ROUTLEDGE COMPANIONS

The Routledge Companion to Smart Design Thinking in Architecture & Urbanism

For a Sustainable, Living Planet

Edited by Mitra Kanaani

THE ROUTLEDGE COMPANION TO SMART DESIGN THINKING IN ARCHITECTURE & URBANISM FOR A SUSTAINABLE, LIVING PLANET

This comprehensive companion surveys *intelligent design thinking* in architecture and urbanism, investigates multiple facets of "smart" approaches to design thinking that augment the potentials of user experiences as well as his/her physical and mental interactions with the built environment.

Split into six paradigms, this volume looks at the theoretical and historical background of smart design, smart design methodologies and typologies, smart materials, smart design for extreme weather and climatic regions, as well as climate change issues and side effects, smart mobility, and the role of digital technologies and simulations in architectural and urban design. Often at odds with each other, this volume places emphasis on smart design for various typologies and user groups, emphasizing on advancements in form-making and implementation of technology for healthy and sustainable living environments.

Written by emerging and established architects, planners, designers, scientists, and engineers from around the globe, this will be an essential reference volume for architecture and urban design students and scholars as well as those in related fields interested in the implications, and various facets and futures of smart design.

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Let us not lose sight of the fact that it was humans' intelligence and ingenuity that provided us with possibilities of further envisioning new opportunities with AI and technological manifestations.

Now, rather than competing with this creative trend, it is incumbent upon us to explore and nurture expertise in areas that complement automated processes through our creative and critical thinking abilities, toward furthering human dignity, elevating social empathy, and benefiting the sustenance and well-being of Planet Earth.

This comprehensive book of Smart Design Thinking is dedicated to all who are immersed in various fields of architecture, design, planning, engineering, sciences, and technology, deploying their expertise, dedicating their knowledge, and striving with sincere intentionality to save our endangered planet-- currently in a deep state of uncertainty...

Mitra Kanaani

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PREFACE

The Background of the Idea, Objectives, and the Conceptual Framework of the Publication – *Meanings and Various Domains of Smart Design Thinking*

Mitra Kanaani

In architecture and urbanism, the concept of *utopia* has often resembled a strong aspiration and yearning for an *ideally perfect* world pursued by visionary designers toward creating opportunities for progress and advancement in the design discipline. The design discipline has always been focused on the future of the world not only toward improving the quality of life and advancement in the development of the built environment, but also in addressing social and political reforms and dogmas. The resulting development of new types of *spatial entities* and urban settings with higher expectations for performative use has become the propellers for inevitable dynamic shifts in the lives of the users, and unprecedented transformation in the lifestyle of people in the communities. They have also driven innovations, advancements, and empowerment for aspiring governmental authorities around the globe.

Through the lens of utopian thinking, visionary ideas in architecture and urbanism look to possible futures that transcend the existing disillusionment currently engulfing our world. Utopian concepts have opened the door for designers to soar to new imaginative horizons. The world of architecture and the built-environment is encountering experimental attempts in design and construction of various types of self-sustained performative habitats as part of the trend toward *smart city design concepts*. Various visionary architects and urban designers, around the globe, in pursuit of experimenting ecological utopia or eco-utopian design concepts are contributing to the advancement of smart design concepts and its various means of application. In essence, the trend is rapidly accelerating toward a smart transition in *design thinking* that requires a new frame of mind and demands novel ways of living. More than ever, users of our built environment must learn to live smarter, cleaner, healthier, and more efficiently, if we intend our next generation to thrive, and if we intend them to inherit and benefit from a better quality of life on the *planet* in the near future and beyond.

The History of an Evolutionary Trend in Architecture

The 1850s second Industrial Revolution and the discovery of the approach to mass production of steel with different grades of carbon and the consequential discovery of ferroconcrete paved the path to the advent of high-rises in the twentieth century, and the current trend toward transformation to skyscrapers as the symbol of progress and advancement in various parts of the world. This evolutionary trend has charted bewildering complexity to our interconnected world, accompanying an unprecedented and fast-paced trajectory toward industrial and technological discoveries that have inevitably brought about their cultural transformations, and unique needs, as well as innovative technological opportunities. Nowadays, these needs are applied not only to tall buildings but also to various large-scope multifunctional types of occupancies including multifaceted institutional and governmental agencies, airports and specialized laboratories, and multiuse residential and commercial habitats constituting cities within the cities.

Design sophistication has brought the demand for the integration of various computer software, Internet of Things (IoT) devices, and artificial intelligence (AI) toward the development of intelligent/smart buildings. Intelligent buildings based on the demands of various typologies or building types pursue specific levels of *control* and *automation* measures that can be unique to every building type of use and occupancy. These needs relate but are not limited to design decisions related to climate control factors (including, temperature, humidity, and air circulation), as well as the needs for various innovative levels of light intensity, communication, safety, and security systems, and stability variables, which are constantly emerging and on the rise. In general, intelligent designs are about smart architectural designs with the crucial hybrid theme of how smart technology and AI will affect both our physical world and the way humans construct the symbolic world and how they see their place in their social and "natural" worlds, not just as the users but contributors to those environments.

Today's concept of smart buildings goes hand in hand with eco-friendly and human-centered green architecture, epitomizing intelligent ecological design thinking and performativity, which includes comprehensive responses to an urgent global need for environmental conservation and energy efficiency, promoting innovative technologies toward creating efficient and sustainable architectural constructs.

Smart building design, along with various development devices and the usage of sensors, has promoted advancement in the realm of innovative and new synthetic and nanotechnology of materials with amazing qualities and properties.

Efficient smart buildings are not just about added IoT and sensors, and demand integration of smart forms and design concepts. To use them efficiently, they demand a new culture of form-making and knowledge and understanding of efficient use and their proper operation.

What Is the Smart Definition as a Design Thinking Concept?

In our current evolutionary status of the world, smart and smartness, in architecture and design, have become buzzwords, signifying innovation in technological transformations. They have even become marketing tools. However, smart concepts for the design of the built environment have a noble mission. They must be considered as *design thinking tools* for the development of safer, healthier, environmentally efficient, equitable, and friendly spaces, transcending beyond showcasing the advancement of technology. As a rapidly expanding concept, "smartness" has the potential to enhance many aspects of daily life by demanding increased convenience and safety while dealing with the inevitable challenges of adapting to sophisticated intelligent systems. However, smart design is not just about automation, the IoT, AI, or robotics. As smart design expands and penetrates deeper into humanization, the psychology, and behavioral and social impacts of smart services, the act of design thinking can become more meaningful, effective, and adaptive for users. By the same token, these characteristics can also render designs that are irrelevant, non-workable, and ineffective for the users.

In this publication, six selected paradigmatic smart design categories have created the framework for its comprehensive content. The six defined paradigmatic categories offer various facets of smart strategies that inform the design of the built environments, user experiences, and the quality of life with a keen eye on sustainability and resiliency of the planet and its inhabitants. This study not only analyzes human health, experience, innovation, and creativity in design production but also investigates alternative solutions for negative psychological effects and mitigating generational trends toward alienation and isolation in our fast-expanding urban environments.

Smart Design Thinking is about designs that focus on equity, respect for diversity, tolerance, safety, and freedom of choice, as well as dignified human life for all citizens and users. It promotes beauty, innovation, and a healthy sense of physical, mental, emotional, and social well-being at all levels of living. *Smart Design Thinking* is an approach and an attitude rather than just the usage of technological tools. It needs to be adopted and introduced cohesively by all experts in various fields of design, technology, and scientific fields toward a fully integrative design methodology, at the onset of the development of the design concepts.

Smart design allows the human experience to reach its highest potential by promoting the inherent sensual and perceptual effects and tangibilities of the built environments. It allows for tangible opportunities to merge measurable and immeasurable attributes of design and promotes a sense of belonging that reduces alienation between inhabitants and the spaces they occupy.

In essence, *Smart Design Thinking* as a methodology of design thinking is about promoting convenience, safety, and well-being, through healthful and resilient urbanizations, spatial entities, and contextual settings that contribute to the sustainability of the *Planet as a Haven for its inhabitants*. By utilizing smart concepts and approaches in design thinking and form-making, and integrating innovative technologies, as tools, it is possible to support healthy generations and sustainable living environments.

This publication incorporates studies and manifestos on integrated inter-transdisciplinary smart design research that impacts our daily lives. Organized around paradigmatic[1] realms, the chapters investigate the impacts of *smart design – some of them still at their infancy level*. Papers and manifestos revolve around topics that promote human intelligence and creative achievement, sophistication in spatial constructs and innovative materiality, cognitive control, and physical well-being for healthy urbanizations and remedial actions to address major ramifications of climatic transformations and global warming. Authored by aspiring inquisitive contributors including architects, planners, designers, scientists, researchers, and engineers, various sections and articles investigate multitudes of notions of "smart design," as visionary processes, products, and design manifestos.

This book is organized around the following six Paradigmatic Categories:[1]

Paradigmatic Category 1: Various Domains of Smartness, Theoretical Discourses, and Approaches

This Paradigmatic Category initiates the discourse, alluding to the fact that the concept of *smart design thinking* in architectural design is not new. It underscores the contradictory implications of the application of smart design concepts in emerging habitats, cityscapes, and the global economy. The chapters in this paradigmatic grouping portray a critical outlook on the psychological, physical, social, and cultural impacts of digital technologies and AI on society and users' lifestyles, health, and well-being.

The chapters in this grouping offer the discourses, manifestos, and theories that analyze the impact of smart design thinking on current evolutionary issues: equity, diversity, inclusivity, social reforms, performativity, and safety. This paradigm expands and promotes architectural and utopian visions and theories that reinforce ideals promoting the development of future smart built environments, from mega-scope masterplans to individual intelligent constructs that are safe, uplifting, flourishing equitable, and healthful, as well as ecologically-friendly.

Paradigmatic Category 2: Smart Design Methodologies and Concepts for Intelligent Typologies and User Needs

This Paradigmatic Category expands on design innovations based on users' needs and architectural types, as well as specific smart methodologies, means, and approaches that constitute design intelligibility and are specific to architectural types and users. This section expands on smart design concepts, their applications for the built environment, and their impacts on the design of spaces and infrastructure. This paradigmatic realm focuses on smart specificity needs for architectural designs based on unique characteristics and qualities of contextual settings, as well as spatial performative typological requirements and users' restrictive conditions. The contextual setting can be in space, under bodies of water, or within a fully enclosed environment, in which the specificity of the user's needs in conjunction with certain physical or cognitive shortcomings, as well as physical restrictive qualities, can create specific design performativity demands. For instance, design for the blind or design for cognitive disorders necessitates certain functionalities that demand designed spaces must be charged with the capacity to address specific performative aspects of their use through smart design thinking concepts and means, for example, in *design for learning* and *design for healing*.

Paradigmatic Category 3: Smart Materiality

This Paradigmatic Category focuses on the role of fast-evolving smart materials and their impact on the process of form-making and the creation of design concepts that are free from material constraints and their advancements. Smart responsive materials undertake considerable responsibility for environmentally sensitive progressive architecture and promoting the ideals of realistic sustainable and energy-efficient built environments. By using information derived from quantum physics, nanotechnology, biology, chemistry, and AI, the chapters in this section offer progressive advancements that are currently taking place in the development of smart materials and tectonics of the built constructs. The fast-paced progressive role of imaging technology in developing various scales of super-hard super-light synthetic materials with superhuman properties is indeed a major contributor to the creation of smart spaces for the design of various typologies.

Paradigmatic Category 4: Smart Design for a Changing Climate

This Paradigmatic Category focuses on smart design solutions in defiance of Climate Change, and resiliency for regions with extreme hot, cold, or arid climates. It considers bodies of water as contextual settings for developing living environments. It also investigates the consequences of major climatic changes, such as fires, and flooding, and new approaches in bridging architecture with agriculture through urban farming, net zero, and clean energy production through artificial and natural aquatic systems, and avoidance of usage of fossil fuels to prevent environmental toxic and harmful pollutions. This section discusses unchartered territories and regions entangled with extreme climates and geographical extremities, constraints, and challenges. It reflects on recently developed technologies for smart habitats and living environments, offering smart solutions to adapt to the negative impacts of intense climates. It also champions the appreciation of good practices for climate-resilient communities and sustainable livable constructs in harmony with their natural settings.

Paradigmatic Categories 5: On Smart Design Mobility and in Defiance of Pollution

This Paradigmatic Category covers topics related to *Intelligent Mobility Systems* and their impact on the design of urban and built environments toward augmenting the space potentials within the buildings and cities – chapters include sustainable design mobility solutions and agendas that synthesize manufacturing, computing energy, and material, toward developing safer, cleaner, and more convenient means of transportations in and between future cities. This paradigm introduces eco-mobility, which prioritizes walking, cycling, public transportation, and shared light electric vehicles. It promotes travel through integrated socially inclusive and environmentally friendly options independent of privately owned vehicles. It gives priority to health, safety, low-emissions, and people-centered urban development encouraging circular and regional economies while limiting the impact of freight transport.

Articles in this section expands on future visions of short distances, long-distance mobility systems, and breaking away from cultural attachments to cars and the infrastructure that supports them. It also introduces lessons learned from developments in Space Architecture.

Paradigmatic Category 6: Simulation and Advancements in Digital Technologies and Data-Driven Smart Designs

This Paradigmatic Category focuses on the technology of design production and the impact of *Smart Design Productions* on the direction of today's design methodology. This Paradigmatic realm looks into new technology and tools utilized in architectural design focused on efficiency, sustainability, and optimization goals. It considers smart methodologies for the production and manufacturing of design constructs. Chapters in this realm reflect on creative advancement in integrative design and construction processes of smart buildings, and how new technologies inform and improve the design process and production. This final section focuses on the idea that buildings are increasingly considered smart self-sufficient structures, which are automated and networked, as intelligent machines for living.

The main goal of this publication is to help raise awareness about the critical condition of our planet concerning the profound ecological and environmental challenges it is facing.

The famous English historian Arnold Toynbee (1889–1975) in his monumental *A Study of History* refers to the fact that "…the well-being of a civilization depends on its ability to respond creatively to challenges, human and environmental"[2].

If we believe that with every challenge, there is an opportunity, smart design thinking in architecture will be a warrant for optimism in saving our planet, and its future generations of inhabitants. Smart design thinking is about the power and utopian promises of a creative design agency that has the highest capacity to transform and reshape our future.

Editor's Notes and Acknowledgments

Sadly, during the production of this massive volume, our large team of contributors and authors was faced with the major loss and sudden passing of Dr. Eduardo Macagno, former Chair and Professor of Cell/Developmental Biology and Neuroscience, and the co-founder of the Academy of Neuroscience and Architecture. I am proud that his last writing and contribution to the world of science is included in this publication, with the sincere work and co-authorship of his graduate student, Julia del Rio.

Design of the Book Cover and Notes of Appreciation

The cover illustration designed by Nasim Rowshan is a collage of concepts toward a vision of speculative design solutions and for what the prospects of the cities might be and the way we might live and work in the future. It is the creative rendition of an exploration of the kaleidoscopic implications and possibilities of kinds of visionary spatial and functional relationships that a self-sufficient multifaceted city might contain and convey.

