment.

#### *2.5.1 Give Reassurance and Build Orientation Through Legible and Predictable Design*

Legibility is the degree to which a building facilitates the ability of users to find their way within it (Weisman, 1981). Legibility is crucial to effectively comprehending an environment. Legibility in the school environment can be enhanced by creating unique identities for various locations, by using landmarks as visual cues, by creating well-structured paths, by limiting navigational choices, and by using clear sightlines to show what's ahead (Thapa, 2019). Predictability refers to the degree to which one can predict what can occur or what we expect to occur in an environment. We need predictability to ensure safety and security that can be enhanced through the thoughtful design of spaces with natural surveillance, a welcoming secure entrance, transparency within spaces, use of familiar elements and sensory connections, and also through safe community involvement (LOSD, 2009).

#### *2.5.2 Encourage Autonomy and Psychological Freedom in the School Environment*

Though it is not possible to grant complete freedom to school children, keeping in mind the concerns related to their safety, it is possible to create an environment that makes them feel psychologically free. Architecture can foster autonomy and impact psychological freedom by doing the following:

- Using scale: switches, water taps, door handles, etc. (Walden, 2015)
- Ensuring personal space/controlling density/crowding/territoriality (Walden, 2015).
- Sense of security and feelings of privacy (Sanoff & Walden, 2012).
- Authenticity (Franz, 2019).

### 2.6 Manageable School Environments

Krause & Lorenz (2009) insist that experiences of self-efficacy are the basis for the development of manageability. This component grows if the requirements for children are available to their developmental level and if they experience the acceptance of their progress. According to Franz (2019), a manageable school environment aims to build competence by being well resourced, enhancing the ability to cope, develop further capabilities and undertake required/desired activities. These resources could also be the environments that allow students to exercise control and support activities by being safe, comfortable, and accessible. The inclusive design also forms a part of a manageable environment where students with special needs are considered. Research on inclusive and universal design provides further support (Myerson & Lee, 2010 & Raheja, 2011). It is also crucial for a manageable environment to be flexible and responsive to change and to encourage participatory planning. Dilani (2001) suggests that environmental components that foster manageability are aesthetics, natural light, green environments, restoration, stimuli, and ergonomics. Comprehensibility is a pre-condition for effective manageability. The following design guidelines can help develop a sense of self-efficacy and balance in school children.

#### *2.6.1 Ensure Comfort and Safety to Increase School Efficiency*

Comfort here refers to 'a state or situation in which you are relaxed and do not have any physically unpleasant feelings caused by pain, heat, cold, etc.' (M.W. Dictionary). 'Research suggests that students need to be comfortable (just like adults) to learn' (Nair, 2014). We can achieve comfort through design via thermal comfort, acoustic comfort, visual comfort, physical (bodily) comfort and olfactory comfort. Also, compliance with the building safety codes is a prerequisite for a healthy school design.

| | |
|---|---|
| **Thermal Comfort** | Natural ventilation, HVAC, air quality (Barrett et al., 2015). |
| **Acoustic Comfort** | Noise control, sound levels complementary to nature (Barrett, 2015). |
| **Visual Comfort** | Colours, natural & pleasant views, natural light, perceived scale, form, etc. (Barrett & Barrett, 2011). |
| **Physical Comfort** | Attention to ergonomics (Zhang & Barrett, 2009). |
| **Olfactory Comfort** | Smells to be avoided/invited (Barrett et al., 2015). |

***Table 3. Comfort in the school environment (Source: Author).***

#### *2.6.2 Create Opportunities for Attention Restoration and Stress Reduction in Schools*

The relevance of salutogenic design from the point of view of school efficiency can be better understood if we are aware of the two types of attention systems. Kaplan and Kaplan (1989) developed the 'attention restorative theory' (ART), which states that activities needing direct attention may cause exhaustion after an intense period of concentration. A person may need to restore their attention after a period of continued concentration to be efficient. In a classroom where children are expected to concentrate on their lessons for hours together, it becomes crucial to restore attention after a certain period of direct concentration. It is now known that an exhausted person often commits human errors (Dilani, 2008). A child's ability to focus has a direct impact on their academic competence and ability to comprehend situations and stay inspired, this further leads to high self-esteem and better manageability. Studies by Amicon et al. (2018) and Determan et al. (2019) have provided the evidence that natural environments in schools can help students with better recovery of their attention resources, as well as in feeling more restored and less stressed and fatigued, as claimed by Ulrich (1991) in the 'stress reduction theory' (SRT). Empirical studies have informed us that experiences of the natural environment provide greater emotional restoration, with lower instances of tension, anxiety, anger, fatigue, confusion, and total mood disturbance than urban environments with limited characteristics of nature (Barton & Pretty, 2010).

#### *2.6.3 Design Flexible Spaces Capable of Quick Adaptation in Changing Scenarios in the Education System*

To foster efficiency, spaces should be flexible to accommodate a variety of purposes, allowing day-to-day changes as well as adaptability to future change (LOSD, 2009). Designing flexible environments could enable the adoption and adaptation of the emerging changes in education. Flexibility in space allows the use of multiple modes of learning, as Howard Gardner suggests each child learns differently depending upon their unique intelligence. Therefore, flexible and adaptable building designs 'future-proof' the spaces and allow for a variety of uses at different points in time (Cardellino, 2009).

#### *2.6.4 Improve Accessibility and Inclusion through the Application of Universal Design Principles to Heighten Self-Esteem and Efficacy*

'Universal design is concerned with more than just removal of barriers, it seeks to eliminate discrimination by design and support full participation for all members of society' (Lusher & Mace, 1989). The goals of universal design given by Steinfeld and Maisel (2012) demonstrate its health-promoting intentions by ensuring an accessible, inclusive and useable environment for all users, making a positive impact on self-esteem and self-efficacy in children.

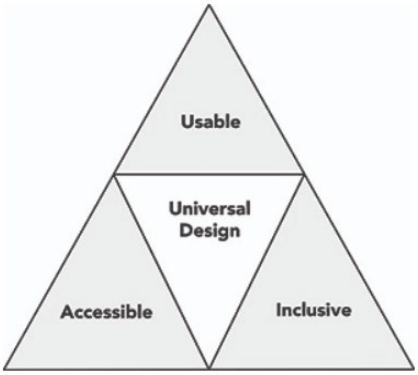



*Figure 6.0: Equal Access. Universal Design of Student Services. Source: Burgstahler, Sheryl (2020).*

### *2.6.5 Encourage Participatory Planning to Build Environmental Stewardship*

Childhood is the best time to inculcate environmental stewardship in children. A sustainable school environment can become a significant instrument and a potent third teacher (Wilson & Ellis, 2007) for environmental education and stewardship. Architects can either encourage participatory planning during the design and conception of the school or can leave room for intervention by children when they use the environment, which is not only a place where education is imparted but a place where learning happens (Tasci, 2015).

## 2.7 Meaningful School Environments

Krause (2011) observed that the motivational and emotional component increases when children can influence and take part in social decision-making processes (sense of purpose). Children need to feel that they belong to the school and school belongs to them. Based on research data from neurobiology and resilience studies, experiencing a minimal amount of empathic resonance is a fundamental biological need, without which the human being could not survive. If children feel accepted and acknowledged, they feel recognised and get feedback, which strengthens their self-worth.

According to Franz (2019), an environment that motivates children's desire for a sense of coherence is perceived to be meaningful. Such environments are 'inspiring, engaging, restoring, challenging and aesthetically rich' (ibid.). Natural and built environments that engage the senses through material qualities of 'colour, texture and pattern' and atmospheric qualities of 'light, temperature and sound' are important in this context. Alongside the natural elements, several other additions can make an environment meaningful, such as music, art, culture, gym, spaces for social support, and the opportunity to interact with other species, i.e., pets and other positive distractions (Dilani, 2008). A meaningful environment must therefore be able to evoke feelings of belongingness (self-worth) and engage people positively so that they experience a sense of purpose. We can inculcate these two qualities in the school environment in the following ways:

### *2.7.1 Create Opportunities for Social Interaction in a Natural Environment*

The social structure and its physical environment determine to a large extent the kinds of experiences children have and what they learn about the world. Every aspect of child development involves socialisation (C. Day, 2007). Socialisation facilitates identification with the school building and makes acceptance possible. Its users must feel connected to the school, feel at ease in it, and consider it a kind of home. A sense of place makes people connect with their surroundings and makes them establish knowledge of and appreciation for the location. Lefebvre's work is significant because it challenges the unidirectional theory between physical space and social relations. In this work, he claims that space is socially produced, engineered, and constructed, and

that social relations are always made up relative to space. McGregor (2004) refers to schools as being a 'physical container for social life' in that they function as an intense place involving social interaction.

A natural environment with 'biophilic' considerations is highly effective in enhancing the feelings of belonging and hence a sense of place. Some key elements of biophilic design, according to Salingaros (2017), are light, spatial permeability, sensory engagement, liminal spaces, organic shapes and forms, natural processes and patterns such as fractal geometry.

#### *2.7.2 Create Sensory-Rich and Actively-Engaging Environments to Foster a Sense of Purpose*

> 'Experience of architecture is multi-sensory; qualities of matter, space, and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton, and muscle. Architecture strengthens [...] one's sense of being in the world, essentially giving rise to a strengthened experience of self' (Pallasmaa, 1996).