A special note of appreciation and deep gratitude to Nasim, who was one of my talented students of the BIHE and a graduate of Yale, for her contributions to the design of the book cover. Also, a special note of appreciation to Lucy Campbell for her sincere support and collaboration in the editorial needs of the publication.

Notes

1 Paradigmatic Category refers to a prototypical classification and formation of a group of concepts and subjects that belong to a specific paradigm or field of association.

2 Bruce Mau, in the Introduction of the book *Massive Change*, under the title of: Now that we can do anything, what will we do?. Mau is referring to the main thesis of famous English historian Arnold J. Toynbee's. In his monumental publication, *A Study of History*, Toynbee declares: "The twentieth century will be chiefly remembered by future generations not as an era of political conflicts or technical innovations but as an age in which human society dared to think of the welfare of the whole human race as a practical objective."

Toynbee, A. J.: 1957, *A Study of History*, New York: Oxford University Press. As cited in Mau, B.: 2004, *Massive Change*. New York, NY: Phaidon Press.

INTRODUCTION

The Design Imagination – Is Smart Design Enough?

Harrison Fraker

The definition and scope of 'smart design' thinking is wide ranging and emergent as evident by the diversity of the 59 essays in this first *Routledge Companion to Smart Design Thinking in Architecture & Urbanism for a Sustainable and Living Planet*. The essays do a good job of illustrating different types of 'smart design thinking', but they represent only a small sampling of smart design strategies that will be necessary to mitigate and adapt to the challenges of climate change in creating a more sustainable and living planet. In fact, a comprehensive review of such smart design strategies would take multiple 'companions' to cover the range and complexity of design considerations. Nonetheless, the smart design strategies included in the *Companion* give a revealing glimpse into the range of innovative strategies that will be necessary to respond to the existential challenges of climate change.

In an effort to help comprehend the scope and diversity of smart design thinking, the essays can be grouped into several broad categories. In the first, the concept of 'smart design' is applied to improving the **performance**[1] of the built environment and specific physical systems. Through the use of smart, wireless sensors, data analytics, and smart controllers, the operation of systems can be managed to be more efficient and more responsive to the changing conditions of their environment and the precise, multi-sensory needs of users. In the second category, 'smart design' focuses on improving the intelligence of the design process itself, specific **methodologies** by which designers search for more appropriate and effective design solutions. A third category of smart design is less about a smart technology or smart methodologies, but more about an expanded **design sensibility**, one that explores the value of integrated whole-systems design thinking in imagining entirely new system configurations; and an expanded role of the senses, not only in custom designing places for special users, but also in making more meaningful places. And finally, smart design can be applied to the **intelligent manufacturing** of building elements, previously unimagined, that can be made more sustainable.

Smart Design Performance

Using 'smart design' to improve the performance of physical systems has been at least 50 years in the making. The development of the smart, programmable thermostat, which

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allowed homeowners to program the timing and temperature settings of their thermostat rather than adjust them manually, is an excellent early example of improving energy efficiency. The evolution in performance of smarter systems has followed the improvement and sophistication in wireless sensors, data analytics, and programmable controllers. It has become almost ubiquitous. It can be found in almost any physical device, home appliance, car operations, not to mention driverless vehicles. It has been crucial in designing buildings to become zero carbon in energy operation. By improving energy efficiency through smart management of HVAC systems, the dynamic response of building envelopes (see Kalantar/Ekeda, Mostafavi/Bao/Montejano_), and even optimizing the properties of smart programmable materials (see Tholen, Rian), the energy demand can be reduced so that the application of local renewables (solar PV and/or wind) can deliver cost-effective energy self-sufficient building operations. It extends to larger systems like the management of urban infrastructure using data analytics and Artificial Intelligence (AI) to anticipate and control system operations. Examples include water supply/storage and maintenance, storm water management, waste water treatment, traffic control, and urban services. It is used by utilities to anticipate and manage energy supply and demand, the use of storage, backup generation, and the integration of renewables (see Herr, Isaac/Casals/Carta, Toyne/Williams, Leach, Thanghavelu, Fairburn/Mohanty/Imhof, Del Campo). It is also being used to measure the moisture content of soils, which, when coordinated with weather forecasting, can deliver more efficient agricultural irrigation.

All of these are examples of 'smart design' using technical intelligence to improve the performance of discrete systems. It has been shown that 'smart design' strategies are particularly effective when the boundary of the system and the metrics of measuring performance are well defined. The question is what happens when the boundary of the design problem is expanded to include other systems that, previously, have been seen as outside the problem but could be integrated to become design resources. What this calls attention to is that 'smart design' needs to adopt a more integrated, whole-systems design sensibility, where 'smart design' captures synergies across systems, where systems are seen as interconnected (see Braham). For example, where sewage is not seen as waste, treated and dumped in the environment, but is seen as a resource that can be treated and re used for irrigation, or gray water, or even potable water; where organic waste is not just dumped or composted, but processed to create biogas for energy. The concept is captured by the analogy with the international space station's self-sufficient, closed-loop operation and thus leads to the hypothesis of a 'spaceship city' (see Cohen/Imhoff) or buildings with a 'brain' (see Arbib). Articulating this kind of expanded 'smart design' thinking holds the promise of it playing a crucial role in both mitigating and adapting to the existential threat of climate change. Many of the essays illustrate the value of integrated whole-system design thinking, by capturing the potential of previously unrecognized opportunities in creating new innovative design solutions. (See Sterry, Mueller, Cody, Besancon, Steudel, Piatek/English, Piatek, Baumeister, Linarki/Baumeister/Stevens/Burton, Dunsmore, Tomber, Young, Mahadevwala.)

Smart Design Methodologies

Recent improvements in the intelligence of the design process build on long-standing traditions in the design professions – both the practice of analyzing precedents and researching the literature on 'post-occupancy' evaluations of building types. Alan Colquhoun reminded us of the value of intelligent pre-design research in his article, 'Typology and Design

Methods' in *Perspecta 13*, where he essentially argues that good design can spring from the creative evolution and adaptation of known building types, rather than starting from scratch with a simple social/functional diagram of program elements. Intelligent (smart) pre-design research has evolved to include the creation and use of 'digital twins' not only to simulate and evaluate the performance of precedents but also to compare the performance of new design alternatives. The construction of digital twins or prototypes can also enable the smart manufacturing of building elements using 3D printing and robotics (see Neumayr, Mostafavi/Mehan/Bagher, Piroozfar/Farr, Kalantar/Borhani). Yet the biggest development in smart design methods is the exponential increase in the search power of generative AI.

Over the past few years, there has been an explosion in the development of AI architecture generator programs (18 have been recently reviewed in Construction Magazine, Aug 28, 3023). These architecture generators have special functions according to the nature of the advanced AI algorithms hidden in them, ranging from 'advanced machine learning', 'CLIP' (contrastive language-image learning pre-training), 'neural network technology', and 'deep learning'. In most cases, the search depends on mastering appropriate text-based input. For example, 'imagine': subject (building type), user, background, arch style desired (can name well-known architect), time period, site, total area, and cost. The program then visualizes multiple design options. But some programs can also begin with an image input that can be edited, renovated, and rendered. Each AI generator can be used specifically for different phases and aspects of the design process, including visualizing alternate schematic designs and/or 'ideagrams', visualizing and rendering different styles, creating pseudo-realistic images, drawing plans for analyzing energy performance and resulting carbon footprint, working with 3D modeling programs like SketchUp, Revit and Rhino to do high-quality rendering. Some programs are customized for interior design, site planning, restoration, urban design, and landscape design.

These AI design generator programs are powerful tools for exploring and developing design ideas. While they may generate unexpected, if not wildly unusual alternate solutions, even completely non-sensical proposals, exposure to them can stimulate the design imagination. Furthermore, they can be used to optimize design alternatives for different criteria, helping make more informed and smart decisions. By automating many menial drafting tasks, they free up time for creative thinking and problem solving and increase design efficiency. It is like having an expansive team of design assistants at the designer's finger tips. Nonetheless, in spite of AI's unparalleled power of search and visualization, a final design proposal (architecture or urban design) depends on the creativity, intuition, critical thinking, and decision-making of the designer.

Of course, the quality of output from AI design generators depends on the depth and efficacy of the data base being searched and mastery of the text-based or image-based input being used (not to mention the nature of the advanced AI algorithms being used). This is a challenge for 'smart design' generators because the data bases used to visualize alternative design concepts are not necessarily linked to performance data of the design problem being explored, either post-occupancy evaluations or energy performance. The data bases are primarily visual and/or scenographic. Furthermore, the metrics on performance vary from technical to social to economic to aesthetic and are not standardized (not to mention the array of data on city performance). This suggests not only the need to expand and improve the data bases, but also a multi-phase design process that first visualizes a solution and then goes through an iterative performance evaluation to arrive at an optimal solution. It also suggests the need to expand the content of the design data bases being searched to include performance metrics beyond the spatial and visual. (Some of the papers address this challenge, see Farr and Piroozfar.)

This challenge of linking spatial images to performance has been recognized by some in the industry. For example, Autodesk, which provides drafting and modeling tools for the design professions, has been working to develop a tool named 'Generative Design'. It brings the complete information on building designs, documented in their BIM (Building Information Management) data base, together with performance modeling tools (digital twins) to compare simulated performance with measured performance and user satisfaction of different designs. The tool will give designers a rich trove of information to evaluate different spatial patterns and configurations, construction materials, envelope designs, and HVAC system specifications to inform their early design explorations. It can inform the search for zero-carbon sustainable solutions. And yet, such a tool does not generate a final design solution, it provides a more intelligent and informed benchmark.

Similar tools have been developed for urban and regional planning scenarios. One example is Urban Footprint. It uses Geographic Information System (GIS) to map the physical characteristics and information sets of a city and its region, including the zoning plan, environmental and climate data, energy supply and demand, building data – use type, construction and density, census data, traffic data, commercial activity, air quality, and health data. It then proposes a menu of 36 place-types, derived from current development models with all their physical characteristics, to be used for planning future development scenarios. For example, the place types include medium density; mixed-use; walkable neighborhoods served by public transit; or low density suburban residential sprawl; commercial centers; regional malls and storage/distribution centers, to name a few. By locating different places types spatially in a city or region, it allows urban designers and planners to paint different futures, to construct different scenarios. The program then calculates the consequence and impact on traffic flow, energy demand/consumption, carbon footprint, water demand, storm water flows, sewage treatment demands, health consequence, to name a few metrics. It is a form of digital prototyping and simulation analysis; however, it does not design the place types in detail, nor does it include new place types. It just reveals estimates of measurable consequences from the spatial deployment of place types, allowing for a comparison among different scenarios (see Schumacher/Blooshan).

These two examples of 'smart design' tools illustrate how 'smart design' improves the intelligence of design research and exploration. Through the use of AI and data analytics, it can discover new patterns, expand the number of potential design solutions, anticipate new needs, and guide the intelligent management and performance of physical systems. By building digital twins, it can model and compare the performance of design alternatives, a form of digital prototyping. Furthermore, with an expanded design sensibility, using integrated whole-systems thinking, it can discover new previously unrecognized synergies across systems. When the expanded design sensibility includes an increased awareness of the role of the senses in user experience and satisfaction, it can custom design environments for users with specialized needs. (See Othon-Villegas, Zhang/Evan-Green, Bauman, Downey/Arbib, Giovannella/Roccasalva, Zisch/Stroe/Ward, Gepshtein/Proietti, Macagno/de Rio, Gaines.)

Thus, the power of 'smart design' as portrayed in the papers is just emerging with the potential to radically improve our search for design solutions that will mitigate and adapt to the existential threat of climate change, helping create a more sustainable and livable planet. In fact, it may be essential for the survival of the planet as we know it.

Nonetheless, there are questions to be asked that are inherent in the definition of and application of 'smart design thinking'. It is particularly good at improving the efficiency of existing systems through intelligent feedback and control, but what about discovering entirely new systems or approaches that are outside or replace existing solutions? AI 'smart design' generators are particularly good at synthesizing the principles and patterns of 'best practices' and visualizing a wide range of alternative solutions. While it may discover previously unrecognized patterns in the data and expand the landscape of potential design solutions, it is limited to existing available data sets. By its own constraints, it is unable to discover entirely new solutions, 'outside the box' of known practices. So, does 'smart design', bound by its search of existing data, limit the search for new innovative and transformative design concepts?

Furthermore, smart design depends on measurable data for its comparisons, but what about the immeasurable – the emotional, the sensorial, and visceral experience of places? While it will be essential in comparing the measured performance of different approaches to climate change, can it also assist in creating places that are more meaningful? This is a complicated question because in many cases meaningful design goes beyond the measurable. Often the immeasurable qualities of a place, along with its technical performance, are why we value, fund, and maintain it. So, the question is are there emotional, sensorial, and visceral qualities of smart design strategies that are under recognized and could lead to creating more meaningful places?

By way of illustrating the immeasurable in design, it is hard to imagine that 'smart design' played any role in Peter Zumthor's creation of the Bruder Klaus Chapel. His idea of burning logs, arranged in a teepee like pyre, enclosed in a concrete box, to carve out a memorial space for a martyred patron saint is an imaginative leap of genius. It creates a powerful sensorial and evocative experience from the lingering smell of the burn, the color and texture of the concrete formed by the burned-out logs, the sparkle of minerals in the burned concrete, the mysterious top light left by the absence of the teepee's apex, and the twinkle of light coming through the concrete tie-holes. It creates a space of reverie that springs from Zumthor's imagination, informed by his embodied visceral experience of the world, not from any AI, simulations, or machine learning.

The same can be said for Louis Kahn's design of the Salk Institute. His brilliant solution to arrange the 'servant' spaces between the 'served' floors in section allows for maximum flexibility and access to all technical support. It comes from his own critical 'post occupancy' evaluation of the Richard's Medical Center, where the 'servant' spaces, arranged in plan as towers around stacked laboratory floors, forced the services to be strung across the ceilings in order to reach lab stations. While the shift to a solution in section can be described as a form of 'smart design', learning from a precedent, its source is not an application of AI or a simulation, but Kahn's own direct experience. Furthermore, while the sectional arrangement of 'servant' and 'served' spaces is an essential idea of the design, it is the clustering of the research office space, forming a cloister with views of the horizon and setting sun that captures a more poetic version of the Institute. It embodies the idea of a community with 'the power of science to explore the foundations of life'. It is this aspect of the design idea that springs from Kahn's imagination, his notion of a community of scientists, that captures our aesthetic imagination and makes the place memorable.

From these two examples, creating meaningful places depends on the creative imagination of the designer to capture special and resonant qualities that transform the experience of a place, beyond its technical performance. This springs from the experience of the designer(s), her/his/their visceral, sensorial, and embodied experience of the world. While 'smart design' can greatly enhance the intelligence of early design explorations and test the performance of alternatives, it needs to recognize and create a place in the process for the design imagination to search for and capture experiences that go beyond the measurable and touch on the emotional. From this perspective, 'smart design' is and will be critical in improving the quality of design for a sustainable and living planet, but not the whole story.

Note

1 The concept that the physical environment performs (beyond its visual construct), that it can be responsive to the needs of users, that it can be designed to perform in response to multiple concerns is foundational to the development of 'smart design thinking'. The case for a performative and responsive built environment (architecture and urbanism) is historically explained and developed in Branko Kolarevic's paper.

Prologue

Benson, Thor. “Humans Aren’t Mentally Ready for an AI-Saturated ‘Post-Truth World’.” Wired, June 18, 2023.
Dator, Jim. “Epilogue: Architects, Artilects, and Climate Change”, in Mitra Kanaani , ed., The Routledge Companion to Ecological Design Thinking. Routledge, 2022, pp. 616–625.
Dator, Jim . “Towards Responsibly Anticipatory Evolvable Architecture for the Anthropocene”, in Mitra Kanaani , ed., The Routledge Companion to Paradigms of Performativity. New York, Routledge, 2020.
Ditlevsen, Peter and Susanne Ditlevsen . “Warning of a Forthcoming Collapse of the Atlantic Meridional Overturning Circulation.” Nature Communications, July 25, 2023. https://doi.org/10.1038/s41467-023-39810-w
IPCC , 2023. “Summary for Policymakers”, in: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II, and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, H. Lee and J. Romero , eds., IPCC, Geneva, Switzerland, pp. 1–34, 2023, doi: 10.59327/IPCC/AR6-9789291691647.001
Rahmstorf, Stefan , Jason E. Box , Georg Feulner, Michael E. Mann , Alexander Robinson, Scott Rutherford, and Erik J. Schaffernicht . “Exceptional Twentieth-Century Slowdown in the Atlantic Ocean Overturning Circulation.” Nature Climate Change 5 (2015), 475–480. https://doi.org/10.1038/nclimate2554
Ripple, William J. , Christopher Wolf, Jillian W. Gregg , Johan Rockström, Thomas M. Newsome , Beverly E. Law , Luiz Marques, Timothy M. Lenton , Chi Xu, Saleemul Huq, Leon Simons, and Sir David Anthony King . “The 2023 state of the climate report: Entering uncharted territory.” BioScience, August 30, 2023 . https://doi.org/10.1093/biosci/biad080

Emerging Smart Design Thinking

Appleyard, D. and Lynch, K. (1974). Temporary Paradise? A Look at the Special Landscape of the San Diego Region. A Report to The City of San Diego Planning Department. San Diego, CA, USA.
Autodesk. Smart Building: Connection, Analysis, and Optimization. www.autodesk.com/solutions/smart-building. 05/28/2024
Bali, M. , Half, D. A. , Polle, D. and Spitz, J. (2018). Smart Building Design: Conception, Planning, Realization, and Operation. Basel, Birkhauser.
Bookey . (2023). 30 Best Kevin Lynch Quotes with Image. http://www.bookey.app/quote-author/kevin-lynch
Deltek . (November 28, 2023). Smart Building Strategies: Three Winning Strategies for Smart Building Design. https://www.aia.org/resource-center/three-winning-strategies-smart-building-design.
Ellard, C. (July 7, 2022). Brains, Cities, Nimbys, and Neurobollocks. The Wandering Brain. https://colinellard.substack.com/p/brains-cities-nimbys-and-neurobollocks.
Figueiredo, S. M. , Krishnamurthy, S. and Schroeder, T. (2020). Architecture and the Smart City. London, Routledge.
Fuller, R. B. (1960). Utopia or Oblivion: The Prospects for Humanity. Ed. Snyder, J. Zurich , Germany, Lars Muller Publisher.
Fuller, R. B. (2010). Operating Manual for Spaceship Earth. Zurich, Germany, Lars Muller Publisher.
Gates, T. (March 2015). How to Revive a Neighborhood: With Imagination, Beauty, and Art [Video]. TED Conferences. https://www.ted.com/talks/theaster_gates_how_to_revive_a_neighborhood_with_imagination_beauty_and_art/transcript.
Kanaani, M. (2016). “Performativity: the Fourth Dimension in Architectural Design.” The Routledge Companion for Architecture Design and Practice, edited by Mitra Kanaani , Routledge, Taylor & Francis Publishers, pp. 93–116.
Marks, R. J. , Dembski, W. A. and Ewert, W. (2017). Introduction to Evolutionary Informatics. Iowa City, USA World Scientific; Singapore, Stallion Press. https://doi.org/10.1142/9789813142152_0008
Naisbett, J. (1982). Megatrends: Ten New Directions Transforming Our Lives. Grand Central Publishing. Published September 30, 2021 . Internet Archive, by O Hall . http://archive.org: the tall office building artistically considered.
SoftwareAG. (2023). What Is IoT? Internet of Things Challenges and Benefits. https://www.softwareag.com/en_corporate/resources/iot/guide/internet-of-things.html.
UtilitiesOne. (November 22, 2023). Smart Cities: The Future of Infrastructure. https://utilitiesone.com/smart-cities-the-future-of-infrastructure.
Valle, Giovanni , (July 31, 2022) Intelligent Building vs. Smart Building:11 Differences. Innovative Technology, Builder Space-Gateway to the Building Industry.

Van Hinte , Ed., Neelen, M. , Vink, J. and Vollaard, P. (2003). Smart Architecture: The Green Challenge. Rotterdam, 010 Publishers.
White, J. (June 23, 2023). 621 Perfect Quotes about City Lights to Brighten Your Night. https://www.consultclarity.org/post/quotes-about-city-lights.
Yiannoudes, S. (2011). The Archigram vision in the context of Intelligent Environments and its current potential (PDF), IEEE Conference Proceedings (researchgate.net).

The Smart City Is More than Just Technology and Data Collection

Appleyard, D. and Lynch, K. (1974). Temporary Paradise? A Look at the Special Landscape of the San Diego Region. A Report to The City of San Diego Planning Department. San Diego, CA, USA.
Autodesk. Smart Building: Connection, Analysis, and Optimization. www.autodesk.com/solutions/smart-building. 05/28/2024
Bali, M. , Half, D. A. , Polle, D. and Spitz, J. (2018). Smart Building Design: Conception, Planning, Realization, and Operation. Basel, Birkhauser.
Bookey . (2023). 30 Best Kevin Lynch Quotes with Image. http://www.bookey.app/quote-author/kevin-lynch
Deltek . (November 28, 2023). Smart Building Strategies: Three Winning Strategies for Smart Building Design. https://www.aia.org/resource-center/three-winning-strategies-smart-building-design.
Ellard, C. (July 7, 2022). Brains, Cities, Nimbys, and Neurobollocks. The Wandering Brain. https://colinellard.substack.com/p/brains-cities-nimbys-and-neurobollocks.
Figueiredo, S. M. , Krishnamurthy, S. and Schroeder, T. (2020). Architecture and the Smart City. London, Routledge.
Fuller, R. B. (1960). Utopia or Oblivion: The Prospects for Humanity. Ed. Snyder, J. Zurich , Germany, Lars Muller Publisher.
Fuller, R. B. (2010). Operating Manual for Spaceship Earth. Zurich, Germany, Lars Muller Publisher.
Gates, T. (March 2015). How to Revive a Neighborhood: With Imagination, Beauty, and Art [Video]. TED Conferences. https://www.ted.com/talks/theaster_gates_how_to_revive_a_neighborhood_with_imagination_beauty_and_art/transcript.
Kanaani, M. (2016). “Performativity: the Fourth Dimension in Architectural Design.” The Routledge Companion for Architecture Design and Practice, edited by Mitra Kanaani , Routledge, Taylor & Francis Publishers, pp. 93–116.
Marks, R. J. , Dembski, W. A. and Ewert, W. (2017). Introduction to Evolutionary Informatics. Iowa City, USA World Scientific; Singapore, Stallion Press. https://doi.org/10.1142/9789813142152_0008
Naisbett, J. (1982). Megatrends: Ten New Directions Transforming Our Lives. Grand Central Publishing. Published September 30, 2021 . Internet Archive, by O Hall . http://archive.org: the tall office building artistically considered.
SoftwareAG. (2023). What Is IoT? Internet of Things Challenges and Benefits. https://www.softwareag.com/en_corporate/resources/iot/guide/internet-of-things.html.
UtilitiesOne. (November 22, 2023). Smart Cities: The Future of Infrastructure. https://utilitiesone.com/smart-cities-the-future-of-infrastructure.
Valle, Giovanni , (July 31, 2022) Intelligent Building vs. Smart Building:11 Differences. Innovative Technology, Builder Space-Gateway to the Building Industry.
Van Hinte , Ed., Neelen, M. , Vink, J. and Vollaard, P. (2003). Smart Architecture: The Green Challenge. Rotterdam, 010 Publishers.
White, J. (June 23, 2023). 621 Perfect Quotes about City Lights to Brighten Your Night. https://www.consultclarity.org/post/quotes-about-city-lights.
Yiannoudes, S. (2011). The Archigram vision in the context of Intelligent Environments and its current potential (PDF), IEEE Conference Proceedings (researchgate.net).

A Smart Paradigm for Participatory Urban Design

Bhooshan, S. , & Vazquez, A. N. (2020). Homes, Communities and Games: Constructing Social Agency in Our Urban Futures. Architectural Design, 90(3), 60–65. https://doi.org/10.1002/ad.2569 Blackarcs. (2023). Blackarcs. Available at: https://blackarcs.org/.

California yimby . (2021). 700 Cities, One Warming Planet. Available at: https://cayimby.org/blog/700-cities-one-warming-planet/ (Accessed 10 December 2023).
Gebel, Titus (2023). Free Private Cities: Making Governments Compete For You, 3rd edition, Aquila Urbis.
Glaeser, E. (2011). Triumph of the City: How Urban Spaces Make Us Human. Pan Macmillan.
Louth, H. D. , Fragachan, C. , Bhooshan, V. , & Bhooshan, S. (2023). Configurator: A Platform for Multifamily Residential Design and Customisation. In Barberio, M. , Colella, M. , Figliola, A. , & Battisti, A. (Eds.), Architecture and Design for Industry 4.0: Theory and Practice. Springer International Publishing.
Olson, M. (1982). The Rise and Decline of Nations Economic Growth, Stagflation, and Social Rigidities. Yale University Press. https://doi.org/10.12987/9780300157673.
Ritchie, H. , & Roser, M. (2018). Urbanization. Available at: https://ourworldindata.org/urbanization (Accessed 21 March 2023March).
Romer, P. (2010). Technologies, Rules, and Progress: The Case for Charter Cities, Center for Global Development. https://www.cgdev.org/sites/default/files/1423916_file_TechnologyRulesProgress_FINAL.pdf
Schumacher, P. (2006). Autopoeisis of a Residential Community. In Ram, T. V. , Dekleva, A. , & Steele, B. (Eds.), Negotiate My Boundary! Mass-Customisation and Responsive Environments. Birkhäuser.
Schumacher, P. (2022). The Metaverse as Opportunity for Architecture and Society: Design Drivers, Core Competencies. Architectural Intelligence, 1, 11. https://doi.org/10.1007/s44223-022-00010-z
Schumacher, P. (2023). Tectonism: Architecture for the 21st Century. Images Publishing.
Wadell, P. (2023). Urbansim. Available at: https://www.urbansim.com/ (Accessed 10 December 2023December).
Weber, B. , Müller, P. , Wonka, P. , & Gross, M. (2009). Interactive Geometric Simulation of 4D Cities. Computer Graphics Forum, 28(2), 481–492. https://doi.org/10.1111/j.1467–8659.2009.01387.
Wheeler, S. M. , Jones, C. M. , & Kammen, D. M. (2018). Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities. Urban Planning. PRT, 3(2), 35–51.

Smart Responsive Design Thinking in Neuroarchitecture

Amoore, L. , & Piotukh, V. (2019). Interview with N. Katherine Hayles. Theory, Culture & Society, 36(2), 145–155.
Applin, S. A. , & Fischer, M. D. (2013). Thing theory: Connecting humans to location-aware smart environments. LAMDa', 13, 29.
Baggs, E. , & Chemero, A. (2021). Radical embodiment in two directions. Synthese, 198(Suppl 9), 2175–2190.
Banker, S. M. , Gu, X. , Schiller, D. , & Foss-Feig, J. H. (2021). Hippocampal contributions to social and cognitive deficits in autism spectrum disorder. Trends in Neurosciences, 44(10), 793–807.
Barad, K. (2007). Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning. Durham, NC: Duke University Press.
Barsalou, L. W. (1999). Perceptual symbol systems. Behavioral and Brain Sciences, 22(4), 577–660.
Barsalou, L. W. (2005). Abstraction as dynamic interpretation in perceptual symbol systems. In Building Object Categories in Developmental Time (pp. 407–450). Psychology Press.
Böhme, G. (1993). Atmosphere as the fundamental concept of a new aesthetics. Thesis Eleven, 36(1), 113–126.
Bostock, E. , Muller, R. U. , & Kubie, J. L. (1991). Experience-dependent modifications of hippocampal place cell firing. Hippocampus, 1(2), 193–205.
Brown, A. M. (2017). Emergent strategy: Shaping change, Changing Worlds. Chico, CA: AK Press
Butnor, A. , & MacKenzie, M. (2022). Enactivism and gender performativity. In McWeeny, J. , Maitra, K. (eds.), Feminist Philosophy of Mind, 190–206.
Choudhury, S. , & Slaby, J. (eds.) (2016). Critical Neuroscience: A Handbook of the Social and Cultural Contexts of Neuroscience. John Wiley & Sons. https://www.google.co.uk/books/edition/Critical_Neuroscience/pjFECwAAQBAJ?hl=en&gbpv=1&dq=Choudhury,+S.,+%26+Slaby,+J.+(eds.)+(2016).+Critical+Neuroscience:+A+Handbook+of+the+Social+and+Cultural+Contexts+of+Neuroscience.+John+Wiley+%26+Sons.&pg=PR8&printsec=frontcover
Clark, A. , & Chalmers, D. (1998). The extended mind. Analysis, 58(1), 7–19.
Corti, C. , Oprandi, M. C. , Chevignard, M. , Jansari, A. , Oldrati, V. , Ferrari, E. , … & Bardoni, A. (2022). Virtual-reality performance-based assessment of cognitive functions in adult patients with acquired Brain Injury: A scoping review. Neuropsychology Review, 32(2), 352–399.
Daston, L. , & Galison, P. (2021). Objectivity. Princeton, NJ; Woodstock: Princeton University Press. https://www.google.co.uk/books/edition/Objectivity/TtsPEAAAQBAJ?hl=en&gbpv=0