C. Day (2007) states that stimulus is essential to a healthy life. According to him, for peaceful but invigorated balance, human beings need both sameness/predictability and contrast/stimulus. Perceived risk and stimulus of new challenges are what children need to stay motivated. These are essential ingredients for developing self-esteem and fostering a sense of purpose. C. Day (2007) insists that children cannot develop resilience without facing their fears. Risk-taking, therefore, becomes essential to developing an acute sense of coherence. Children love adventure, but their safety is a major concern. It is therefore important to maximise challenge while minimising injury risk. The designer must provide these whilst keeping actual risk. This is believed to be achieved through the design of environments that accommodate a wide range of sensory experiences and activities and that include many types of learning: intellectual, physical, practical, social, emotional, spiritual, and cultural (Building Futures, 2004).

| **Experiences that can lead to positive emotions** | **Spatial considerations in school design (lifestyle) capable of supporting experiences that may lead to positive emotion** | **Positive emotions leading to improved SOC** |
|---|---|---|
| Sense of security, knowing and freedom. | i) Give reassurance and build orientation through legible and predictable design.<br>ii) Encourage autonomy and psychological freedom in the school environment. | Security/Joy.<br><br>Confidence. |
| Sense of self-efficacy and balance. | iii) Ensure comfort and safety to increase efficiency in school.<br>iv) Create opportunities for attention restoration and stress reduction in school.<br>v) Design flexible spaces capable of quick adaptation in the changing scenario of the education system.<br>vi) Improve accessibility and inclusion through the application of universal design principles to heighten self-esteem and efficacy.<br>vii) Encourage participatory planning to build environmental stewardship. | Mastery.<br><br>Relaxation/Peace.<br><br>Enthusiasm.<br><br>Acceptance.<br><br>Capability/ Competence. |
| Sense of place and purpose. | viii) Create opportunities for social interaction in the natural environment.<br>ix) Create sensorially rich and actively engaging/challenging environments to foster a sense of purpose. | Belonging.<br><br>Curiosity/Awe. |

***Table 4: Emotion, Experience & Lifestyle in school (Source: Author).***

The above table illustrates how positive experiences in school, reinforced with suitable environmental conditions, can help children create positive emotions that may further result in an improved sense of coherence. We can further convert the nine spatial considerations derived by critically reviewing the literature related to holistic health and the built school environment into a practically applicable design criteria matrix, including design criteria with an intention to form the basis for a healthy school design. This exhaustive matrix lists thirty-six design criteria for improving holistic health in the school environment. Although this matrix can be used as a ready reference for examining the health status of existing schools and a basis for new schools, the components of the matrix could be made more specific to suit the various contexts of its application.

## 3.0 Conclusion

The above discussion leads to the conclusion that the experiences of children in a salutogenic school environment can affect their ability to create positive emotions that may lead to an increased sense of coherence and hence improved holistic health. The nine vital considerations under the umbrella of salutogenic design can lead to effective and elaborate design criteria for schools from the point of view of health promotion. Applying the Matrix of Design and Health (Ken Yeang & Alan Dilani) to the salutogenic school environment (Table 5), we get a comprehensive list of design criteria that affect the holistic health of children.

Further research could quantify the impact of these design considerations by conducting post-occupancy evaluations (POE) of existing school facilities in the context where the newer proposed interventions aim to resolve the site/community/city-specific issues related to holistic health in children. The POE may comprise observation (of students in school) by the architect, as well as interviews and questionnaires (for teachers). There are various methods of POE in schools, such as Sanoff's (2001) school-building assessment methods; Tanner's 'Effect of school design on student outcomes' (2008); Cohen, Gilbert, Bodass and Leaman's 'Assessment of building performance in use: PROBE process' (2001); and Leaman's and Bodass' 'Assessment of building performance in use: PROBE occupant survey and their implications' (2001). These may be referred to in order to create a suitable assessment method for measuring the impact of the built school environment on the holistic health of children.

***Table 5.1 ,5.2, 5.3 Following pages: Conclusive Matrix of Design and Health (Ken Yeang & Alan Dilani) with psychosocial design factors (that prevent stress) on the horizontal axis and health-promoting factors (SOC) on the vertical axis within the context of the salutogenic learning environment.***

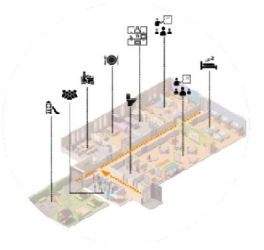
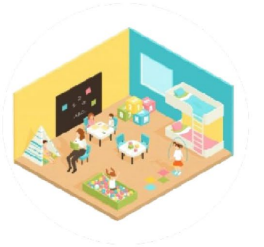
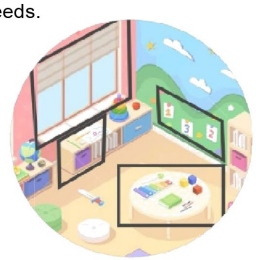
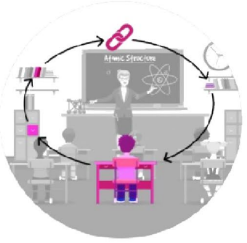
| SOC Prevent stress — COMPONENTS OF HEALTH PROMOTION | PSYCHOSOCIAL DESIGN FACTORS | | |
|---|---|---|---|
| | **LIFESTYLE** | **EMOTION** | **EXPERIENCE** |
| COMPREHENSBILITY "World is understandable" | Improve **LEGIBILITY** by creating unique identity of each block.  | Build **CONFIDENCE** through natural surveillance (esp corridors& toilets) to counter bullying.  | **WELCOMING** entrance, inviting, friendly and not institutional-looking or forbidding  |
| | **WAY FINDING** through clear sightlines and use of landmarks..  | **SECURITY** through transparency. ex. Landscaping and trees must be carefully chosen to not block sightlines.  | **VISUAL ORDER** through limited and clear navigational choices.  |
| | **PRIVACY** through provision of retreat areas in classroom or in corridors to observe others and be alone as well.  | **AUTHENTICITY & HONESTY** conveyed through use of natural materials and construction.  | Create **HOMELIKE** environment by using familiar elements.  |
| | Safe Community involvement through **ACCESS CONTROL**.  | Foster **AUTONOMY** by designing places with respect for scale and developmental needs.  | **TERRITORIALITY** to value personal space ex. Home base for every student (LOSD).  |



*Table 5.1: Design criteria with a view to strengthening comprehensibility in children.*

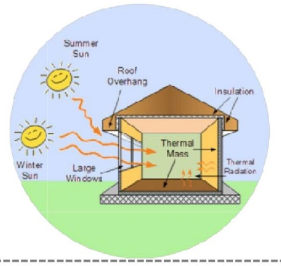
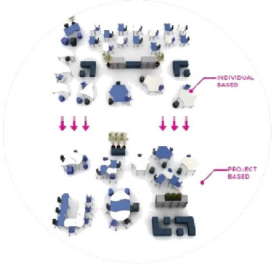
| SOC Prevent stress — COMPONENTS OF HEALTH PROMOTION | PSYCHOSOCIAL DESIGN FACTORS | | |
|---|---|---|---|
| MANAGEABILITY "Resources to meet needs" | **LIFESTYLE** | **EMOTION** | **EXPERIENCE** |
| | **ERGONOMIC DESIGN** for posture correction and efficiency in class room   | **REDUCE** learners' **STRESS** by the use of colours to facilitate vision and create a pleasant atmosphere and mood  | Create **BUFFER ZONES** from outside traffic and large school playgrounds to reduce noise disturbance  |
| | **SUSTAINABLE** / energy Efficient /**VERNACULAR** architecture to foster sustainable lifestyle.  | Ensure **COMFORT** in the Interior environment so children can concentrate on the task at hand ex thermal and acoustic   | Opportunities of **ACCESSING GREEN ENVIRONMENTS** in break periods in order to rejuvenate.  |
| | Improve accessibility and safety through the use of **UNIVERSAL DESIGN** principles  | **VISUAL STIMULI** by student work display fuelling better performance  | Participatory planning to boost **SELF EFFICACY** and competency.  |
| | **BUILD COMPETENCE** through flexible spaces suited for multiple modes of learning   | Allow **NATURAL LIGHT** into the classroom to uplift the mood and improve efficiency  | **ATTENTION RESTORATION** through outside / green views to allow minds and eyes to take a break.  |



*Table 5.2: Design criteria with a view to strengthening manageability in children.*

SOC Prevent stress

COMPONENTS OF HEALTH PROMOTION

MEANINGFULNESS

"Life makes sense"

PSYCHOSOCIAL DESIGN FACTORS

| LIFESTYLE | EMOTION | EXPERIENCE |
|---|---|---|
| Let **CULTURE REFLECT** by Using local materials and signature elements  | **LEARNING COMPASSION** by spending time with pets in the school garden.  | **AGENTIC LEARNING** environment to fuel belongingness  |
| Inspiration through **ENGAGING** and well designed **LIBRARIES**, performing /visual art areas  | Developing **EMPATHY** for other children through informal interactions  | **STIMULATING ENVIRONMENTS** appealing to all senses ex. falling water sound  |
| Intimate scale green spaces for positive **PEER INTERACTION**  | **AESTHETIC RICHNESS** through materials and furnishings in order to refresh and reflect  | **BIOPHILLIC DESIGN** to experience proximity to nature  |
| **GYM** and playground for **PHYSICAL FITNESS** and mental strength  | **SENSE OF PLACE** through display of student artwork in corridors and waiting areas  | **RISK TAKING OPPORTUNITIES** (perceived) to experience sense of adventure  |



*Table 5.3: Design criteria with a view to strengthening meaningfulness in children.*

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# THEME 6:

# CHOICE ARCHITECTURE AND SALUTOGENIC VALUE FOR SOCIETY

# CHAPTER XII

# CHOICE ARCHITECTURE AND SALUTOGENESIS

AVANI PARIKH AND DEBAJYOTI PATI

## Background

Can health-promoting and safe human behaviour be influenced through physical design? Can the perceptual response to a designed environment be engineered to influence spontaneous user choices? Can the perpetual gap between design intent and observed usage/behaviour be narrowed? Can physical design enhance health for individuals and communities?

Built environment professionals (architects, designers, planners, engineers) have an important role to play in implementing the design and health goals of promoting healthy actions. This chapter contributes to developing a new tool and shows how design elements in the built environment could be successfully used to influence healthy behaviours in diverse settings and contexts, multiple scales, and all population groups. Health and sustainable building standards (WELL, FITWEL, etc.) now play an important role in reshaping the building industry to address new health goals. Yet, there is a need for deeper research that understands user perceptions of their benefits. This is a key challenge for healthy development and includes taking a closer look at the principles used for ideal building standards and the actual responses of human beings to their built environments. In this chapter, a focus on human choice and agency offers the possibility for using design as a strategy that mediates ideal and actual building uses to help people lead daily lives that are healthy without making a deliberate effort to do so or being aware of ideal rules and following them.