De Cothi, W. , Nyberg, N. , Griesbauer, E. M. , Ghanamé, C. , Zisch, F. , Lefort, J. M. , … & Spiers, H. J. (2022). Predictive maps in rats and humans for spatial navigation. Current Biology, 32(17), 3676–3689.
Dingli, S. (2008). Thinking outside the box: Edward de Bono's lateral thinking. In Tudor, R. , Mark A. R. , & Susan, M. (eds.), The Routledge Companion to Creativity (pp. 338–350). London: Routledge.
Doran, G. T. (1981). There's a SMART way to write management's goals and objectives. Management Review, 70(11), 35–36.
Easterling, K. (2021, 19 January). Reading mutualism: A contemplation after medium design. Verso. https://www.versobooks.com/blogs/4976-reading-mutualism-a-contemplation-after-medium-design (Accessed 6 November 2023November).
Edelmann, G. (n.d.). Neuroarchitecture. https://www.youtube.com/watch?v=p1LoP9W5Qng (Accessed 6 November 2023November).
Epstein, R. A. , Patai, E. Z. , Julian, J. B. , & Spiers, H. J. (2017). The cognitive map in humans: Spatial navigation and beyond. Nature Neuroscience, 20(11), 1504–1513.
Farzanfar, D. , Spiers, H. J. , Moscovitch, M. , & Rosenbaum, R. S. (2023). From cognitive maps to spatial schemas. Nature Reviews Neuroscience, 24(2), 63–79.
Federici, S. (2020). Beyond the Periphery of the Skin: Rethinking, Remaking, and Reclaiming the Body in Contemporary Capitalism. Oakland, CA: PM Press.
Fernandez-Velasco, P. , & Spiers, H. J. (2023). Wayfinding across ocean and tundra: What traditional cultures teach us about navigation. Trends in Cognitive Sciences, 28(1), 56–71.
Frampton, K. (2020). Modern Architecture: A Critical History (World of Art). London: Thames & Hudson.
Glanville, R. (2007). Try again. Fail again. Fail better: The cybernetics in design and the design in cybernetics. Kybernetes, 36(9/10), 1173–1206.
Grobstein, P. (1994). Variability in brain function and behavior. In Ramachandran, V. S. (ed.), The Encyclopedia of Human Behavior (Vol. 4, pp. 447–458). Amsterdam: Elsevier Science. https://www.google.co.uk/books/edition/Encyclopedia_of_Human_Behavior/yASuxMCuhKkC?hl=en&gbpv=0
Gumbrecht, H. U. (2004). Production of preSence: What Meaning Cannot Convey? Stanford, CA: Stanford University Press.
Haraway, D. (1997, February). Wired Magazine. https://www.wired.com/1997/02/ffharaway/ (Accessed 15 October 2023October).
Haraway, D. (2019, 6 December). Making Kin: An interview with Donna Haraway (Steve Paulson interviews Donna Haraway). LA Review of Books. https://www.lareviewofbooks.org/article/making-kin-an-interview-with-donna-haraway/ (Accessed 5 June 2021June)
Hayles, N. K. (2017). Unthought: The Power of the Cognitive Nonconscious. Chicago, IL: University of Chicago Press.
Hays, K. M. (1984). Critical architecture: Between culture and form. Perspecta, 21, 15–29.
Hegarty, M. , Montello, D. R. , Richardson, A. E. , Ishikawa, T. , & Lovelace, K. (2006). Spatial abilities at different scales: Individual differences in aptitude-test performance and spatial-layout learning. Intelligence, 34(2), 151–176.
Hendrix, J. (2012). Architecture as the psyche of a culture. In Paul Emmons , Jane Lomholt , John Shannon Hendrix (eds.), The Cultural Role of Architecture: Contemporary and Historical Perspectives (pp. 208–215). London: Routledge.
Ihde, D. (2000). Putting technology in its place. Nature, 404(6781), 935–935.
Jeffery, K. , & Zisch, F. (2022). Spatial entities of the future: Design through the lens of neuroscience. In Mitra Kanaani (ed.), The Routledge Companion to Ecological Design Thinking (pp. 92–103). New York: Routledge.
Li, A. W. , & King, J. (2019). Spatial memory and navigation in ageing: A systematic review of MRI and fMRI studies in healthy participants. Neuroscience & Biobehavioral Reviews, 103, 33–49.
Massumi, B. (2002). Parables for the Virtual: Movement, Affect, Sensation. Durham, NC: Duke University Press.
Murrani, S. (2011). Third way architecture: Between cybernetics and phenomenology. Technoetic Arts, 8(3), 267–281.
Nazareth, A. , Huang, X. , Voyer, D. , & Newcombe, N. (2019). A meta-analysis of sex differences in human navigation skills. Psychonomic Bulletin & Review, 26, 1503–1528.
O'Keefe, J. , & Nadel, L. (1978). The Hippocampus as a Cognitive Map. Oxford: Clarendon Press.
Poulter, S. , Lee, S. A. , & Lever, C. (2015). Place Cells and Episodic Memory. https://www.researchgate.net/profile/Sang-Ah-Lee/publication/273127587_Place_Cells_and_Episodic_Memory/links/559d1aaa08aece2562fc0c98/Place-Cells-and-Episodic-Memory.pdf
Puig de la Bellacasa, M. (2017). Matters of Care: Speculative Ethics in More than Human Worlds. Minneapolis: University of Minnesota Press.

Rittel, H. W. J. , & Webber, M. M. (1972). Dilemmas in a General Theory of Planning. Working paper presented at the Institute of Urban and Regional Development, University of California, Berkeley, November 1972.
Rittel, H. W. , & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155–169.
Russell, L. (2020). Glitch Feminism: A Manifesto. London: Verso.
Schrott, R. , & Jacobs, A. (2011). Gehirn und Gedicht. Wie Wir Unsere Wirklichkeiten Konstruieren. München: Carl Hanser.
Skarbez, R. , Smith, M. , & Whitton, M. C. (2021). Revisiting Milgram and Kishino's reality-virtuality continuum. Frontiers in Virtual Reality, 2, 647997.
Sterelny, K. (2010). Minds: Extended or scaffolded? Phenomenology and the Cognitive Sciences, 9(4), 465–481.
Tronto, J. C. (2013). Caring Democracy: Markets, Equality, and Justice. New York; London NYU Press.
Tronto, J. C. , & Fisher, B. (1990). Toward a feminist theory of caring. In Abel, E. K. and Nelson, M. K. (eds.), Circles of Care: Work and Identity in Women's Lives (pp. 35–62, p. 40). New York: State University of New York Press.
Tyrrell, J. (2023). Sense and Senseability, Lecture, the Bartlett School of Architecture. London: University College London.
van der Ham, I. J. , Claessen, M. H. , Evers, A. W. , & van der Kuil, M. N. (2020). Large-scale assessment of human navigation ability across the lifespan. Scientific Reports, 10(1), 3299.
Venturi, R. (1977). Complexity and Contradiction in Architecture (Vol. 1). New York: The Museum of Modern Art.
Von Foerster, H. (2007). Understanding Understanding: Essays on Cybernetics and Cognition. New York: Springer Science & Business Media.
Zach, S. , & King, A. (2022). Wayfinding and spatial perception among adolescents with mild intellectual disability. Journal of Intellectual Disability Research, 66(12), 1009–1022.
Zhuang, F. , Qi, Z. , Duan, K. , Xi, D. , Zhu, Y. , Zhu, H. , … & He, Q. (2020). A comprehensive survey on transfer learning. Proceedings of the IEEE, 109(1), 43–76.
Zisch, F. (2020). Wicked neuroarchitecture: Reciprocity, Shapeshifting problems and a case for embodied knowledge. Architectural Design, 90(6), 118–127.
Zisch, F. E. (2020). Doppelkopf Neuroarchitecture. A Wicked Threshold Space (Doctoral dissertation, UCL, University College London).
Albrecht, L. (2013). Barclays Center's "signature scent" tickles noses curiosity. https://www.dnainfo.com/new-york/20130520/prospect-heights/barclays-centers-signature-scent-tickles-noses-curiosity
Arbib, M. A. (2021). When brains meet buildings: A conversation between neuroscience and architecture. Oxford University Press.
Cui, T. , Xi, J. , Tang, C. , Song, J. , He, J. , & Brytek-Matera, A. (2021). The relationship between music and food intake: A systematic review and meta-analysis. Nutrients, 13, 2571. https://doi.org/10.3390/nu13082571.
Edelstein, E.A. , & Macagno, E. (2011). Form Follows Function: Bridging Neuroscience and Architecture. In: Rassia, Stamatina Th . & Pardalos, P. M. (eds), Sustainable Environmental Design in Architecture: Impacts on Health, 1–13. UK, London: Springer.
Fenko, A. , & Loock, C. (2014). The influence of ambient scent and music on patients' anxiety in a waiting room of a plastic surgeon. HERD (Health Environments Research and Design Journal), 7(3), 38–59. https://pubmed.ncbi.nlm.nih.gov/24782235.
Herssens, J. , & Heylighen, A. (2008). Haptics and vision in architecture.
IRT Kodisoft . (2023, September 26). Smart furniture design in restaurants: Enhancing dining experiences. IRT Restaurant. https://itrestaurant.net/benefits
Jahandideh, F. , & Tabibian, M. (2015). Smart building, a way to achieve sustainable architecture.
Keçecioğlu Dağlı, Pelin & Özdemir Durak, Manolya. (2022). Smart urban furniture as innovative landscape design elements in public spaces.
Kirwan, C. G. , & Fu, Z. (2020). Smart cities and artificial intelligence: Convergent systems for planning, design, and operations. Elsevier.
Li, Z. , Zhang, J. , Li, M. , Huang, J. , & Wang, X. (2020). A review of smart design based on interactive experience in building systems. Sustainability, 12, 6760. https://doi.org/10.3390/Su12176760.
North, A. C. , Hargreaves, D. J. , & McKendrick, J. (1997). In-store music affects product choice. Nature, 390, 132.
North, A. C. , Hargreaves, D. J. , & McKendrick, J. (1999). The influence of in-store music on wine selections. Journal of Applied Psychology, 84, 271–276.

Norman, D. A. (2005). Emotional design: Why we love (or hate) everyday things. Basic Books.
Rapoport, A. (1990). The meaning of the built environment: A nonverbal communication approach. University of Arizona Press.
Sennett, R. (2009). The craftsman. Yale University Press.
Spence, C. (2020). Senses of place: Architectural design for the multisensory mind. Cognitive Research, 5, 46. https://doi.org/10.1186/s41235-020-00243-4.
Arbib, M. A. (Ed.) (2003). The Handbook of Brain Theory and Neural Networks, Second Edition. Cambridge, MA: A Bradford Book/The MIT Press.
Arbib, M. A. (2012). Brains, machines and buildings: Towards a neuromorphic architecture. Intelligent Buildings International, 4(3), 147–168. https://doi.org/110.1080/17508975.17502012.17702863
Arbib, M. A. (2021). When Brains Meet Buildings: A Conversation between Neuroscience and Architecture. New York: Oxford University Press.
Arbib, M. A. , Banasiak, B. , & Othón Villegas-Solís, L. (2022). Systems of systems: Architectural atmosphere, neuromorphic architecture, and the well-being of humans and ecospheres. In M. Kanaani (Ed.), The Routledge Companion to Ecological Design Thinking: Healthful Ecotopian Visions for Architecture and Urbanism (pp. 64–74). London: Taylor & Francis.
Arbib, M. A. , Bonaiuto, J. J. , Jacobs, S. , & Frey, S. H. (2009). Tool use and the distalization of the end-effector. Psychological Research, 73(4), 441–462. https://doi.org/10.1007/s00426-009-0242-2
Brand, S. (1994). How Buildings Learn: What Happens after They're Built. New York: Viking.
Canepa, E. , Condia, B. , & Wynne, M. (Eds.) (2023). Atmosphere(s) for Architects: Between Phenomenology and Cognition (A Dialogue between Michael Arbib and Tonino Griffero, with Commentaries) (Vol. 5). Manhattan, Kansas: New Prairie Press.
Dave, B. , Buda, A. , Nurminen, A. , & Främling, K. (2018). A framework for integrating BIM and IoT through open standards. Automation in Construction, 95, 35–45. https://doi.org/10.1016/j.autcon.2018.07.022
di Pellegrino, G. , Fadiga, L. , Fogassi, L. , Gallese, V. , & Rizzolatti, G. (1992). Understanding motor events: A neurophysiological study. Experimental Brain Research, 91(1), 176–180. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=1301372.
Downey, C. , & Arbib, M. A. (2024). Smart Architecture for the blind. In M. Kanaani (Ed.), Routledge Companion to Smart Design Thinking in Architecture & Urbanism for a Sustainable Living Planet. New York and London: Routledge.
Eng, K. , Klein, D. , Babler, A. , Bernardet, U. , Blanchard, M. , Costa, M. , … Verschure, P. F. M. J. (2003). Design for a brain revisited: The neuromorphic design and functionality of the interactive space 'Ada'. Reviews in the Neurosciences, 14, 145.
Fellous, J.-M. , & Arbib, M. A. (Eds.) (2005). Who Needs Emotions: The Brain Meets the Robot. Oxford, New York: Oxford University Press.
Haque, U. (2007). The architectural relevance of Gordon Pask. Architectural Design, 77(4), 54–61.
Hart, R. L. (2015). A New Look at Humanism—in Architecture, Landscapes, and Urban Design. California: Meadowlark Publishing.
Heidari, A. , Peyvastehgar, Y. , & Amanzadegan, M. (2023). A systematic review of the BIM in construction: From smart building management to interoperability of BIM & AI. Architectural Science Review, 67, 1–18. https://doi.org/10.1080/00038628.2023.2243247
Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. Annual Review of Psychology, 60(1), 653–670. https://doi.org/10.1146/annurev.psych.60.110707.163604
Ijspeert, A. J. (2020). Amphibious and sprawling locomotion: From biology to robotics and back. Annual Review of Control, Robotics, and Autonomous Systems, 3(1), 173–193. https://doi.org/10.1146/annurev-control-091919-095731
Kolarevic, B. , & Parlac, V. (Eds.) (2015). Building Dynamics: Exploring Architecture of Change. London and New York: Routledge.
Maravita, A. , & Iriki, A. (2004). Tools for the body (schema). Trends in Cognitive Sciences, 8(2), 79–86. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=15588812.
Minsky, M. L. , & Papert, S. (1969). Perceptrons: An Introduction to Computational Geometry. Cambridge, MA: The MIT Press.
Oztop, E. , Kawato, M. , & Arbib, M. A. (2013). Mirror neurons: Functions, mechanisms and models. Neuroscience Letters, 540, 43–55. https://doi.org/10.1016/j.neulet.2012.10.005
Prescott, T. J. , Ayers, J. , Grasso, F. W. , & Verschure, P. F. M. J. (2016). Embodied models and neurorobotics. In M. A. Arbib & J. J. Bonaiuto (Eds.), From Neuron to Cognition via Computational Neuroscience (pp. 483–511). Cambridge, MA: The MIT Press.