As we now know that our genetic contribution to health is very much lower than our social/behavioural/environmental contribution, designers can have a deep impact on improving health if design is approached in the right way. Choice architecture, a new framework, claims our emphasis as designers should first be on how people experience and interact with the built environment because our experiences influence our choices which, in turn, could improve our actions and affect our health.[1] Its new idea is that the way to realise this orientation is to apply the principles of choice from economics to design. The role of design is to be a supportive element, enabling people to avoid unhealthy actions.

The mainstream theoretical approach in consumer economics since the 18th century has been rational choice based on costs and benefits. But, as it turns out, people do not always choose rationally. The foundations of a broader behavioural approach to human decision-making were laid out by Amos Tversky and Daniel Kahneman in the 1970s, for which the latter won the Nobel Prize in Economics.[2] Rational choice sometimes involves deliberation – an explicit analysis of net benefits – and is context-free, whereas behavioural choice is often spontaneous and contextual. In some situations, the former appropriately describes a person's decisions regarding behaviour and action and, in others, the latter appropriately describes the response. In fact, it could be argued that other than major life decisions, very few conscious human choices follow a rational cost-benefit analysis. It is the unique strength of choice architecture to extend both sets of ideas to architectural decision-making.

It is well-known that architecture influences our moods and behaviour and therefore our health. But as people do not always make healthy choices, it has seldom been clearly demonstrated exactly how this influence is realised. Understanding this process could help architects to design in ways that

promote health. Choice architecture is different from existing design approaches with its focus on the importance of the choices people inevitably make when they experience the built environment. These choices then impact their wellbeing in positive or negative ways.

More specifically, while the connection between design and health has been well researched, decision-making in architecture, interior design, urban design, and landscape architecture has been founded on the belief that users generally use some rational framework. The fact that in many cases the actual use of spaces does not reflect those intended in design underscores the role of choice-making beyond the rational choice framework. Simply put, the choice architecture framework can help designers create better engineered solutions with more precise predictions to reduce stress, improve wellbeing, enable human relationships, and promote safer settings in a self-sustaining way.

## A Choice-Based Design Framework

Experience is a key concept that mediates the relationship between choice-based design and health. This model leads to a scheme where the built environment influences human agents to act in meaningful ways. The scheme can be specified as:

*design element* – leads to – *experience / choice* – leads to – *action* – leads to – *health*

Design induces experiences and choices from which individuals choose an action that affects health positively or negatively. There are several rational and behavioural principles that govern how people make choices. These have been developed by economists and can be extended to gain a deeper understanding of architecture. While rational choices are made by optimising net benefits as applied to the user's own health (should I climb the stairs or ride an elevator?), behavioural choices (should I linger or move elsewhere?) are spontaneous and reflect factors such as relativity, status quo bias, non-linearity, framing, availability, anchoring, representativeness, reference point shifts, and others. A choice architecture framework offers an added layer of information during design decision-making that enables positive effects on health. For example, the presence or absence of factors in a specific context that influence user choices, leading to the use of a safe stairway or a light-filled room, can drive precise design decisions to improve health and wellbeing. The key is in understanding the factors that influence rational and/or spontaneous decisions in the use of designed spaces.

## Example: Representativeness and Design

This example focuses on one behavioural principle – representativeness – to show how the design of choices could be used to support health goals. We often make snap judgements about people, places, things, or events being of a certain type based on a few *representative* cues. These cues offer partial evidence that can lead us to draw stronger conclusions. As will become evident, this kind of stereotype-based thinking is common.

Here is an example from Thaler and Sunstein: "We think a 6-foot-8-inch African-American man is more likely to be a professional basketball player than a 5-foot-6-inch Jewish guy (Figure 1) because there are lots of tall black basketball players and not many short Jewish ones. Stereotypes are sometime right."[3]

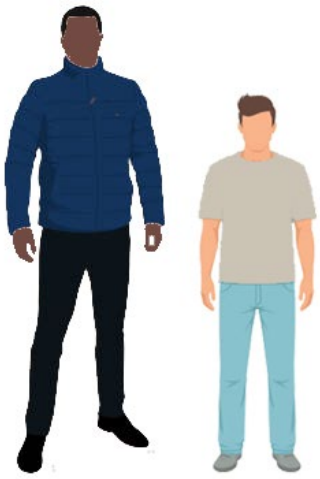

*Figure 1.[4] Snap judgements made based on physical attributes are common.*

This tendency works by linking a few chance attributes to our previous experiences or beliefs and results in quick judgements. All it takes to accomplish such a mental shortcut is a few significant and representative elements. Such cues could be used as rules of thumb if the corresponding meanings are warranted. When used in a positive way, the outcomes can be especially beneficial. For example, a building with wide openings and an accessible, barrier-free design (Figure 2) may, based on one's previous experience, get classified as a safe building, and can evoke confidence in users.


*Figure 2. Buildings with wide openings and an accessible, barrier-free design may get spontaneously classified as safe.*

Use of the representativeness heuristic in design was first introduced in Parikh's co-authored book.[5] It presents designers with a strategy to study how people choose healthy actions based on a few carefully selected architectural cues. For example, small changes in light, space, and safety could have a favourable effect on users, owing to the way such environmental cues would drive snap judgement about the space (Figure 3). Designers can employ this behavioural insight to evaluate their projects' design intentions against actual usage by users, by examining and utilising knowledge of stereotype-based thinking patterns of their target users. When designers grasp behavioural principles like representativeness, they can engineer their designs for the desired outcomes. The following examples present representativeness as a design strategy in a residential neighbourhood that signals a relative healthfulness.

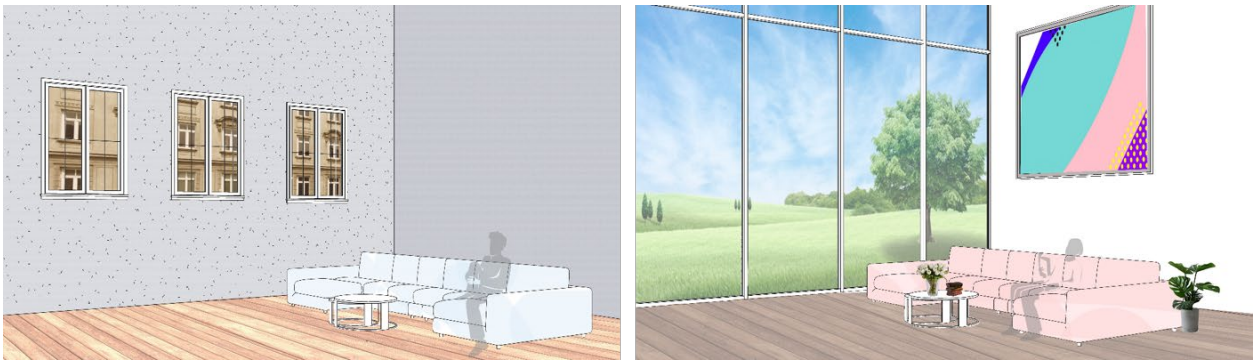

*Figure 3. Small changes in lighting and space can influence a user's snap judgement about a space.*

## A Residential Neighbourhood and Representativeness

### *Background*

Residential neighbourhoods reflect many kinds of development. Mixed-use residential neighbourhoods differ from single-zoned neighbourhoods. When their physical infrastructure is designed to impact the activity and behaviours of their residents positively, it can result in a significant number of them choosing healthier actions and lifestyles. The key is in identifying and incorporating the right cues for a target population.

We consider here a hypothetical neighbourhood considering affordable design measures to minimise childhood obesity. As is well-known, children's obesity is an international public health concern.[6] Physical activity is a factor influencing obesity.[7] The literature also suggests that parents only choose outdoor activities for children in safe neighbourhoods.[8]

### *The Design Problem*

Imagine a local government concerned with the health of its residents, specifically with childhood obesity. Assume it has two possible choices:

a) An upgraded network of streetscapes that would be perceived as safe, inducing confidence in parents to allow and encourage their children to engage in outdoor physical activities.

or

b) An upgraded park with amenities for outdoor physical activities. To make the park inviting, the city could upgrade the design and quality of the playground by adding new equipment for play.

Ideally, both are needed. However, it is not uncommon that funds are limited, and local governments consider various options to invest wisely. As the solution will affect people's actions and behaviours, the city examines both options, the habits of the children, and how they use the neighbourhood. Investing in a park is generally considered a positive investment towards increasing the physical activity of the residents. However, if the streets leading to the park are perceived as unsafe, the latter may not succeed in increasing physical activities. Parents, especially in low and lower middle-class neighbourhoods, may decide against encouraging their children to go outdoors, even with a newly renovated park, if the streets are perceived as unsafe. In essence, this example demonstrates a case of rational choice-making by the local government to influence spontaneous choice-making by the residents: whether to be outdoors or not would depend on whether people classify the streetscape as safe or not.

What cues are crucial to spontaneous classification of a street as safe? There are numerous examples where a local government could invest limited funds to include protection from driving cars, protection from possible trips and falls on uneven walking surfaces, a pleasing appearance, trees and greenery, street furniture, access and opportunity, visibility, sidewalk width, park equipment, and security, among numerous others. Which area of investment would instil confidence in parents to encourage their children to be outdoors?

### *The Design Solution*

Representativeness is the behavioural insight where the human tendency to make snap judgements based on a few cues affects how things are judged by users. In a neighbourhood that aims to signal safe activity to its residents, design elements that are representative cues for safety offer a simple design solution to enhance active living. Affordable and stereotypical cues in the physical environment can ensure that physical elements create a perception of safety and affordance of physical activity. It should be noted that both dimensions – perceived safety and affordance of physical activity – need to be addressed in a rational decision-making format. There is literature supporting the positive associations of both domains with social life.[9] The presence of people on the street results in a perception of safety, and human-scale environments with associated affordances attract people.[10] The focus of rational choice-making, however, as noted earlier, needs to be on physical cues that influence spontaneous choices by the target end-users. The question is which cues to invest in.