Rosenblatt, F. (1958). The perceptron: A probabilistic model for information storage and organization in the brain. Psychological Review, 65, 386–408.
Tidwell, P. (Ed.) (2014). Architecture and Atmosphere. Espoo, Finland: Tapio Wirkkala - Rut Bryk Foundation.
von Uexküll, J. (1957/1934). A stroll through the worlds of animals and men: A picture book of invisible worlds. In C. H. Schiller (Ed.), Instinctive Behavior: The Development of a Modern Concept (pp. 5–80 [Also in Semiotica 89 (84), 319–391. Originally appeared as von Uexküll (1934) Streifzüge durch die Umwelten von Tieren und Menschen. Springer, Berlin.]). New York: International Universities Press.
Wiener, N. (1948). Cybernetics: or Control and Communication in the Animal and the Machine. New York: The Technology Press and John Wiley & Sons.
WOHA, & Bingham-Hall, P. (2015). WOHA: Selected Projects, Volume 2. Oxford, Singapore, Sydney: Pesaro Publishing.

NeuroArchitecture for Cognitive Ecologies

Amoore, L. , & Piotukh, V. (2019). Interview with N. Katherine Hayles. Theory, Culture & Society, 36(2), 145–155.
Applin, S. A. , & Fischer, M. D. (2013). Thing theory: Connecting humans to location-aware smart environments. LAMDa', 13, 29.
Baggs, E. , & Chemero, A. (2021). Radical embodiment in two directions. Synthese, 198(Suppl 9), 2175–2190.
Banker, S. M. , Gu, X. , Schiller, D. , & Foss-Feig, J. H. (2021). Hippocampal contributions to social and cognitive deficits in autism spectrum disorder. Trends in Neurosciences, 44(10), 793–807.
Barad, K. (2007). Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning. Durham, NC: Duke University Press.
Barsalou, L. W. (1999). Perceptual symbol systems. Behavioral and Brain Sciences, 22(4), 577–660.
Barsalou, L. W. (2005). Abstraction as dynamic interpretation in perceptual symbol systems. In Building Object Categories in Developmental Time (pp. 407–450). Psychology Press.
Böhme, G. (1993). Atmosphere as the fundamental concept of a new aesthetics. Thesis Eleven, 36(1), 113–126.
Bostock, E. , Muller, R. U. , & Kubie, J. L. (1991). Experience-dependent modifications of hippocampal place cell firing. Hippocampus, 1(2), 193–205.
Brown, A. M. (2017). Emergent strategy: Shaping change, Changing Worlds. Chico, CA: AK Press
Butnor, A. , & MacKenzie, M. (2022). Enactivism and gender performativity. In McWeeny, J. , Maitra, K. (eds.), Feminist Philosophy of Mind, 190–206.
Choudhury, S. , & Slaby, J. (eds.) (2016). Critical Neuroscience: A Handbook of the Social and Cultural Contexts of Neuroscience. John Wiley & Sons. https://www.google.co.uk/books/edition/Critical_Neuroscience/pjFECwAAQBAJ?hl=en&gbpv=1&dq=Choudhury,+S.,+%26+Slaby,+J.+(eds.)+(2016).+Critical+Neuroscience:+A+Handbook+of+the+Social+and+Cultural+Contexts+of+Neuroscience.+John+Wiley+%26+Sons.&pg=PR8&printsec=frontcover
Clark, A. , & Chalmers, D. (1998). The extended mind. Analysis, 58(1), 7–19.
Corti, C. , Oprandi, M. C. , Chevignard, M. , Jansari, A. , Oldrati, V. , Ferrari, E. , … & Bardoni, A. (2022). Virtual-reality performance-based assessment of cognitive functions in adult patients with acquired Brain Injury: A scoping review. Neuropsychology Review, 32(2), 352–399.
Daston, L. , & Galison, P. (2021). Objectivity. Princeton, NJ; Woodstock: Princeton University Press. https://www.google.co.uk/books/edition/Objectivity/TtsPEAAAQBAJ?hl=en&gbpv=0
De Cothi, W. , Nyberg, N. , Griesbauer, E. M. , Ghanamé, C. , Zisch, F. , Lefort, J. M. , … & Spiers, H. J. (2022). Predictive maps in rats and humans for spatial navigation. Current Biology, 32(17), 3676–3689.
Dingli, S. (2008). Thinking outside the box: Edward de Bono's lateral thinking. In Tudor, R. , Mark A. R. , & Susan, M. (eds.), The Routledge Companion to Creativity (pp. 338–350). London: Routledge.
Doran, G. T. (1981). There's a SMART way to write management's goals and objectives. Management Review, 70(11), 35–36.
Easterling, K. (2021, 19 January). Reading mutualism: A contemplation after medium design. Verso. https://www.versobooks.com/blogs/4976-reading-mutualism-a-contemplation-after-medium-design (Accessed 6 November 2023November).
Edelmann, G. (n.d.). Neuroarchitecture. https://www.youtube.com/watch?v=p1LoP9W5Qng (Accessed 6 November 2023November).
Epstein, R. A. , Patai, E. Z. , Julian, J. B. , & Spiers, H. J. (2017). The cognitive map in humans: Spatial navigation and beyond. Nature Neuroscience, 20(11), 1504–1513.

Farzanfar, D. , Spiers, H. J. , Moscovitch, M. , & Rosenbaum, R. S. (2023). From cognitive maps to spatial schemas. Nature Reviews Neuroscience, 24(2), 63–79.
Federici, S. (2020). Beyond the Periphery of the Skin: Rethinking, Remaking, and Reclaiming the Body in Contemporary Capitalism. Oakland, CA: PM Press.
Fernandez-Velasco, P. , & Spiers, H. J. (2023). Wayfinding across ocean and tundra: What traditional cultures teach us about navigation. Trends in Cognitive Sciences, 28(1), 56–71.
Frampton, K. (2020). Modern Architecture: A Critical History (World of Art). London: Thames & Hudson.
Glanville, R. (2007). Try again. Fail again. Fail better: The cybernetics in design and the design in cybernetics. Kybernetes, 36(9/10), 1173–1206.
Grobstein, P. (1994). Variability in brain function and behavior. In Ramachandran, V. S. (ed.), The Encyclopedia of Human Behavior (Vol. 4, pp. 447–458). Amsterdam: Elsevier Science. https://www.google.co.uk/books/edition/Encyclopedia_of_Human_Behavior/yASuxMCuhKkC?hl=en&gbpv=0
Gumbrecht, H. U. (2004). Production of preSence: What Meaning Cannot Convey? Stanford, CA: Stanford University Press.
Haraway, D. (1997, February). Wired Magazine. https://www.wired.com/1997/02/ffharaway/ (Accessed 15 October 2023October).
Haraway, D. (2019, 6 December). Making Kin: An interview with Donna Haraway (Steve Paulson interviews Donna Haraway). LA Review of Books. https://www.lareviewofbooks.org/article/making-kin-an-interview-with-donna-haraway/ (Accessed 5 June 2021June)
Hayles, N. K. (2017). Unthought: The Power of the Cognitive Nonconscious. Chicago, IL: University of Chicago Press.
Hays, K. M. (1984). Critical architecture: Between culture and form. Perspecta, 21, 15–29.
Hegarty, M. , Montello, D. R. , Richardson, A. E. , Ishikawa, T. , & Lovelace, K. (2006). Spatial abilities at different scales: Individual differences in aptitude-test performance and spatial-layout learning. Intelligence, 34(2), 151–176.
Hendrix, J. (2012). Architecture as the psyche of a culture. In Paul Emmons , Jane Lomholt , John Shannon Hendrix (eds.), The Cultural Role of Architecture: Contemporary and Historical Perspectives (pp. 208–215). London: Routledge.
Ihde, D. (2000). Putting technology in its place. Nature, 404(6781), 935–935.
Jeffery, K. , & Zisch, F. (2022). Spatial entities of the future: Design through the lens of neuroscience. In Mitra Kanaani (ed.), The Routledge Companion to Ecological Design Thinking (pp. 92–103). New York: Routledge.
Li, A. W. , & King, J. (2019). Spatial memory and navigation in ageing: A systematic review of MRI and fMRI studies in healthy participants. Neuroscience & Biobehavioral Reviews, 103, 33–49.
Massumi, B. (2002). Parables for the Virtual: Movement, Affect, Sensation. Durham, NC: Duke University Press.
Murrani, S. (2011). Third way architecture: Between cybernetics and phenomenology. Technoetic Arts, 8(3), 267–281.
Nazareth, A. , Huang, X. , Voyer, D. , & Newcombe, N. (2019). A meta-analysis of sex differences in human navigation skills. Psychonomic Bulletin & Review, 26, 1503–1528.
O'Keefe, J. , & Nadel, L. (1978). The Hippocampus as a Cognitive Map. Oxford: Clarendon Press.
Poulter, S. , Lee, S. A. , & Lever, C. (2015). Place Cells and Episodic Memory. https://www.researchgate.net/profile/Sang-Ah-Lee/publication/273127587_Place_Cells_and_Episodic_Memory/links/559d1aaa08aece2562fc0c98/Place-Cells-and-Episodic-Memory.pdf
Puig de la Bellacasa, M. (2017). Matters of Care: Speculative Ethics in More than Human Worlds. Minneapolis: University of Minnesota Press.
Rittel, H. W. J. , & Webber, M. M. (1972). Dilemmas in a General Theory of Planning. Working paper presented at the Institute of Urban and Regional Development, University of California, Berkeley, November 1972.
Rittel, H. W. , & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155–169.
Russell, L. (2020). Glitch Feminism: A Manifesto. London: Verso.
Schrott, R. , & Jacobs, A. (2011). Gehirn und Gedicht. Wie Wir Unsere Wirklichkeiten Konstruieren. München: Carl Hanser.
Skarbez, R. , Smith, M. , & Whitton, M. C. (2021). Revisiting Milgram and Kishino’s reality-virtuality continuum. Frontiers in Virtual Reality, 2, 647997.
Sterelny, K. (2010). Minds: Extended or scaffolded? Phenomenology and the Cognitive Sciences, 9(4), 465–481.
Tronto, J. C. (2013). Caring Democracy: Markets, Equality, and Justice. New York; London NYU Press.

Tronto, J. C. , & Fisher, B. (1990). Toward a feminist theory of caring. In Abel, E. K. and Nelson, M. K. (eds.), Circles of Care: Work and Identity in Women’s Lives (pp. 35–62, p. 40). New York: State University of New York Press.
Tyrrell, J. (2023). Sense and Senseability, Lecture, the Bartlett School of Architecture. London: University College London.
van der Ham, I. J. , Claessen, M. H. , Evers, A. W. , & van der Kuil, M. N. (2020). Large-scale assessment of human navigation ability across the lifespan. Scientific Reports, 10(1), 3299.
Venturi, R. (1977). Complexity and Contradiction in Architecture (Vol. 1). New York: The Museum of Modern Art.
Von Foerster, H. (2007). Understanding Understanding: Essays on Cybernetics and Cognition. New York: Springer Science & Business Media.
Zach, S. , & King, A. (2022). Wayfinding and spatial perception among adolescents with mild intellectual disability. Journal of Intellectual Disability Research, 66(12), 1009–1022.
Zhuang, F. , Qi, Z. , Duan, K. , Xi, D. , Zhu, Y. , Zhu, H. , … & He, Q. (2020). A comprehensive survey on transfer learning. Proceedings of the IEEE, 109(1), 43–76.
Zisch, F. (2020). Wicked neuroarchitecture: Reciprocity, Shapeshifting problems and a case for embodied knowledge. Architectural Design, 90(6), 118–127.
Zisch, F. E. (2020). Doppelkopf Neuroarchitecture. A Wicked Threshold Space (Doctoral dissertation, UCL, University College London).

Smart Design for Promoting Social Performativity and Interactivity of All the Senses

Albrecht, L. (2013). Barclays Center’s “signature scent” tickles noses curiosity. https://www.dnainfo.com/new-york/20130520/prospect-heights/barclays-centers-signature-scent-tickles-noses-curiosity
Arbib, M. A. (2021). When brains meet buildings: A conversation between neuroscience and architecture. Oxford University Press.
Cui, T. , Xi, J. , Tang, C. , Song, J. , He, J. , & Brytek-Matera, A. (2021). The relationship between music and food intake: A systematic review and meta-analysis. Nutrients, 13, 2571. https://doi.org/10.3390/nu13082571.
Edelstein, E.A. , & Macagno, E. (2011). Form Follows Function: Bridging Neuroscience and Architecture. In: Rassia, Stamatina Th . & Pardalos, P. M. (eds), Sustainable Environmental Design in Architecture: Impacts on Health, 1–13. UK, London: Springer.
Fenko, A. , & Loock, C. (2014). The influence of ambient scent and music on patients’ anxiety in a waiting room of a plastic surgeon. HERD (Health Environments Research and Design Journal), 7(3), 38–59. https://pubmed.ncbi.nlm.nih.gov/24782235.
Herssens, J. , & Heylighen, A. (2008). Haptics and vision in architecture.
IRT Kodisoft . (2023, September 26). Smart furniture design in restaurants: Enhancing dining experiences. IRT Restaurant. https://itrestaurant.net/benefits
Jahandideh, F. , & Tabibian, M. (2015). Smart building, a way to achieve sustainable architecture.
Keçecioğlu Dağlı, Pelin & Özdemir Durak, Manolya. (2022). Smart urban furniture as innovative landscape design elements in public spaces.
Kirwan, C. G. , & Fu, Z. (2020). Smart cities and artificial intelligence: Convergent systems for planning, design, and operations. Elsevier.
Li, Z. , Zhang, J. , Li, M. , Huang, J. , & Wang, X. (2020). A review of smart design based on interactive experience in building systems. Sustainability, 12, 6760. https://doi.org/10.3390/Su12176760.
North, A. C. , Hargreaves, D. J. , & McKendrick, J. (1997). In-store music affects product choice. Nature, 390, 132.
North, A. C. , Hargreaves, D. J. , & McKendrick, J. (1999). The influence of in-store music on wine selections. Journal of Applied Psychology, 84, 271–276.
Norman, D. A. (2005). Emotional design: Why we love (or hate) everyday things. Basic Books.
Rapoport, A. (1990). The meaning of the built environment: A nonverbal communication approach. University of Arizona Press.
Sennett, R. (2009). The craftsman. Yale University Press.
Spence, C. (2020). Senses of place: Architectural design for the multisensory mind. Cognitive Research, 5, 46. https://doi.org/10.1186/s41235-020-00243-4.

Neuromorphic Architecture at a Turning Point

Arbib, M. A. (Ed.) (2003). The Handbook of Brain Theory and Neural Networks, Second Edition. Cambridge, MA: A Bradford Book/The MIT Press.
Arbib, M. A. (2012). Brains, machines and buildings: Towards a neuromorphic architecture. Intelligent Buildings International, 4(3), 147–168. https://doi.org/110.1080/17508975.17502012.17702863
Arbib, M. A. (2021). When Brains Meet Buildings: A Conversation between Neuroscience and Architecture. New York: Oxford University Press.
Arbib, M. A. , Banasiak, B. , & Othón Villegas-Solís, L. (2022). Systems of systems: Architectural atmosphere, neuromorphic architecture, and the well-being of humans and ecospheres. In M. Kanaani (Ed.), The Routledge Companion to Ecological Design Thinking: Healthful Ecotopian Visions for Architecture and Urbanism (pp. 64–74). London: Taylor & Francis.
Arbib, M. A. , Bonaiuto, J. J. , Jacobs, S. , & Frey, S. H. (2009). Tool use and the distalization of the end-effector. Psychological Research, 73(4), 441–462. https://doi.org/10.1007/s00426-009-0242-2
Brand, S. (1994). How Buildings Learn: What Happens after They’re Built. New York: Viking.
Canepa, E. , Condia, B. , & Wynne, M. (Eds.) (2023). Atmosphere(s) for Architects: Between Phenomenology and Cognition (A Dialogue between Michael Arbib and Tonino Griffero, with Commentaries) (Vol. 5). Manhattan, Kansas: New Prairie Press.
Dave, B. , Buda, A. , Nurminen, A. , & Främling, K. (2018). A framework for integrating BIM and IoT through open standards. Automation in Construction, 95, 35–45. https://doi.org/10.1016/j.autcon.2018.07.022
di Pellegrino, G. , Fadiga, L. , Fogassi, L. , Gallese, V. , & Rizzolatti, G. (1992). Understanding motor events: A neurophysiological study. Experimental Brain Research, 91(1), 176–180. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=1301372 .
Downey, C. , & Arbib, M. A. (2024). Smart Architecture for the blind. In M. Kanaani (Ed.), Routledge Companion to Smart Design Thinking in Architecture & Urbanism for a Sustainable Living Planet. New York and London: Routledge.
Eng, K. , Klein, D. , Babler, A. , Bernardet, U. , Blanchard, M. , Costa, M. , … Verschure, P. F. M. J. (2003). Design for a brain revisited: The neuromorphic design and functionality of the interactive space ‘Ada’. Reviews in the Neurosciences, 14, 145.
Fellous, J.-M. , & Arbib, M. A. (Eds.) (2005). Who Needs Emotions: The Brain Meets the Robot. Oxford, New York: Oxford University Press.
Haque, U. (2007). The architectural relevance of Gordon Pask. Architectural Design, 77(4), 54–61.
Hart, R. L. (2015). A New Look at Humanism—in Architecture, Landscapes, and Urban Design. California: Meadowlark Publishing.
Heidari, A. , Peyvastehgar, Y. , & Amanzadegan, M. (2023). A systematic review of the BIM in construction: From smart building management to interoperability of BIM & AI. Architectural Science Review, 67, 1–18. https://doi.org/10.1080/00038628.2023.2243247
Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. Annual Review of Psychology, 60(1), 653–670. https://doi.org/10.1146/annurev.psych.60.110707.163604
Ijspeert, A. J. (2020). Amphibious and sprawling locomotion: From biology to robotics and back. Annual Review of Control, Robotics, and Autonomous Systems, 3(1), 173–193. https://doi.org/10.1146/annurev-control-091919-095731
Kolarevic, B. , & Parlac, V. (Eds.) (2015). Building Dynamics: Exploring Architecture of Change. London and New York: Routledge.
Maravita, A. , & Iriki, A. (2004). Tools for the body (schema). Trends in Cognitive Sciences, 8(2), 79–86. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=15588812.
Minsky, M. L. , & Papert, S. (1969). Perceptrons: An Introduction to Computational Geometry. Cambridge, MA: The MIT Press.
Oztop, E. , Kawato, M. , & Arbib, M. A. (2013). Mirror neurons: Functions, mechanisms and models. Neuroscience Letters, 540, 43–55. https://doi.org/10.1016/j.neulet.2012.10.005
Prescott, T. J. , Ayers, J. , Grasso, F. W. , & Verschure, P. F. M. J. (2016). Embodied models and neurorobotics. In M. A. Arbib & J. J. Bonaiuto (Eds.), From Neuron to Cognition via Computational Neuroscience (pp. 483–511). Cambridge, MA: The MIT Press.
Rosenblatt, F. (1958). The perceptron: A probabilistic model for information storage and organization in the brain. Psychological Review, 65, 386–408.
Tidwell, P. (Ed.) (2014). Architecture and Atmosphere. Espoo, Finland: Tapio Wirkkala - Rut Bryk Foundation.
von Uexküll, J. (1957/1934). A stroll through the worlds of animals and men: A picture book of invisible worlds. In C. H. Schiller (Ed.), Instinctive Behavior: The Development of a Modern Concept (pp. 5–80 [Also

in Semiotica 89 (84), 319–391. Originally appeared as von Uexküll (1934) Streifzüge durch die Umwelten von Tieren und Menschen. Springer, Berlin.]). New York: International Universities Press.
Wiener, N. (1948). Cybernetics: or Control and Communication in the Animal and the Machine. New York: The Technology Press and John Wiley & Sons.
WOHA, & Bingham-Hall, P. (2015). WOHA: Selected Projects, Volume 2. Oxford, Singapore, Sydney: Pesaro Publishing.

AI and the Morphology of the City _AI's Dynamic Power in Shaping the Future of Urban Design

Carpo, M. (2013). The Digital Turn in Architecture 1992–2012. Edited by Mario Carpo . Chichester: Wiley.
Chen, Leshang & Davidson, Susan. (2019). Automate Software Citation using GitCite.
Choay, F. , Hugo, M. , & Collins, G. R. (1970). 1969. The Modern City: Planning in the 19th Century. New York: George Braziller.
Coleman, S. (2023). Ludwig Hilberseimer: Reanimating Architecture and the City. London: Bloomsbury Publishing.
Crawford, K. (2021). Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence (pp. 123–149). New Haven: Yale University Press. https://doi.org/10.12987/9780300252392.
Cuthbert, Alexander . (2008). The Form of Cities: Political Economy and Urban Design. The Form of Cities: Political Economy and Urban Design. 1-304. 10.1002/9780470774915.
Cuthbert, A. (2008). The Form of Cities: Political Economy and Urban Design (pp. 1–304). London: Wiley. https://doi.org/10.1002/9780470774915.
del Campo, M. (2022). Neural Architecture—Design and Artificial Intelligence. Novato, CA: ORO Edition.
Donepudi, P. (2017). Machine Learning and Artificial Intelligence in Banking. Engineering International, 5: 83–86. https://doi.org/10.18034/ei.v5i2.490.
Ebenezer, H. , & Osborn , Frederic J. (1965). Garden Cities of To-Morrow. Cambridge, MA: MIT Press.
Esteva, A. , Chou, K. , Yeung, S. et al. (2021). Deep Learning-Enabled Medical Computer Vision. npj Digital Medicine, 4: 5. https://doi.org/10.1038/s41746-020-00376-2.
Giedion, S. (1941). Space, Time and Architecture. Cambridge, MA: Harvard University Press.
Hilberseimer, L. (1944). The New City; Principles of Planning. Chicago: Paul Theobald.
Kamrowska-Załuska, D. (2021). Impact of AI-Based Tools and Urban Big Data Analytics on the Design and Planning of Cities. Land, 10, no. 11: 1209.
Mertins, D. (1996). The Enticing and Threatening Face of Prehistory: Walter Benjamin and the Utopia of Glass. Assemblage, no. 29: 7–23. https://doi.org/10.2307/3171392.
Pearson, C. (2011). Humanism and the Urban World: Leon Battista Alberti and the Renaissance City. Philadelphia, PA: Penn State University Press. https://doi.org/10.5325/j.ctt7v6f4.
Poon, S. (2017). Understanding the Impact of Cultural Design Aesthetics and Socioeconomic Shifts: Approaches to Urban Resilience Empower Place Making. Journal of Urban Culture Research, 14: 34–56. https://doi.org/10.14456/jucr.2017.3.
Rodríguez, L. (2006). The Form of Cites: Political Economy and Urban Design. AUS. 6, 32–46. https://doi.org/10.4206/aus.2006.n2-05.
Rowe, H. A. (2011). The Rise and Fall of Modernist Architecture. Inquiries Journal/Student Pulse, 3, no. 4, 21–34. http://www.inquiriesjournal.com/a?id=1687
Schirren, M. , & Taut, B. (2004). Bruno Taut Alpine Architektur: Eine Utopie = A Utopia. München: Prestel.
Simmel, G. (1950). The Metropolis and Mental Life. In K. H. Wolff (Ed.), The Sociology of Georg Simmel (pp. 409–424). New York: The Free Press.
Spence, C. (2020). Senses of Place: Architectural Design for the Multisensory Mind . Cognitive Research: Principles and Implications, 5, no. 1: 46.
Tafuri, M. (1976). Architecture and Utopia: Design and Capitalist Development (p. 86). Cambridge, MA: MIT Press.
van Eck, C. (1998). The Structure of ‘De Re Aedificatoria’ Reconsidered. Journal of the Society of Architectural Historians, 57, no. 3: 280–297. https://doi.org/10.2307/991347.
Wright, F. L. (1932). 1867–1959. The Disappearing City. New York: W.F. Payson.

Lived Multi-species High-Density Utopias

Birkeland, J. (2020). Net-Positive Design and Sustainable Urban Development. Routledge.
Catalano, C.E. , Meslec, M. , Boileau, J. , Guarino, R. , Aurich, I. , Baumann, N. , Chartier, F. , Dalix, P. , Deramond, S. , Laube, P. , Lee, A.K.K. , Ochsner, P. , Pasturel, M. , Soret, M. and Moulherat, S. (2021). Smart sustainable cities of the new millennium: Towards design for nature. Circular Economy and Sustainability, 1(3): 1053–1086.
Crace, J. (2023). 'Magical' tech innovations a distraction from real solutions, climate experts warn. The Guardian, 10 December 2023. Retrieved from https://www.theguardian.com/environment/fossil-fuels/2023/dec/10/all.
Crosby, P.M. (2023). Towards an anti-antiutopia: Solarpunk cities and the precarity of our urban future. Enquiry the ARCC Journal for Architectural Research, 20(2): 79–91.
Deng, M. (2017). Research on the Ecological Design Strategy for Super High-Rise Buildings in Lingnan (in Chinese). PhD thesis. South China University of Technology.
Diamond, R.C. , Ye, Q. , Feng, W. , Yan, T. , Mao, H. , Li, Y. , Guo, Y. and Wang, J. (2013). Sustainable building in China—A green leap forward? Buildings, 3(3): 639–658.
Eschrich, J. , Miller, C. and Wylie, R. 2021). Cities of Light: A Collection of Solar Futures. Tempe, Arizona State University Center for Science and the Imagination.
Grobman, Y.J. , Weisser, W. , Shwartz, A. , Ludwig, F. , Kozlovsky, R. , Ferdman, A. , Perini, K. , Hauck, T.E. , Selvan, S.U. and Saroglou, S. , Barath, S. , Schloter, M. and Windorfer, L. (2023). Architectural multispecies building design: Concepts, challenges, and design process. Sustainability, 15: 15480.
Herr, C.M. (2022). Sublimating tectonics of architecture: Innovations in creative structural engineering. In M. Kanaani (ed.), The Routledge Companion to Ecological Design Thinking: Healthful Ecotopian Visions for Architecture and Urbanism, Routledge, 328–338.
Herr, C.M. , Blokhina, E. , Gao, Z. , Ji, Y. , Jiang, Y. and Tang, C. (2022). Designing biodiverse high-rise façade microbiomes for healthy urban environments. CTBUH Journal 4: 20–27.
Herr, C.M. and Duan, Y. (2020). Designing facade microbiomes. In Imaginable Futures: Design Thinking, and the Scientific Method, Proceedings of the 54th International Conference of the Architectural Science Association, Auckland, New Zealand, 365–374.
Herr, C.M. and Li, C. (2023). Articulating facade microbiomes at human scale: A cellular automata driven bioreceptive facade design approach to communicate a new dimension of urban health. In CAADRIA 2023: Proceedings of the 28th International Conference on Computer-Aided Architectural Design Research in Asia, Ahmenabad, India, 281–290.
Herr, C.M. , Li, C. , Zhou, Y. and Yan, M. (2024). Embracing local biodiversity as part of sustainable high rise building facades in subtropical China. In Proceedings of ICSBS 2023 the 3rd International Conference on Sustainable Buildings and Structures, Springer Nature.
Huang, H. , Ma, Z. and Li, J. (2009). Application of green and energy-saving building technology in super high-rise buildings in subtropical regions (in Chinese). Architectural Journal, (9): 99–101.
Moghadam, T.T. and Feizabadi, M. (2018). Increasing ecological capacity by designing ecological high-rise buildings. Open House International, 43: 94–104.
Oberndorfer, E. , Lundholm, J. , Bass, B. , Coffman, R. , Doshi, H. , Dunnett, N. , Gaffin, S. , Köhler, M. , Liu, K. ,and Rowe, D.B. (2007). Green roofs as urban ecosystems: Ecological structures, functions, and services. BioScience, 57(10): 823–833.
Research institute for Eco-civilization, Chinese Academy of Social Science. (2021). Shenzhen Sustainable Development Report. Retrieved on 2 January, 2024 from https://www.undp.org/china/publications/shenzhen-sustainable-development-report-2021
Robinson, J.M. , Wissel, E.F. and Breed, M.F. (2023). Policy implications of the microbiota-gut-brain axis. Trends in Microbiology, November 10: S0966-842X(23)00299-8.
Rockström, J. , Steffen, W. , Noone, K. , Persson, A. , Chapin, III , F.S., Lambin, E. , Lenton, T.M. , Scheffer, M. , Folke, C. , Schellnhuber, H. , Nykvist, B. , De Wit, C.A. , Hughes, T. , van der Leeuw, S. , Rodhe, H. , Sorlin, S. , Snyder, P.K. , Costanza, R. , Svedin, U. , Falkenmark, M. , Karlberg, L. , Corell, R.W. , Fabry, V.J. , Hansen, J. , Walker, B. , Liverman, D. , Richardson, K. , Crutzen, P. and Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. Ecology and Society, 14(2): 32.
The Solarpunk Community . (2019). A Solarpunk manifesto. re-des.org. Regenerative Design. Archived from the original on 2019 October 12. Retrieved on 2 January 2024 from https://web.archive.org/web/20191012233135/http://www.re-des.org/a-solarpunk-manifesto/.
Weisser, W.W. , Hensel, M. , Barath, S. , Culshaw, V. , Grobman, Y. J. , Hauck, T. E. , Joschinski, J. , Ludwig, F. , Mimet, A. , Perini, K. , Roccotiello, E. , Schloter, M. , Shwartz, A. , Hensel, D. S. and Vogler, V.

(2023). Creating ecologically sound buildings by integrating ecology, architecture and computational design. People and Nature, 5(1): 4–20.
Zhong, W. , Schoeder, T. and Bekkering, J. (2023). Designing with nature: Advancing three-dimensional green spaces in architecture through frameworks for biophilic design and sustainability. Frontiers of Architectural Research, 12(4): 732–753.