The specific cues to invest in would depend on the socio-cultural-economic characteristics of the targeted end users. General associations between physical cues and behaviour are available in the published literature. For instance, the CPTED (Crime Prevention Through Environmental Design) literature suggests several environmental cues including perceived territoriality, perceived surveillance, lighting, furniture, and connectivity among others to influence crime and hence perceived safety.[11] Similarly, design features that emphasise the human scale and de-emphasise the vehicular scale, accompanied by other features, have been shown to be associated with human activity (Ewing & Handy, 2009).[12]

Returning to the local government's choice problem we see both sets of cues are feasible: (a) either designing/adding cues to neighbourhood streetscapes to influence people's snap judgements regarding street safety or (b) adding colour, better equipment, and attractive litter bins in the park, signalling affordances for active play, shared space, and social support. But while both sets of design elements are affordable and representative of a health-promoting environment and trigger an active lifestyle, thereby addressing the problem of children's obesity, rational decision-making by the city may dictate that focusing on streetscapes to trigger positive snap decisions by residents could work as a safe path to more immediate physical activity, as well as a greater use of the park. That is, adding representative cues to the streetscape offers the two-fold advantage of increased physical activity on the street together with greater use of the park, whereas adding representative cues to the park offers only the latter.

Cues such as wide pavements, sports-type sensory materials, and well-designed street lighting may signal safety and normalcy in the public domain, and may work in dual ways: first as infrastructure-supporting functions (street lighting, wide pavements, etc.) and second as representativeness signalling approachable, usable, and safe surroundings (visibility and safety, cleanliness, and health). Such cues could prompt parents to encourage outdoor activities and address the issue of childhood obesity. This simple strategy works as the stereotypical design elements override extraneous design elements and create a positive meaning for the neighbourhood, especially its children. An added benefit is that it is age-friendly and encourages the elderly and other residents to be active users as well (Figure 4).

*Figure 4. Design strategy in a residential neighbourhood that may signal safety.*

Of course, using a generic checklist of solutions may or may not work in all situations as the cues needed to trigger a positive spontaneous stereotyping response may vary depending on social, cultural, economic, and other factors. Not all public places with a design intent to attract people have been successful.[13] There may be many factors leading to a mismatch between design intentions and actual use of a space/place. Some have been examined, such as those identified in the seminal work of William Whyte,[14] followed by many other studies. However, factors that have never been examined by the design community are those that influence snap stereotyping by intended users/consumers, thereby leading to spontaneous decision-making. It represents an area ripe for examination, which may provide designers and owners with an additional toolset to ensure a closer match between design intentions and actual usage. Such empirical studies can then feed back into the design process for future refinements. Crucially, better matching constitutes a fundamental driver of successful organisational and economic processes, to which the choice architecture framework may make a substantial contribution.

## The Scope of Choice Architecture

In our example, cues incorporated to support the snap perception of accessible, usable, and safe surroundings are relatively meaningful to users when associated with their stereotypical qualities. This is a principle of choice architecture, enabling better design decision-making generally, as well as specifically, for the example explored here pertaining to childhood obesity and other health issues. In fact, there are several other behavioural principles besides representativeness that can be put to work. Together they contribute a new set of tools for building healthier built environments and shaping people's lives. Behavioural economics and choice architecture allow for studies of how people choose one action over another. It asks how subtle changes in design, light, space, greenery, etc. motivate people to make a desired choice.

The relationship between human health and material design is not always proportional. More objects do not actually make us healthier. Here, choice architecture shows that the physical environment has a role to play in our different choices of actions involving physical activity, social interaction, and emotions, each experienced through design elements like streets, public parks, neighbourhoods, residences, etc.

The theory of change in choice architecture is about passively encouraging people to promote their health without any conscious deliberation via appropriately targeted design experiences. The built environment and its design can then trigger a more holistic set of spontaneous, health-promoting behaviours. A potent strategy to enhance health-promoting behaviours is to use a model of human beings as broadly spontaneous choosers. The choice architecture framework can reduce the hypothesis-outcome gaps in design, which are costly. Design is the mediating element in improving outcomes and bringing designers and users closer to desirable solutions. It influences a more holistic

set of health-promoting behaviours, drawing upon studies of how people choose to act in different environments.

Indeed, choice architecture can be connected with the traditional Vitruvian triad of utility, firmness, and beauty as a framework for the different dimensions of architecture by incorporating health in each of these aspects. For example, a new streetscape can add health via utility by offering scope for physical activity, via firmness by offering better infrastructure for movement, and via beauty by offering attractive elements for play.

Finally, choice architecture offers a tool that is measurable, cost-effective, addresses multiple issues, and is flexible. It reduces the intention/outcome gap between the ideal and the actual use.

Salutogenic design thinking is key to relating design with wellness[15] and choice architecture may be one way to realise its aims, by providing thoughtful choices to end-users, and potentially creating the conditions for people to voluntarily adopt health-promoting behaviour change in a variety of social and cultural settings.

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# CHAPTER XIII

# THE IMPACT OF DESIGN ON INTELLECTUAL CAPITAL (IC) AND SOCIETY 5.0: CREATING AN 'AHA'

LEIF EDVINSSON

Many years ago, on my way home after a long working day at Skandia Future Center, I experienced an *'aha*.' I was full of energy and spirit! After so many hours of work, how had the workplace provided me with energy rather than drained it? What an impact! Was this down to the effects of salutogenic design?

**Where and how do we learn to think of work design?**

One of my key learning aspects as a student at Berkeley University was to 'learn to think.'

Skandia Future Center in Stockholm was designed to be a workspace for 'futurising': a space for organizational design prototyping. It opened in May 1996 as the World's first future centre and was situated in an old wooden house in the archipelago outside of Stockholm. Initially, it was full of high-tech devices which were gradually supplemented by older antiques, such as old mechanical typewriters. Old tech was impacting the mind's rhythms positively in among the fascination of high tech.

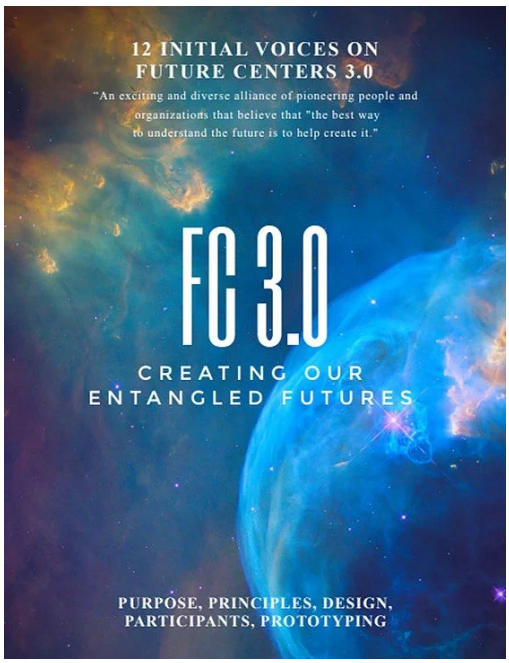


*Image 1: Voices on Future Centers.*
https://www.futurecenteralliance.com/home
https://issuu.com/simoon04/docs/fc_3.0_final_small

This 100-year old technical device was designed to help typesetting. Today we would use Google or AI based voice systems but, 100 years ago the design needed to ensure the tangent would not jam during fast typing, so they had to design the keyboard based on calculations of the optimal frequency of typed letters. The writing speed had to be reduced from the optimum of finger-touching. The standard design of a keyboard was born and was called *QWERTY*. The paradox is that this standard is still applied and, more than 100 years later, it is on my mobile phone and iPad! The lesson might be that 'the standard' remains for an exceptionally long time, despite shifts in context.


*Image 2: Old Antique Typewriter.*

What other design or architecture do we find surrounding us despite it having become 'over mature'? The shape of a car? Motorways for traffic flow? The design of offices, classrooms, prisons, or hospitals? Forestry harvesting without focusing on the eco-system of its cell communication?

**How do we nourish salutogenic architecture and design for wise spaces?**

The *International Academy for Design and Health*, founded by Prof. Dr Alan Dilani, is pioneering several elements around these questions. The very first step might be a deeper understanding of the above-mentioned 'aha,' followed by extended cross-disciplinary dialogues for a long-term and holistic understanding of sustainability.

**IA - Intangible Assets**

Intellectual capital is often perceived as 'soft' and sometimes even hidden. Modern economics has labelled it as intangible, both in terms of assets and liabilities. The deeper meaning is perceived insights into head value. Capital is not only money. The main city in a nation is also known as the 'capital,' for example.

**Where do you find your intangibles?**

Think of a common agreement about driving a car on the 'right' side. Such a common agreement would reduce traffic accidents. This is a societal design asset of order. Now think about the impact of stress in the workplace, which might be ruining the health of employees. This might be an illustration of rule-making or management that is developing the work eco-system into a 'soft' intangible liability.

A whole new paradigm is emerging from multidisciplinary dimensions of such examples. It is called intellectual capital, or IC, and can also be simplified to '**the roots for the fruits**.' It's also labelled as the impressive and often vast network called 'my cell under the trees.' Design and architecture are at the core of these IC dimensions, as drivers of attention, appreciation, interest and curiosity, desire to buy and consume, or act. Value is the driver for the interrelated and tentative transaction.

Where do you find your intangibles? The taxonomy emerged, among others, in Skandia in the quest for visualizing, describing, and measuring hidden assets in the early 1990s. I was appointed globally as the very first Director of Intellectual Capital. We identified billions of Euros, often based on acquisition cost or replacement costs, but the major value was in the strategic inter-dependence of the impact of these value drivers. So, we developed a taxonomy and a video tape to describe those intangibles.

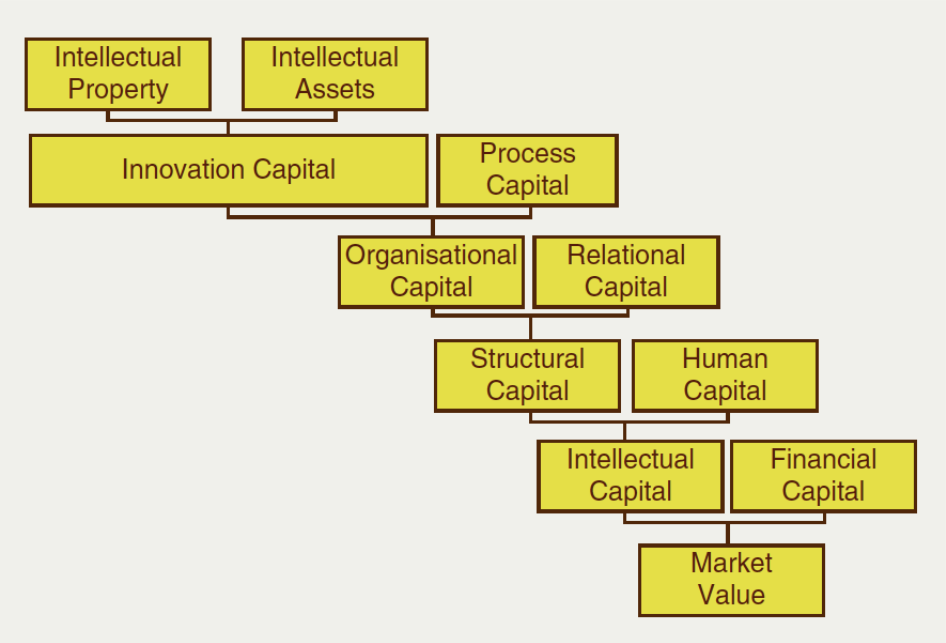


*Diagram: Value scheme original from leifedvinsson@gmail.com*

That pioneering initiative has since impacted global accounting systems, such as IAS 38, the Innovation Standards ISO 56002, and Knowledge Management Standard ISO 30401.

Based on the taxonomy, we can start to design systems to leverage these options, including the use of artificial intelligence (AI). This goes for health-care systems as well as management.

At WHIS (World Health Innovation Systems) in the UK, prototyping is taking the place of apps for digital systems to be used in patient care. Early such prototyping emerged in 2012 in Silicon Savanna, Nairobi, Kenya, for digital access to health-care in the Sub Sahara. Numerous companies in many nations are now riding high on the digital entrepreneurship wave with digital devices. They must be integrated into larger purpose engineering of an eco-system for health. Otherwise, the costs will escalate beyond funding capabilities.

In designing these options, we might look at the larger societal meta-system, the organizational level, or individual health-care.

The accounting system as a way of mapping wealth and value creation has existed since at least 1494 when Pacioli launched the double-entry bookkeeping system, almost equivalent to the *QWERTY* standard. We are still navigating value creation based on that mapping design.

Since then, value creation has been more and more about cost. Today, we are moving towards experience value, which could be seen as even more ‘soft’ when it comes to values being monetized. One fascinating dimension is that the value drivers are increasingly in networking and relational capital, also referred to as networking effects, like in neurology. Under the old taxonomy, this might have been called sociology. Now it is illustrated by Amazon, Google, Tencent, Alibaba, or Baidu from China, and Recruit or SoftBank from Japan.

Perhaps it might be seen as a value shift from tangible to a softer impact effect. Spotify is a 15-year-old enterprise which started in Sweden and has a customer engagement of more than 345 million visitors per month. They have designed a philosophy called 'positive active,' building on personal, emotional, and active connections.

Some might argue that we are moving towards appreciating human capital more for its dynamic ingenuity. It might as well be the opposite: how to replace human touch with avatars. Recent experiments at Lund University show the appreciation of participants when going from Zoom meetings into the avatar-based gamification of learning systems.

The core cost is increasing with the technology involved but the dissemination of knowledge is multiplied. The balancing point might be in dissemination versus complexity. Sometimes, simplicity in design offers intrinsic value. Prof. Dr Sugata Mitra experimented with the colloquial design of a school as a hole in the wall. That system design provided a higher speed of learning in the classroom in rural India than in university classes at MIT in Boston, USA.

What you start to understand here is the navigating of the 'IC multiplier combo effect' of human capital, multiplied by the impact of the network's technology. This is also referred to as design of the extremely critical OC, or organisational capital, illustrated by Amazon as well as IKEA. A similar effect is emerging in Spotify as well as in the mass vaccination of citizens.

This effect and impact were visualised by Nonaka & Konno in the SECI model. It's a spiralling effect described as being like the whirling steam from a teapot. It is rising and going beyond perceptions of the circular economy. The space of the teapot, in a tea house, is often referred to as a 'ba' — an elevated place for knowledge-sharing in many dimensions.

Where do we find such a space today? Seldom in traditional offices or shopping centers. More in so-called knowledge cafes, which we had started to experiment with at the Skandia future Center. The multiplier and spiraling effect is the purpose of these kinds of spaces and is also referred to as 'interactive purpose engineering' in Japan, by Noburo Konno. Another way to express it, is as the 'meaning-making space', going beyond the individual participants towards a more spiritual capital knowledge exchange. A giant step from the initial stock exchanges at the Hay Market in London in 1700.

The design of Society 5.0 is now in progress, especially in Japan, as described by the JIN-Japan Innovation Network and Professor Noburo Konno. It is a process of merging from physical space to cyberspace. The hope is that it will balance economic and technological advancement with super-intelligent AI systems (IoT). For more on this, see Dinis Guarda in www.intelligenthq.com and Forbes.

### Some further inspirational questions

- Who and where are the architects, systems designers, or coding talents of Society 5.0?
- What military intelligence and defence systems will add to the SDG (sustainability development goals) with the impact of the generations that are to follow?
- How can we orchestrate and synthesize the complex spaces of both visible and invisible network threads in the 'my cell' of Society 5.0?

For complex navigation, we need to train our understanding all the way from the individual level in the young generation, to the meta-level of higher purpose for a salutogenic literacy understanding, or meaning-making 5.0, based on salutogenic design. In New Club, Paris, we see it as agenda-setting in a knowledge society (see link below).

Major salutogenesis might appear in the multiplier effect mentioned above. It is multidisciplinary design, from soft to hard, from object to relationship, from economics to neuroscience. Some of the impact is in the monetizing of that multiplier effect, but it is also much more multi-dimensional than just that. The recently started project with the LEF Future Center, on positive cartography, which is searching for salutogenic dimensions, might provide further inspiration.

A saluogenic design approach should be considered as important intellectual capital in our cities and societies. In cities, it can create landmarks as intellectual capital for the purposes of creating mind maps to facilitate easy navigation, thereby improving quality of life by reducing stress and promoting health and wellbeing.

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# THEME 7:

# IMPLEMENTING SALUTOGENIC DESIGN IN AFRICA

# CHAPTER XIV

# SALUTOGENESIS PHILOSOPHY AND ITS INFLUENCE ON A POST-COVID-19 ERA IN AFRICA

INNOCENT OKPANUM

## 1. Introduction

The current public health pandemic due to COVID-19 has underscored the importance of access to a high quality physical built environment based on a salutogenesis philosophy in Africa. Indeed, the pandemic has exposed the weaknesses and threats in the design guidance used in most physical built environments globally and, in particular, in Africa. It is now time to look towards design philosophies and theories that can promote a healthy lifestyle and support health and wellbeing.

The World Health Organization (WHO) defines a health system as "all the activities whose primary purpose is to promote, restore, or maintain health" (WHO, 2000:5). A health system includes the institutions, actors, and resources related to the provision, financing, and regulation of health actions, whereby a health action is defined as "any set of activities whose primary intent is to improve or maintain health for all" (Murray and Frenk, 1999:4).

Salutogenic design supports health promotion and wellbeing. In 1997, the World Health Organization identified the health “arena” as including priority settings and frequently used spaces such as:

- Workplace.
- Schools.
- Hospitals.
- Correctional institutions.
- Commercial offices.
- Public spaces within our towns and cities.

Indeed, especially in our homes, salutogenic design should be at the centre of health promotion activities in the 21st century.

The aim of this chapter is to assess the role of a salutogenesis philosophy in the development and provision of the physical built environment, and more specifically to assess their role in the design of buildings in Africa. It also makes recommendations on how to improve their design and project development processes (Figure 1.1).

*Figure 1.1: Architects: Ngonyama Okpanum and Associates. Proposed Fidelity Bank Headquarters, Lagos.*

### *1.1 Overview of Salutogenesis Philosophy*

The basic assumption of this chapter is that the use of salutogenesis design philosophy can improve the design of the physical built environment in Africa, which is essential to the achievement of "the right to health for all," as recognised in the Universal Declaration of Human Rights and several international human rights instruments, covenants and consensus documents.

Moreover, a majority of state governments in Africa have committed themselves, to varying degrees, to implement the "right to health," including the right to access a healthy lifestyle, and goods and services. This is provided for in their respective constitutions.

## 2. Concepts

The client or the institution's vision for a physical built environment project should be supported by a research-based design philosophy and conceptual framework, as well as a sound theoretical framework. A comprehensive understanding of the institution's vision, mission and aims, supported by a conceptual framework, theories, and design philosophy is important for the success of the project's development and implementation processes (Figure 2.1).

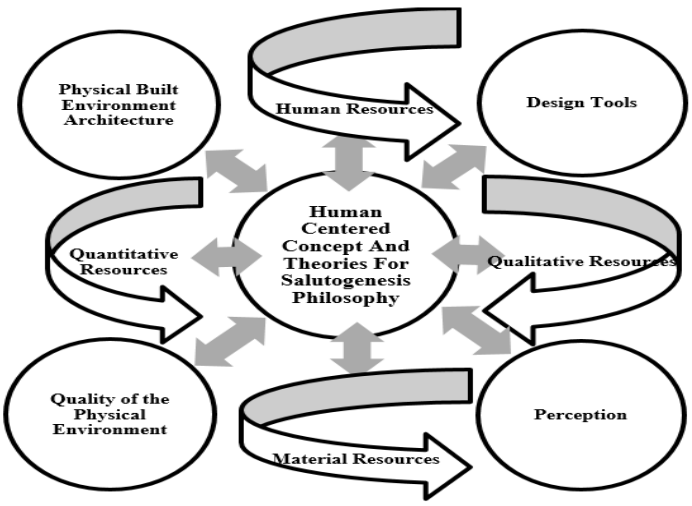


*Figure 2.2. The design concept model for a human-centred concept, and theories for salutogenesis philosophy.*

The project vision defines the conceptual framework, theories, and key goals of the project. Moreover, the project vision also defines the general and specific requirements in salutogenesis design philosophy used for space design and space provision, spatial relationships, functional suitability, and the efficiency and effectiveness of the spatial utilisation. The current model and systems for project development processes for the physical built environment in Africa are often based on an *ad hoc* approach without a clear understanding of critical features of the place. For example, issues related to human-centred design; culture; traditions and customs; urban design; architectural vernacular; landscape design; interior design, textures, and colours are generally not adequately considered through research (Figure 2.2).