Smart City and the Concept of Safety

Abou-Senna, H. , Abdel-Aty, M. , Wu, J. and Darius, B. (2015), “MRI-2: Integrated Simulation and Safety”, University of Central Florida, Orlando, FL, USA.
Aghabayk, K. , Sarvi, M. and Young, W. (2015), “A state-of-the-art review of car-following models with particular considerations of heavy vehicles”, Transport Reviews, Vol. 35, No. 1, pp. 82–105.
Ahmed, H.U. , Huang, Y. and Lu, P. (2021), “A review of car-following models and modeling tools for human and autonomous-ready driving behaviors in micro-simulation”, Smart Cities, Vol. 4, No. 1, pp. 314–335.
Ahmed, H.U. , Huang, Y. , Lu, P. and Bridgelall, R. (2022), “Technology developments and impacts of connected and autonomous vehicles: An overview”, Smart Cities, Vol. 5, No. 1, pp. 382–404.
Barceló, J. and Casas, J. (2005), “Dynamic network simulation with AIMSUN”, Simulation Approaches in Transportation Analysis: Recent Advances and Challenges, Springer, Boston, MA, USA, pp. 57–98.
Bierstedt, J. , Gooze, A. , Gray, C. , Peterman, J. , Raykin, L. and Walters, J. (2014), “Effects of next-generation vehicles on travel demand and highway capacity”, FP Think Working Group, Vol. 8, pp. 10–11.
Brackstone, M. and McDonald, M. (1999), “Car-following: A historical review”, Transportation Research Part F: Traffic Psychology and Behaviour, Vol. 2, No. 4, pp. 181–196.
Chandler, R.E. , Herman, R. and Montroll, E.W. (1958), “Traffic dynamics: Studies in car following”, Operations Research, Vol. 6, No. 2, pp. 165–184.
Chen, J. , Liu, R. , Ngoduy, D. and Shi, Z. (2016), “A new multi-anticipative car-following model with consideration of the desired following distance”, Nonlinear Dynamics, Vol. 85, pp. 2705–2717.
Chin, H.-C. and Quek, S.-T. (1997), “Measurement of traffic conflicts”, Safety Science, Vol. 26, No. 3, pp. 169–185.
Das, P. (2018), “Risk Analysis of Autonomous Vehicle and Its Safety Impact on Mixed Traffic Stream”, Master’s Thesis, Rowan University, Glassboro, NJ, USA.
Fritzsche, H.-T. and Ag, D. (1994), “A model for traffic simulation”, Traffic Engineering+ Control, Vol. 35, No. 5, pp. 317–321.
Fyfe, M.R. (2016), “Safety Evaluation of Connected vehicle Applications using Micro-Simulation”, Master’s Thesis, University of British Columbia, Vancouver, BC, Canada.
Gazis, D.C. , Herman, R. and Rothery, R.W. (1961), “Nonlinear follow-the-leader models of traffic flow”, Operations Research, Vol. 9, No. 4, pp. 545–567.
Gettman, D. and Head, L. (2003), “Surrogate safety measures from traffic simulation models”, Transportation Research Record, Vol. 1840, No. 1, pp. 104–115.
Gipps, P.G. (1981), “A behavioural car-following model for computer simulation”, Transportation Research Part B: Methodological, Vol. 15, No. 2, pp. 105–111.
Greenblatt, N.A. (2016), “Self-driving cars and the law”, IEEE Spectrum, Vol. 53, No. 2, pp. 46–51.
Harlow, C. and Peng, S. (2001), “Automatic vehicle classification system with range sensors”, Transportation Research Part C: Emerging Technologies, Vol. 9, No. 4, pp. 231–247.
Herman, R. (1959), “Car-following and steady state flow”, Journal of Zhejiang University-SCIENCE A, 12(8), 645-654.
Hoogendoorn, S.P. and Hoogendoorn, R. (2010), “Generic calibration framework for joint estimation of car-following models by using microscopic data”, Transportation Research Record, Vol. 2188, No. 1, pp. 37–45.
Huang, F. , Liu, P. , Yu, H. and Wang, W. (2013), “Identifying if VISSIM simulation model and SSAM provide reasonable estimates for field measured traffic conflicts at signalized intersections”, Accident Analysis & Prevention, Vol. 50, pp. 1014–1024.
Hunter, M.P. , Guin, A. , Rodgers, M.O. , Huang, Z. and Greenwood, A.T. (2017), “Cooperative Vehicle–Highway Automation (CVHA) Technology: Simulation of Benefits and Operational Issues”, United States: Federal Highway Administration, Atlanta, GA, USA.
Jones, S.L. , Sullivan, A.J. , Cheekoti, N. , Anderson, M.D. and Malave, D. (2004), “Traffic simulation software comparison study”, UTCA Report, Vol. 2217.
Kockelman, K.M. , Avery, P. , Bansal, P. , Boyles, S.D. , Bujanovic, P. , Choudhary, T. , Clements, L. , Domnenko, G. , Fagnant, D. , Helsel, J. , Hutchinson, R. , Levin, M. Li, J. , Li, T. , Loftus-Otway, L. , Nichols, A. , Simoni, M. and Stewart, D. (2016), “Implications of Connected and Automated Vehicles on the Safety and Operations of Roadway Networks: A Final Report.” Texas Department of Transportation: Austin, TX,

USA.
Lazar, H. , Rhoulami, K. and Rahmani, D. (2016), “A review analysis of optimal velocity models”, Periodica Polytechnica Transportation Engineering, Vol. 44, No. 2, pp. 123–131.
Leutzbach, W. (1988), Introduction to the Theory of Traffic Flow, Vol. 47, Springer, Heidelberg, Germany.
Litman, T. (2017), Autonomous Vehicle Implementation Predictions, Canada, BC: Victoria Transport Policy Institute Victoria.
Liu, R. (2010), “Traffic simulation with DRACULA”, Fundamentals of Traffic Simulation, Springer, New York, NY, pp. 295–322.
Lochrane, T. (2014), “A new multidimensional psycho-physical framework for modeling car-following in a freeway work zone” Ph.D. Thesis, University of Central Florida, Orlando, FL, USA, 2014.
National Highway Traffic Safety Administration. (2008), “National motor vehicle crash causation survey: Report to congress”, National Highway Traffic Safety Administration Technical Report DOT HS, Vol. 811, p. 059.
National Highway Traffic Safety Administration. (2022), Early Estimate of Motor Vehicle Traffic Fatalities in 2020, Washington, DC: United States Department of Transportation.
Olstam, J.J. and Tapani, A. (2004), Comparison of Car-Following Models, Vol. 960, Sweden: Swedish National Road and Transport Research Institute Linköping.
Perkins, S.R. and Harris, J.L. (1968), “Traffic conflict characteristics-accident potential at intersections”, Highway Research Record, No. 225, pp. 35–43.
Pipes, L.A. (1953), “An operational analysis of traffic dynamics”, Journal of Applied Physics, Vol. 24, No. 3, pp. 274–281.
PTV Group . (2020), PTV VISSIM 2020 User Manual, Karlsruhe, Germany: PTV Group.
Pu, L. , Joshi, R. and Energy, S. (2008), Surrogate Safety Assessment Model (SSAM)--Software User Manual, Turner-Fairbank Highway Research Center, McLean, VA, USA.
Richard, C.M. , Morgan, J.F. , Bacon, L.P. , Graving, J. , Divekar, G. and Lichty, M.G. (2015), “Multiple Sources of Safety Information from V2v and V2i: Redundancy, Decision Making, and Trust—Safety Message Design Report”, United States: Federal Highway Administration. Office of Research, McLean, VA, USA.
SAE. (2018), “Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles”, Available at: https://www.sae.org/standards/content/j3016_201806/ (Accessed 13 November 2023November).
Subramanian, H. (1996), “Estimation of Car-Following Models”, Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, MA, USA.
Tang, Q. , Dagley, G. , Ghamsari, A. , Price, M. and Hoover, J. (2020), “Automatic vehicle configuration based on sensor data”, Google Patents.
Tettamanti, T. and Varga, I. (2012), “Development of road traffic control by using integrated VISSIM-MATLAB simulation environment”, Periodica Polytechnica Civil Engineering, Vol. 56, No. 1, pp. 43–49.
Toledo, T. , Koutsopoulos, H.N. and Ben-Akiva, M. (2007), “Integrated driving behavior modeling”, Transportation Research Part C: Emerging Technologies, Vol. 15, No. 2, pp. 96–112.
Van Arem, B. , Van Driel, C.J. and Visser, R. (2006), “The impact of cooperative adaptive cruise control on traffic-flow characteristics”, IEEE Transactions on Intelligent Transportation Systems, Vol. 7, No. 4, pp. 429–436.
Weiss, D.J. and Weidman, J. (2012), “5 Ways the Obama administration revived the auto industry by reducing oil use”. Center for American Progress.
Wiedemann, R. (1974), “Simulation des Strassenverkehrsflusses.”
Wiedemann, R. and Reiter, U. (1992), “Microscopic traffic simulation: The simulation system MISSION, background and actual state”, Project ICARUS (V1052) Final Report, Vol. 2, pp. 1–53.
Wu, J. , Xu, H. , Tian, Y. , Zhang, Y. , Zhao, J. and Lv, B. (2020), “An automatic lane identification method for the roadside light detection and ranging sensor”, Journal of Intelligent Transportation Systems, Vol. 24, No. 5, pp. 467–479.
Yang, X. (2020), “Cumulative-anticipative Car-following Model for Enhanced Safety in Autonomous Vehicles”, Master Thesis, North Dakota State University, Fargo, ND, USA.
Yang, X. , Ahemd, H.U. , Huang, Y. and Lu, P. (2023), “Cumulatively anticipative car-following model with enhanced safety for autonomous vehicles in mixed driver environments”, Smart Cities, Vol. 6, No. 5, pp. 2260–2281.
Younsi, M. , Diaf, M. and Siarry, P. (2020), “Automatic multiple moving humans detection and tracking in image sequences taken from a stationary thermal infrared camera”, Expert Systems with Applications, Vol. 146, p. 113171.

Examining the Presence of Intelligent Design in Low-Tech and High-Tech Designs Leading to Eco-Tech Smart Architectural Design Strategies

Kanaani, M. (2022). A Prospective for Smart Design Thinking in Architecture & Urbanism for a Sustainable Living Planet. To be published as a Routledge Companion, NewYork, NY: Taylor & Francis.
Komendant, A. E. (1975). 18 Years with Architect Louis I Kahn. Englewood, NJ: Aloray.
Slessor Smith, C. (2001). Eco-Tech: Sustainable Architecture. London: Thames & Hudson Ltd.
Crimmins, A. Usgcrp . (2023). Fifth National Climate Assessment. U.S. Global Change Research Program, Washington, DC. https://doi.org/10.7930/NCA5.2023.
Datar, S. (2021). https://www.online.hbs.edu| Design Thinking Course.
Faucon, T. and Bonjean, A. (2022). https://www.oecd-forum.org/posts/what-do-we-mean-by-low-tech
Grammarly . https://app.grammarly.com/?affiliateNetwork=sas&affiliateID=2081315.
High-Tech. https://www.merrianwebster.com/dictionarywebster.com/dictionary/high%20tech. Accessed 27 September 2023 .
How big is Canada? Fun facts about its size|Canadian Affair . https://www.canadianaffair.com/blog/how-big-is-canada/.
Low-Tech. https://www.meriam-webstercom/dictionary/low-tech. Accessed September 27, 2023
Older, Tom (2017). Shakkei. https://www.treehugger.com/art-shakkei-or-borrowed-scenery-4863268.
Sahtu Renewable Resources Board. (SRRB)—Délı̨nę . https://www.srrb.nt.ca/ehdzo-got-ne/de-l-ne.
Sisson, P. https://www.autodesk.com/design-make/articles/smart-architecture
Soller, K. and Snyder, M. (2021). https://www.nytimes.com/by/kurt-soller.
UNESCO Biosphere Reserves . https://www.unesco.org/en/mab/wnbr/about
Tsa Tue. https://en.unesco.org/biosphere/eu-na/tsa-tue
Tsa Tue . http://tsatue.ca/about-us/
UNESCO World Heritage Sites . Shirakawa-go and Gokayama. https://whc.unesco.org/en/list/734
Vesting, N. (2022). Low Tech Architecture. The (Re)discovery of Sustainable Buildings. https://ndion.de/en/low-tech-architecture-the-rediscovery-of-sustainable-buildings/

Toward Performative, Environmentally Responsive Architecture

Beesley, Philip , Hirosue, S. , Ruxton, J. , Trankle, M. and Turner, C. (2006). Responsive Architectures: Subtle Technologies. Toronto, ON: Riverside Architectural Press.
Eastman, Charles (1972). “Adaptive-Conditional Architecture,” in N. Cross (ed.), Design Participation: Proceedings of the Design Research Society Conference. London: Academy Editions, pp. 51–57.
Fox, Michael and Kemp, Miles (2009). Interactive Architecture. New York: Princeton Architectural Press.
Haque, Usman (2007). “The Architectural Relevance of Gordon Pask,” in Lucy Bullivant (ed.), 4dsocial: Interactive Design Environments, Architectural Design, no. 77. London: Wiley Academy, pp. 54–61.
Kolarevic, Branko (2004). “Towards the Performative in Architecture,” in B. Kolarevic and A. Malkawi (eds.), Performative Architecture: Beyond Instrumentality. London and New York: Routledge, pp. 203–214.
Kolarevic, Branko and Parlac, Vera (2015). “Adaptive, Responsive Building Skins,” in B. Kolarevic and V. Parlac (eds.), Building Dynamics: Exploring Architecture of Change. London and New York: Routledge, pp. 69–88.
Negroponte, Nicholas (1975). Soft Architecture Machines. Cambridge, MA: MIT Press.
Parlac, Vera (2015). “Material as Mechanism in Agile Spaces,” in B. Kolarevic and V. Parlac (eds.), Building Dynamics: Exploring Architecture of Change. London and New York: Routledge, pp. 177–190.
Pask, Gordon (1969). “Architectural Relevance of Cybernetics,” in Architectural Design, vol. 39, no. 9, pp. 494–496, London: Standard Catalogue Company.
Slessor, Catherine (1998). Eco-Tech: Sustainable Architecture and High Technology. London: Thames and Hudson.
Sterk, Tristan d'Estree (2006). “Responsive Architecture: User-Centered Interactions within the Hybridized Model of Control,” in GameSetandMatch II: On Computer Games, Advanced Geometries and Digital Technologies. Rotterdam, the Netherlands: Episode Publishers, pp. 494–501.
van Hinte, Ed , Neelen, Marc , Vink, Jacques and Vollaard, Piet (2003). Smart Architecture. Amsterdam: 010 Publishers.

Smart Urban Resiliency Concepts and Goals

Andrade, R. O. , Yoo, S. G. , Tello-Oquendo, L. , and Ortiz-Garcés, I. (2021). Cybersecurity, sustainability, and resilience capabilities of a smart city. In Visvizi, A. , & del Hoyo, R. P. (Eds.), Smart Cities and the UN SDGs (pp. 181–193). Amsterdam: Elsevier.

ARUP and Rockefeller Foundation , (2014). City Resilience Framework. London: ARUP.

Baniassadi, A. , Heusinger, J. , and Sailor, D. J. (2018). Energy efficiency vs resiliency to extreme heat and power outages: The role of evolving building energy codes. Building Environment, 139, 86–94.