*Figure 2.2: Pathogenesis in Sub-Saharan Africa.*

The current public health emergency due to COVID-19 therefore offers a great opportunity to change project design and implementation processes in Africa based on a salutogenesis philosophy. A salutogenesis perspective, as explained below, is a research-based project design approach that requires the development and introduction of an appropriate continuous evaluation and monitoring of the tools to be used during the design, construction, and operation phases. This process is essential to ensure that the physical built environment vision and objectives are fully met.

## 3. People

Salutogenesis philosophy, and its conceptual framework and theories used for built environment projects in the African cultural and socioeconomic context, to influence people's daily activities, should be research-based. It should also show an understanding of the client's or institution's vision and objectives. It is necessary that the design consultant assists the client or the institution in defining the vision and objectives of the physical built environment, which should be based on salutogenesis design principles and be influenced by the lifestyle needs of the community and its people. This new approach for physical built environment design in Africa is currently recommended for use in planning and design development, and for project implementation systems, commissioning, and post-occupancy evaluation. Indeed, evidence found in the literature argues that a physical built environment developed on the basis of salutogenesis philosophy provides measurable improved positive health outcomes. Salutogenesis design principles can definitely positively influence these key issues: safety; comfort; way finding; user satisfaction; social interaction; cultural interaction; political interaction; economic interaction, and other multiple activities within the physical built environment.

Venice, Rome, Florence, and Siena in Italy are very good examples of cities designed based on salutogenesis design philosophy. In fact, we become like children once in these cities.

Some German cities like Hamburg and Frankfurt are now using salutogenesis philosophy to improve their respective central business districts with good positive health outcomes. The design of these cities is focusing on improvements to apply psycho-social design factors that influence people's attitudes and lifestyle behaviours for better health outcomes.

In Africa, salutogenesis design philosophy is not widely publicised. Physical built environment design still focuses on the use of design theories that encourage vehicular movements over pedestrian and cycle paths.

### *3.1 Lack of Opportunities for Youth Employment*

A salutogenic design approach should be considered in most cities in Nigeria, South Africa, Kenya, and other African countries. It is important that salutogenesis design philosophy is taught in all departments and faculties of environmental design in Africa to ensure that new cities and buildings are designed based on this philosophy. In fact, the use of outdated design philosophy in Africa has significant implications for the very high youth unemployment rate. The African youth population is negatively affected by the use of poor physical built environment concepts and theories. In Nigeria, the youth unemployment rate is currently 33.3%, and in South Africa, it is currently above 55.97%. Youth unemployment in Kenya is currently above 17.6% depending on the type of data analysis obtained from key economic indicators of Kenya.

### *3.2 Salutogenesis Design Philosophy and Opportunities for Youth Employment*

Human-centred city design based on salutogenesis philosophy could improve youth employment rather than focus on gated residential estate concepts and theories that are now common in most urban settlements in Africa. The use of wide-ranging types of design philosophy, responsible for encouraging class segregation and urban settlements reminiscent of correctional services, denies people the opportunity to walk through their own cities which could create positive social, cultural, political, and economic interaction with their physical built environment. Salutogenesis design philosophy encourages the design of cities with lots of social, cultural, political, and economic values. It is when we walk through our cities that we appreciate the enormous benefits of the positive social, cultural, political, and economic values that can take place within our physical built environment. The architecture of our cities is capable of generating positive interaction within a defined geographical place.

Indeed, a salutogenesis philosophy approach should be adopted in the design of cities in Africa. This approach is based on human-centred design philosophy for the reasons outlined above. The architecture of our cities should focus on human-centred space design, space provision, space articulation, and functional suitability that will encourage positive and happy interaction for all. The concepts and theories for city environments should be an integrated network of dwellings, workplaces, shopping, sports, and leisure places which should be social, cultural, and economic centres. In contrast, in most cities in Africa, homes are surrounded by high and ugly walls for security reasons, thereby denying people the opportunity for meaningful social, cultural, and economic interactions to take place within the built environment (Figure 3.1).

*Fig 3.1: The effect of poor leadership on the built environment in Africa encourages youth unemployment. A gated residence with an ugly and tall wall.*

The first question to ask is: “Who are we afraid of”? The second question is “Why do we need these high and ugly walls?” The answers to the first questions are as follows: We are afraid of our children neglected by our elected government due to poor leadership. The answer to the second question is: We build high and ugly walls to secure our homes from our children who are now criminals due to a lack of employment opportunities. This raises another question: How can we ensure a better life for our children in order for them to become good and better citizens? The answer is once again simple: The process of leadership selection or election must be transparent and rigorous. Indeed, it is through quality leadership that serious and accountable institutions are built.

## 4. Leadership

The management and efficiency of any process relies on the characteristics of the key actors, institutions, operating environment, communication strategies, information systems, and the quantity and quality of relationships and social interactions. Based on this analysis, it is important that strategies are developed to continuously innovate the concepts and theories used for the physical built environment in Africa, taking into account these key issues: moral values; ethical values; and the conservation of the surrounding natural environment.

The leadership role can serve as a catalyst to encourage the search for optimal solutions in a physical built environment that will enhance the geographical place's efficiency and responsiveness to people's needs, as well as the social and economic values for user satisfaction. From the above, it is clear that the key variables for space design can be influenced by the introduction of benchmarking tools for monitoring the project development process and the extent of the use of the design tools for physical built environment projects in Africa. Indeed, the challenges and problems related to moral values and ethical issues can be addressed using design tools in salutogenesis design philosophy. The concepts and theories used for space design and provision, functional suitability, and spatial relationships can be a catalyst for organisational change through the calibre of the leaders chosen to lead this process.

### *4.1 Leadership and Salutogenesis Design Philosophy*

Evidence from comparative literature argues that lack of quality and purposeful leadership in most African countries is the reason it is difficult to develop a high quality physical built environment necessary for human development.

The important question that should be asked is: "How do we address this current issue relating to the lack of high quality physical built environments in Africa?" Obviously, the simple answer will be through the adoption of a salutogenesis design philosophy and through purposeful leadership. The concepts and theories used for physical built environments can address these multiple issues: massive youth unemployment, poor moral and ethical values, and poor attitude and behaviour in our society.

Cities designed with an emphasis on salutogenesis design philosophy stimulate the creation of multiple private businesses that are the engine room for youth employment. Indeed, the impact of COVID-19 in most African cities is huge due to the poor physical built environment. COVID-19 will continue to change the social, cultural, political, and economic imperatives of most African countries. In fact, the effect of the current public health pandemic in Africa is still grossly underestimated. The real effect of the psychosocial factors of COVID-19 on the African population may not be known for years due to the lack of accurate data. However, the current state of the physical built environment in most countries in Africa provides an enormous opportunity for the leaders through salutogenesis design philosophy for a post-pandemic era in Africa.

## 5. Salutogenesis Philosophy and Urban Settlements

In Nigeria, the number of housing units required is more than 21 million. This figure is even greater in other African countries. The housing crisis presents a unique opportunity to address the issues relating to the poor, bad and ugly physical built environment currently in place in most African countries. But the main aspect of this problem relates to the adoption of an appropriate design philosophy that will provide correct solutions to the problems.

"Indeed, architecture should promote good health through quality spaces, good space utilisation and its spatial relationships based on a system of rules which is imposed by certain functional obligations that must be efficient, effective, flexible, adaptable and responsive to the needs of the communities" (Okpanum, 2010).

Certainly, salutogenesis philosophy, concepts, and theories, as argued and considered below, could be the solution to the design of quality urban settlements in Nigeria and in Africa at large.

### *5.1 Reflection 1 on Salutogenesis Philosophy*

According to Aaron Antonovsky (1979), we should look for wellness factors instead of risk factors in all human activities. In fact, the health theory of salutogenesis is in contrast to the pathogenic orientation that dominates the architecture of the physical built environment in Africa. The architecture of the physical built environment plays a critical role in the health of its inhabitants. A poorly designed physical built environment leads to stress factors which are the main cause of psychosocial diseases and other ailments. Indeed, the quality of the physical built environment can increase the happiness index of the inhabitants based on hard evidence obtained through research. Therefore, the architecture of the physical built environment can influence one's happiness index as a non-verbal means of communication that is vital for the quality of the health of the community.

### *5.2 Reflection 2 on Salutogenesis Philosophy*

Alan Dilani (2015) argues that pharmaceutical industries and medical science have been focusing on factors that cure diseases, rather than on factors that lead to disease, therefore focusing on pathogenic philosophy rather than on salutogenesis philosophy. This is a plausible argument since most professionals in the built environment in Africa focus primarily on the architecture of site rather than on the architecture of place. Indeed, the architecture of place determines what the architecture of the site should look like and how the natural environment of the place should play a meaningful role in determining the architecture of the site based on salutogenesis philosophy.

### *5.3 Reflection 3 on Salutogenesis Philosophy*

Architecture can shape our ways of existence through the choices we make. It can be argued that our lives are continually being shaped by the choices we make, and the convictions and values that underscore them. For example, the poor social, cultural, and economic conditions of most African countries may be attributed to the poor status of the physical built environment in Africa.

The theory of salutogenesis influences our individual and collective choices positively for a better lifestyle, which is in contrast to the pathogenic orientation that dominates the current architecture of the physical built environment in Africa, with devastating effects on the lifestyles of those living in the communities. The architecture of the physical built environment plays a critical role in the health of communities.

Certainly, the non-communicative language of architecture sends a powerful message about the identity of the community, no matter the social class of the inhabitants of the geographical place. This argument might be taken for granted, but it is important that what we see, touch and communicate with, in terms of spatial arrangement and the spatial organisation of our geographical places, must be meaningful and powerful to us. According to Lawson (2001), Wittgenstein argues that “where there is nothing to glorify there can be no architecture”. This is a powerful statement with deep meaning that the leaders in Africa must reflect on and consider when making important decisions about the architecture of the built environment in Africa.

The spatial design of any geographical place must be a source of inspiration to its users. It is through the architecture of the physical built environment that we can daily interact socially, culturally and economically with one another. Okpanum (2021) is of the opinion that the “architecture of the physical built environment is a dynamic artefact and should be a source of positive inspiration for the users. Architecture of the physical built environment should inspire us and architecture of the physical built environment can also cloud our ability to learn as spatial arrangements and composition are based on our sense of knowledge, wisdom and judgement.

“Architecture of the physical built environment should inspire positive experience to the users through spatial arrangements and compositions for creativity and innovation to happen continuously”.

### *5.4 Reflection 4 on Salutogenesis Philosophy*

In a way, our lives are like works of art: they are what we make of them, and they ‘say’ who we are. Indeed, the status of the architecture of our physical built environment can influence positively or negatively our attitudes and behaviours, thereby affecting the quality of our lifestyle and our ‘lifeworld.’

The theory of salutogenesis influences the social, cultural, and economic imperatives of the architecture of the physical built environment positively, creating better lifestyles for the inhabitants. This is in contrast to the pathogenic orientation to which the poor-quality lifestyles of most communities in Africa can be attributed. Indeed, there can be little or no positive developments in slum urban settlements in Africa through the latter orientation.

Okpanum (2021) argues that the architecture of the physical built environment defines us and engages us at all times and can bridge or worsen the gap between the different classes in our society. The architecture of the physical built environment is the engine of the society which influences and determines the rate of growth in our cities. The architecture of the physical built environment determines a city's economic growth in terms of monthly internal-generated revenue.

What is the relationship between the architecture of the physical built environment and its monthly internal-generated revenue? Through various interactions of the physical built environment, social, cultural, and political activities can happen. Social, cultural, and political activities are the catalyst to major economic activities in various forms within a community. For example, Singapore has no natural resources but has good architecture in the city and more economic growth through monthly internal-generated revenue than any city in the developing countries that have enormous natural resources and bad city architecture.

## 6. The Key Dimensions of Salugenesis Philosophy

As has been argued above, salutogenesis theory is now gaining recognition by designers in all fields of the physical built environment and salutogenesis design, as:

1. A proactive approach to health promotion and prevention through the quality of the architecture of the city.

2. A characteristic condition that determines a person's abilities to cope with various stress factors which are determined by the person's sense of coherence, defined as follows:

A) **Comprehensibility**: *Language games, information, and communication.*
B) **Manageability**: *Human, financial and material resources.*
C) **Meaningfulness**: *Passion, attachment, participation, involvement, and identity*.

## 7. New Systems and Processes for Developing Built Environment Projects

The introduction of systems and processes for physical built environment projects in design, construction, and operations are capable of generating intelligent information systems. These can be standardised to ensure replicable good practice for physical built environment projects in Africa. These should obviously be based on local dynamics and the geography of the natural environment, which will dictate the type of design concepts that are appropriate for each geographical location and site. It is important that the natural environment imperatives are considered during a project's vision, aims, and objectives stages.

The chosen systems and processes should be informed by a salutogenesis design philosophy and through interdisciplinary processes, as illustrated in Table 7.1.

| Owners | Users | Consultants | Researchers |
|---|---|---|---|
| Government<br>Board members<br>Chief executive officer<br>Chief financial officer<br>Chief of staff<br>Medical director<br>Key managers<br>Foundation<br>Marketing<br>Operations | Patients<br>Family members<br>Caregivers and staff<br>Clinicians<br>Physicians<br>Community<br>Infection control<br>Quality improvement managers<br>Information systems managers<br>Medical records managers<br>Facilities managers | Project managers<br>Medical planners<br>Interior designers<br>Architects<br>Landscape architects<br>Operations experts<br>Engineers<br>Construction managers<br>Wayfinding and art experts<br>Philanthropy managers<br>Vendors | Academic researchers<br>Student researchers<br>Professional researchers<br>Internal researchers<br>Staff support<br>Quality improvement<br>Finance<br>Records<br>Information systems |

**Table 7.1:** ***Interdisciplinary project team participants. Source:*** **Adapted from The Center for Health Design (2009:8).**

Indeed, the conceptual and theoretical framework used for the project design and the project implementation processes should be determined by the vision and objectives, and dictated by a human-centred design philosophy. These processes are now imperative during a project's briefing, in order to avoid the mistakes made in physical built environment projects, exposed during the Covid-19 pandemic.

These systems and processes must provide all necessary tools to be used by the design professionals to encourage the use of salutogenesis in the built environment. Undoubtedly, these design tools are now urgently needed in Africa to improve the physical built environment and provide youths with much-needed employment opportunities.

It is important to introduce benchmarking tools for space standards, and functional layouts based on ergonomic studies, through research-based procedures, systems and processes, as illustrated in Figure 7.1.

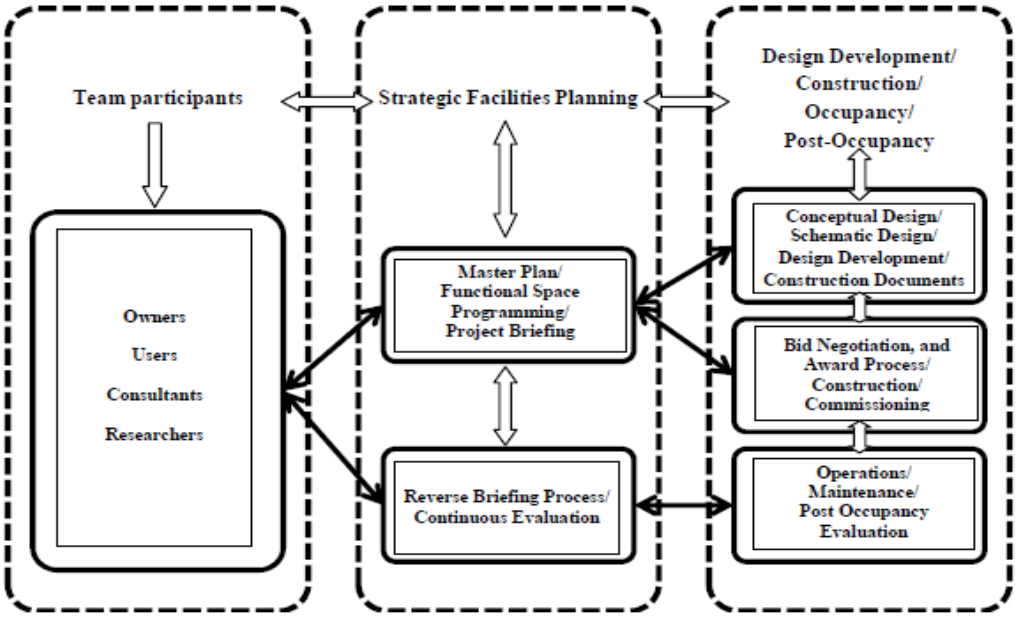


*Figure 7.3: The role of the interdisciplinary team in the project development process.*

When the geographical place is in Africa, it is important to recognise the need to design a physical built environment with the systems and processes described in detail above. Africa is an incredibly beautiful continent, and her built environment must equally respond to her natural beauty. The beauty of African countries should be inseparable from the concepts and theories found in salutogenesis philosophy, especially in a post-COVID-19 era.

Surprisingly, in Africa, the design of the physical built environment contradicts the beauty of the geographical places. This section of the book highlights the need for and importance of architecture and architectural languages that should be used in Africa in the post-COVID-19 era.

### *7.1 The Importance of an Architectural Language of Place*

Unfortunately, authentic historical African vernacular architecture (Figure 7.2), which was spontaneously based on salutogenesis philosophy, just like ancient Greek architecture, is no longer fashionable, and was replaced with Western and Asian inauthentic eclecticism, alien to Africa's natural environment.

*Fig 7.2: Architectural languages of KwaZulu-Natal province South Africa. Thatched roof building standing on posts.*

The site's natural features, which had a major influence on the choice of the design philosophy, concept, theories, and design development and the project implementation processes, have now been abandoned. The languages of "international architectural styles" are now used extensively in Africa, with a major effect on her natural geographical beauty. Africa's built-environment consultants' obsession with "international architectural styles" means they are simply copied verbatim, without research, contributing to the poor architectural concepts and theories used today in the developments of physical built environments in Africa.

Indeed, poor integration of "international architectural styles" with the natural features found in each geographical place, and at times dictated by most clients, has done irreparable damage to Africa's landscape. Nowadays, site features are relegated to an abstract substance and are not an integral part of the design brief, design initiation, and design development processes. Moreover, based on information gathered through comparative studies from experience and in the literature, the lack of experience that architects and designers have in salutogenesis philosophy is evident, especially during the project implementation process. The impact of their lack of knowledge in the use of research-based project development tools may have a negative effect on the completion of the project. At the same time, certain client interventions and instructions to the poorly-skilled construction firms may result in negative outcomes for the projects.

In addition, the main focus on "international architectural styles" influences the use of inauthentic forms, proportions, rhythm, textures, materials, and colours in the project implementation process. It is important that the opportunities offered by the current public health emergency can be used to change the narrative in the design philosophy used for the physical built environment in Africa.

Certainly, research-based design philosophy may be a viable option recommended to be used by designers, architects, and urban designers, with more emphasis on the natural features of a particular geographical place for the improvement of the social, cultural, and economic imperatives of the area (Figure.7.3).

*Figure 7.3: Architectural design with an emphasis on the environment's natural features. Ngonyama Okpanum and Associates. Demera Adigrate, Ethiopia.*

### *7.2 Developing Salutogenesis Philosophy in Africa for Post-Pandemic Built Environment Projects*

I argue in this chapter that salutogenesis design philosophy should be developed focusing on these areas, as illustrated in Table 7.2:

| **Traditional design process** | **The effect of concept and theories of philosophy on the design** | **Salutogenesis Philosophy Themes** |
|---|---|---|
| Project | *People/Political issues* | *Design tools* |
| Building | People/social/economic aspects | *Quality of the physical environment* |
| Place | People/cultural/other imperatives | *Perception* |
| Form | Aesthetics metrics toolkit | *Institutional culture* |
| Zone | Rigid order of space cluster | |
| Space | Fixed accommodation schedule | |
| Configuration | Rigid relationships of the layout plan | |
| Functionality | Level of space utilisation | |
| Standardisation | Rigid repeatable spaces/pre-assembly | |
| Effectiveness | Focus is on cost | |
| Efficiency | Unpredictable delivery time | |
| Quantity | Limited resources | |
| Quality | Moral and ethical values | |
| Flexibility | Limited ability to change | |
| Adaptability | Rigid space translation | |
| Durability | Performance metrics | |
| Serviceability | Maintenance benchmarking tools | |

***Table 7.2: Traditional Design Praxis and the Proposed Salutogenesis Philosophy. Adapted from Jenso (2004).***

i. Process (standardisation of information, protocols, frameworks for planning, procurement, evaluation, performance measurement, and monitoring of the systems and processes used for constant and continuous improvement);
ii. Data systems (provide detailed information on different kinds of data, such as data on the natural environment, accurate data on the local government area population including the population of each ward within the local government area);
iii. Guidance (provide detailed information on a set of principles to inform good practice in space planning and design, materials, textures, colours, landscape, structures and services, commissioning, and on post-occupancy evaluation and information on exemplary research-based projects and practice).

Why do we need salutogenesis design philosophy guidance? Most people will argue otherwise, but the absence of unified design initiation protocols leads to the inauthentic architectural vernacular currently witnessed all over Africa. Indeed, the beautiful natural environment of Africa is being destroyed daily, as can be seen in Figure 7.4. This is due to a lack of project development systems and leadership in the design and project implementation industry in Africa.

### *7.3 The Importance of Salutogenesis Design Philosophy in Africa*

The architecture of a place is very important and can no longer be ignored by politicians and industry leaders in Africa. What distinguishes all other forms of art from architecture is that, if any art object is ugly, you can hide it from public view, but if a piece of architecture is ugly, it is very difficult to ignore. It will continue to condition the attitudes and behaviours of the communities where it is located. Therefore, it is important to consider ways of adopting salutogenesis design philosophy concepts and theories for project implementation processes and systems, in order to improve the African physical built environment (Figure 7.4).

Several districts in Lagos are designed in such a manner that the physical built environment dehumanises its inhabitants. Even the physical built environments of the so-called "elite" in Lagos, like Ikoyi, Banana Island, Lekki, and Victoria Island, are dehumanising to the inhabitants. The quality of the physically built environments of these areas is so poorly planned that the inhabitants can longer distinguish between what is bad, ugly, and uninhabitable. It is now generally accepted as a way of life. This is not acceptable in the 21st century. The architecture of our physical built environment in Africa must be changed for a better quality of life for the inhabitants. The quality of our physical built environment is vital to the quality of our lifestyle as human beings.

*Fig 7.4: Most expensive districts in Lagos. Bourdillon Road, Ikoyi, Lagos.*

## 8. The Social, Cultural and Economic Need for Salutogenesis Philosophy in the African Built Environment

According to Francis et al. (2001), the design philosophy used for physical built environments may address common challenges related to life-cycle costing concerns on space design, functional suitability, space utilisation, space requirements, and space economy. Salutogenesis design philosophy can address the issues relating to the sustainability paradigm in terms of short-term and long-term city urban design requirements, and especially for space requirements, cost, technical performance requirements, and future space needs due to constant and continuous changes over time.

The current public health emergency has provided the much-needed opportunity to address the sustainability issues relating to poor urban design concepts and theories used in Africa's physical built environments. Poor architectural concepts and theories used in most physical built environments in Africa are arguably the reason for many of the negative outcomes in the social, economic, and environmental circumstances witnessed. It is now imperative to change the current poor quality physical built environment by using a salutogenesis design philosophy to improve the space design in terms of land use, space provision, and social, economic, and built environmental circumstances.

According to Hamilton (2002), it is expected that the evaluation tools in the concepts and theories used for designing the physical built environment can provide essential information that will address the challenges and problems emerging daily, especially during a project's briefing, design, construction, commissioning and operation phases. The information available in comparative literature shows that the design tools in the concepts and theories used for physical built environment projects provide information only on minimum space requirements and on square-metre cost. Vital information required for the architecture of the physical built environment is limited at times and difficult to find. It is not taught in most African universities.

Abbot (1989) argues that there is little research-based information on the concepts and theories used for the design of physical built environment projects in Africa. Therefore, it is extremely difficult to positively improve the environmental variables used for space design and provision, functional suitability, and spatial relationship. There are also inadequate benchmarking tools to evaluate the qualitative aspects of the built physical environment in relation to space design and provision, functional suitability, and spatial relationship.

Okpanum (2021) is of the view that the current public health emergency due to COVID-19 may have provided the right opportunity to embrace a salutogenesis design philosophy for physical built environment projects. He further suggests that this new paradigm shift can be used to address the major sources of the carbon dioxide footprint in our environment. Hayward (2007) suggests that research-based information on the concepts and theories highlights the need for resource-use-awareness, which may improve the reduction of the carbon dioxide footprint in the environment. For example, findings in literature argue that it is now time to develop and introduce key performance indicators in the research-based information, in the form of salutogenesis design philosophy concepts and theories to monitor the use of construction resources. In particular, water and energy used during and after construction may provide measurable outcomes in terms of carbon dioxide reduction in the atmosphere (Figure 8.1).

*Figure 8.1: Residential building designed by Ngonyama Okpanum Associates. Ken Orji, Country Home, 'Owerri,' by Ngonyama Okpanum (Associate).*

## 9. A Salutogenesis Philosophy for Physical Built Environments in Africa

The opportunities presented by the current pandemic and the lack of quality housing are unique, and can be used to transform the African architectural landscape positively, using salutogenesis perspectives. As an architect, designer and urban designer, I am aware of the social, cultural and economic benefits of symbolic, authentic and inauthentic contents of the Western and Asian physical built environments. It is vital that salutogenesis philosophy, when used for the physical built environment, is called upon for its inherent social, cultural and economic benefits.

Once you journey across Sub-Saharan Africa, the architectural language across the continent becomes very eclectic, confusing and inauthentic. The architectural language of the physical built environment in Africa can be very hostile and confusing. Indeed, for someone used to the orderliness and better image of architecture in Western and Asian cities, when confronted with the architectural language of African cities, the social, cultural and economic benefits inherent in them are lost. This issue can no longer be ignored and the COVID-19 experience presents a unique opportunity to address it appropriately.

It is a pity that physical built environments in other parts of the world have moved forward, and thus their contemporary architectural language may seem appropriate to those less involved in the physical built environment professions. In Africa, however, there is poor leadership in the architecture and design. Architecture plays a more important role in the quality of the physical built environment than other arts such as music, painting, sculpture, and literature.

In fact, other are of the arts have made more progress in Africa than African architecture. African music plays a significant role in world music culture. In the West and Asia, modern movements have abandoned the medieval and ancient architectural styles for something new, like post-modern architectural languages and others.

Africa is yet to develop an authentic African vernacular architectural language suitable for its physical built environment, considering the hot, humid and temperate climatic conditions. Instead, young African architects still focus on the abandoned historical styles from the West. In Africa, Roman classical architectural design philosophy has gained enthusiasm amongst young architects and their clients. Most clients are now focusing on the textures, materiality, colours and space planning, space articulation, and functional suitability, based on classical Roman architectural design philosophy.

African architects have abandoned their role as leaders of the society through their ability to influence the architecture of the physical built environment. They have abandoned their cultures and languages. It is like learning how to speak your language and then abandoning it for another language and vernacular alien to your own. In the absence of a clear cultural identity, the revival of African vernacular architecture is imperative. Although it may be difficult to define African cultural imperatives and her architectural artefacts, this can be achieved through comparative research by African architects. I suggest here that this research process can be undertaken through salutogenesis philosophy.

Salutogenesis philosophy can offer an invaluable opportunity for young African architects to organise themselves and adopt a movement in this direction. The architecture of the physical built environment helps us understand who we are and defines our cultural identity. The architecture of any physical built environment should be seen as a non-verbal communication artefact that can be read not only as a physical object, but also as one that has the power to influence our attitudes and behaviours positively or negatively.

### *9.1 Built Environment Architecture as Powerful Non-Verbal Communication*

The architecture of the physical built environment is not just about the architecture itself. It is also about storytelling, culture, tradition, and customs. Most importantly, it is about who we are as people. Indeed, it is about who we are and about our artefacts, our languages, and our means of non-verbal communication. It is information about our geographical places and spaces (Figure. 9.1).

*Figure 9.1: Proposed Fidelity HQ, Lagos, by Ngonyama Okpanum Associates.*

The architectural language of the physical built environment must have a past, present, and future based on the social, cultural, and geographical factors of its natural environment. African historical architectural vernacular is poorly documented by African architects. This is not the case in other arts such as music, art, sculpture, painting, and theatre, where there is ample literature on each (Figure 9.2). Lack of quality literature on the history of African architecture in the physical built environment is unacceptable.


*Figure 9.2: Nigerian Traditional artifacts*

Young African architects' knowledge of the past is very uncertain and inauthentic. Their knowledge of the present is based on Western architectural doctrines and is incoherent, which is the reason the African architectural landscape is eclectic and confusing for young architects, and there is a lack of research culture in the physical built environment in Africa. Nevertheless, the knowledge of the future is generally uncertain, since the West and Asian architectural trends are copied verbatim without research or translation based on African cultural imperatives.

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