Bueno, S. , Banuls, V. A. , and Gallego, M. D. (2021). Is urban resilience a phenomenon on the rise? A systematic literature review for the years 2019 and 2020 using textometry. International Journal of Disaster Risk Reduction, 66, 102588.

Caputo, S. , Caserio, M. , Coles, R. , Jankovic, L. , and Gaterell, M. R. (2015). Urban resilience: Two diverging interpretations. Journal of Urbanism: International Research on Placemaking Urban Sustainability, 8, 222–240.

Carta, S. , Pintacuda, L. , Owen, I. W. , and Turchi, T. (2021). Resilient communities: A novel workflow. Frontiers in Built Environment, 7.

Carta, S. , Turchi, T. , and Pintacuda, L. (2022). Measuring resilient communities: An analytical and predictive tool. CAADRIA 2022 Proceedings. CAADRIA.

Carta, S. , Turchi, T. , Spencer, N. , and Vidal Calvet, M. (2023). Encoding social values of local communities in algorithmic-driven design methods. In Mora, Plácido Lizancos , et al. (eds), Formal Methods in Architecture—Proceedings of the 6th International Symposium on formal methods in Architecture (6FMA). A Coruna 2022. Singapore: Springer Nature.

Cugurullo, F. (2018). The origin of the smart city imaginary. In Lindner, C. and Meissner, M. (eds.), The Routledge Companion to Urban Imaginaries. London: Routledge.

Escandón, R. , Suárez, R. , Alonso, A. , and Mauro, G. M. (2022). Is indoor overheating an upcoming risk in southern Spain social housing stocks? Predictive assessment under a climate change scenario. Building Environment, 207. https://doi.org/10.1016/j.buildenv.2021.108482

Eusgeld, I. , Nan, C. , and Dietz, S. (2011). “System-of-systems” approach for interdependent critical infrastructures. Reliability Engineering & System Safety, 96(6), 679–686.

Faturechi, R. , and Miller-Hooks, E. (2014). A mathematical framework for quantifying and optimizing protective actions for civil infrastructure systems. Computer-Aided Civil and Infrastructure Engineering, 29(8), 572–589.

Feldmeyer, D. , Wilden, D. , Kind, C. , Kaiser, T. , Goldschmidt, R. , Diller, C. , and Birkmann, J. (2019). Indicators for monitoring urban climate change resilience and adaptation. Sustainability, 11. https://doi.org/10.3390/su11102931

Ferre-Bigorra J. , Casals M. , and Gangolells M. (2022). The adoption of urban digital twins. Cities, 131, 103905.

Ganin, A. A. , Massaro, E. , Gutfraind, A. , Steen, N. , Keisler, J. M. , Kott, A. , … & Linkov, I. (2016). Operational resilience: Concepts, design and analysis. Scientific Reports, 6(1), 1–12.

Holling, C. S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4(1), 1–23.

Homaei, S. , and Hamdy, M. (2021). Thermal resilient buildings: How to be quantified? A novel benchmarking framework and labeling metric. Building Environment, 201, 108022.

Hughes, K. and Bushell, H. , 2013. A Multidimensional Approach to Measuring Resilience. Oxfam GB. Available at: https://oxfamilibrary.openrepository.com/handle/10546/302641

Jankovic, L. (2018). Designing resilience of the built environment to extreme weather events. Sustainability, 10, 141.

Johansson, J. , Hassel, H. , and Zio, E. (2013). Reliability and vulnerability analyses of critical infrastructures: Comparing two approaches in the context of power systems. Reliability Engineering & System Safety, 120, 27–38.

Katal, A. , Mortezazadeh, M. , and Wang, L. (2019). Modeling building resilience against extreme weather by integrated CityFFD and CityBEM simulations. Applied Energy, 250, 1402–1417.

Kauffman, Stuart . (1996). At Home in the Universe: The Search for the Laws of Self-Organization and Complexity. Oxford University Press.

Kitchin, R. , (2018). Reframing, reimagining, and remaking smart cities. In Coletta, C. , Evans, L. , Heaphy, L. and Kitchin, R. (eds.), Creating Smart Cities. London: Routledge, pp. 219–230.

Kwok, A. H. , Doyle, E. E. H. , Becker, J. , Johnston, D. , and Paton, D. (2016). What is ‘social resilience’? Perspectives of disaster researchers, emergency management practitioners, and policymakers in New Zealand. International Journal Disaster Risk Reduction, 19, 197–211.

Leykin, D. , Lahad, M. , and Aharonson-Daniel, L. (2018). Gauging urban resilience from social media. International Journal Disaster Risk Reduction, 31, 393–402.

Linkov, I. , Anklam, E. , Collier, Z. A. , DiMase, D. , and Renn, O. (2014). Risk-based standards: Integrating top–down and bottom–up approaches. Environment Systems and Decisions, 34(1), 134–137.
Mavrogianni, A. , Davies, M. , Taylor, J. , Chalabi, Z. , Biddulph, P. , Oikonomou, E. , Das, P. , and Jones, B. (2014). The impact of occupancy patterns, occupant-controlled ventilation, and shading on indoor overheating risk in domestic environments. Building and Environment, 78, 183–198.
Osei-Kyei, R. , Tam, V. , Komac, U. , and Ampratwum, G. (2023). A critical review of urban community resilience indicators. Smart and Sustainable Built Environment. https://doi.org/10.1108/SASBE-08-2022-0180
Petrescu, D. , Petcou, C. , Safri, M. and Gibson, K. , 2021. Calculating the value of the commons: Generating resilient urban futures. Environmental Policy and Governance, 31(3), 159–174.
Pyrgou, A. , Castaldo, V. L. , Pisello, A. L. , Cotana, F. , and Santamouris, M. (2017). On the effect of summer heatwaves and urban overheating on building thermal-energy performance in central Italy. Sustainable Cities and Society, 28, 187–200.
Rajput, M. , Augenbroe, G. , Stone, B. , Georgescu, M. , Broadbent, A. , Krayenhoff, S. , and Mallen, E. (2022). Heat exposure during a power outage: A simulation study of residences across the metro Phoenix area. Energy Building, 259, 111605.
Ribeiro, P. J. G. , and Gonçalves, L. A. P. J. (2019). Urban resilience: A conceptual framework. Sustainable Cities and Society, 50, 101625.
Sailor, D. J. (2014). Risks of summertime extreme thermal conditions in buildings as a result of climate change and exacerbation of urban heat islands. Building Environment, 78, 81–88.
Sharifi, A. (2016). A critical review of selected tools for assessing community resilience. Ecological Indicators, 69, 629–647.
Sharifi, A. , Srivastava, R. , Singh, N. , Tomar, R. , and Raji, M. A. (2022). Recent advances in smart cities and urban resilience and the need for resilient smart cities. In Sharifi, A. , Salehi, P. (eds.), Resilient Smart Cities: Theoretical and Empirical Insights, Springer, Cham, pp. 17–37. https://doi.org/10.1007/978-3-030-95037-8_2
Sharifi, A. , & Yamagata, Y. (2016). Principles and criteria for assessing urban energy resilience: A literature review. Renewable and Sustainable Energy Reviews, 60, 1654–1677. https://doi.org/10.1016/j.rser.2016.03.028
Siu, C. Y. , O'Brien, W. , Touchie, M. , Armstrong, M. , Laouadi, A. , Gaur, A. , Jandaghian, Z. , and Macdonald, I. (2023). Evaluating thermal resilience of building designs using building performance simulation – A review of existing practices. Building Environment, 234, 110124.
Sturgess, P. ; DFID. Measuring Resilience. Evidence on Demand, UK (2016) 51 pp. https://doi.org/10.12774/eod_tg.may2016.sturgess2. Available at: https://www.gov.uk/research-for-development-outputs/measuring-resilience
Sun, K. , Zhang, W. , Zeng, Z. , Levinson, R. , Wei, M. , and Hong, T. (2021). Passive cooling designs to improve heat resilience of homes in underserved and vulnerable communities. Energy Building, 252, 111383.
Vatenmacher, M. , Svoray, T. , Tsesarsky, M. , and Isaac, S. (2022). Performance-driven vulnerability analysis of infrastructure systems. International Journal of Disaster Risk Reduction, 76, 103031.
Wang, Y. , Shen, J. -k., Xiang, W. , and Wang, J.-Q. (2018). Identifying characteristics of resilient urban communities through a case study method. Journal of Urban Management, 73, 141–151.
Yu, J. Z. , and Baroud, H. (2019). Quantifying community resilience using hierarchical bayesian kernel methods: A case study on recovery from power outages. Risk Analysis, 399, 1930–1948.

“Designing Smart Retrofits using Nature's Patterns”

Barr, Z. , Norm B. , et al. (2019). Accelerating the Deployment of Advanced Energy Communities: The Oakland EcoBlock. Sacramento: California Energy Commission. Publication Number: CEC-500–2019–043.
Calthorpe, P. (2011). Urbanism in the Age of Climate Change. Washington, DC: Island Press.
Kelbaugh, D. (2019). The Urban Fix: New York: Routledge.
King, B. and Magwood, C. (2022). Build Beyond Zero: New Ideas for Carbon Smart Architecture. Washington, DC: Island Press.
Lynch, K. , (1960). The Image of the City. Cambridge, MA: MIT Press.
McHarg, I. (1992). Design with Nature. New York: J. Wiley.
Olgyay, V. (2015). Design with Climate: Bioclimatic Approach to Architectural Regionalism. Princeton; Oxford: Princeton University Press.
Olgyay, V. , Coan, S. , Webster, B. and Livingood, W. (2020). Connected Communities: A Multi-Building Energy Management Approach. Golden, CO: National Renewable Energy Laboratory. NREL/TP-

5500–75528.
Olgyay, V. , Hainline, J. and Harris, E. (2006). Quantifying the Ecological Restoration Provided by Green Machines. Boulder, CO: American Solar Energy Society.
Olgyay, V. and Herdt, J. (2004). The application of ecosystems services criteria for green building assessment. Solar Energy, 77, 389–398.
University of Arkansas Community Design Center. (2010). LID Low Impact Development -a Design Manual for Urban Areas. Fayetteville: University of Arkansas Press.

From Smart to Autonomous Cities on the Eve of AI

Barns, S. (2019). Platform Urbanism: Negotiating Platform Ecosystems in Connected Cities. Palgrave.
Bell, J. (2022, September 16). AI will be the ‘beating heart’ of Saudi’s NEOM, THE LINE: Summit. Alarabiya News. https://english.alarabiya.net/News/gulf/2022/09/16/AI-will-be-the-beating-heart-of-Saudi-s-NEOM-THE-LINE-Summit
Carlino, G. A. , Chatterjee, S. , & Hunt, R. M. (2007). Urban density and the rate of invention. Journal of Urban Economics, 61(3), 389–419. https://doi.org/10.1016/j.jue.2006.08.003.
Carta, S. , & Pisu, D. (2022). Human-AI co-design and urban resilience. In RGS-IBG Annual International Conference 2022- Proceedings (pp. 466).
Chen, B. (2023). Performed imaginaries of the AI-controlled city: Conducting urban AI experimentation in China (pp. 223–237). In Artificial Intelligence and the City. Routledge. https://www.vitalsource.com/en-au/products/artificial-intelligence-and-the-city-v9781003810421
Cook, J. (Host). (2023, December 8). How AI is revolutionizing commercial real estate. [Audio podcast episode]. In Trends & Insights: The Future of Commercial Real Estate. JLL. https://podcasts.apple.com/us/podcast/trends-insights-the-future-of-commercial-real-estate/id1503057415.
Cugurullo, F. (2024, January 3). AI could make cities autonomous, but that doesn’t mean we should let it happen. The Conversation. https://theconversation.com/ai-could-make-cities-autonomous-but-that-doesnt-mean-we-should-let-it-happen-218638.
Cugurullo, F. , Caprotti, F. , & Cook, M. (2024). Artificial Intelligence and the City Urbanistic Perspectives on AI. New York: Routledge.
European Commission. (2024). Excellence and Trust in Artificial Intelligence. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/excellence-and-trust-artificial-intelligence_en.
European Commission. (2024). Smart Cities: Cities Using Technological Solutions to Improve the Management and Efficiency of the Urban Environment. https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en.
Frost & Sullivan . (2019). Smart Cities: Frost & Sullivan Value Proposition. https://www.frost.com/wp-content/uploads/2019/01/SmartCities.pdf
Giuliano, G. , Kang, S. , & Yuan, Q. (2019). Agglomeration economies and evolving urban form. Annals of Regional Science, 63, 377–398. https://doi.org/10.1007/s00168-019-00957-4
Haggart, B. , & Tusikov, N. (2020). Sidewalk Labs’ smart-city plans for Toronto are dead. What’s next? The Conversation. https://theconversation.com/sidewalk-labs-smart-city-plans-for-toronto-are-dead-whats-next-138175.
IBM. (2024). What Is Internet of Things? https://www.ibm.com/topics/internet-of-things.
Kastle . (2023, September 26). Evidence of the new hybrid work pattern. https://www.kastle.com/resource/evidence-of-the-new-hybrid-work-pattern/
Luusua, A. , Ylipulli, J. , Foth, M. et al. (2023). Urban AI: Understanding the emerging role of artificial intelligence in smart cities. AI & Society, 38, 1039–1044. https://doi.org/10.1007/s00146-022-01537-5
Marks, H. (2019, June 13). This time it’s different. Advisor Perspectives. https://www.advisorperspectives.com/commentaries/2019/06/13/this-time-its-different.
Mazzucato, M. (2022). Mission Economy: A Moonshot Guide to Changing Capitalism. Penguin Press.
McKinsey. (2023, June 14). The Economic Potential of Generative AI: The Next Productivity Frontier. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-AI-the-next-productivity-frontier#introduction.
Milton Keynes City Council. (2018). MK Digital Strategy 2018–2025. https://www.milton-keynes.gov.uk/sites/default/files/2022-03/Milton%20Keynes%20Digital%20Strategy%202018-2025%20-%20FV.pdf.
Mittal, A. (2024, January 9). The plagiarism problem: How generative AI models reproduce copyrighted content. Unite AI. https://www.unite.ai/the-plagiarism-problem-how-generative-ai-models-reproduce-copyrighted-content/.

O'Kane, J. (2023, November 18). Rio de Janeiro: A test for the intelligence of smart cities. The Globe and Mail. https://www.theglobeandmail.com/business/article-rio-de-janeiro-a-test-for-the-intelligence-of-smart-cities/
Oxford English Dictionary . (2023, December). Generative Artificial Intelligence, N. https://doi.org/10.1093/OED/9657191441.
Pisu, D. , & Carter, S. (2023). Architectural AI urban artificial intelligence in architecture and design. In Artificial Intelligence and the City (pp. 339–360). Routledge. https://www.vitalsource.com/en-au/products/artificial-intelligence-and-the-city-v9781003810421
Ramos, G. , & Mazzucato, M. (2022, December 26). AI in the common interest. Project Syndicate. https://www.project-syndicate.org/commentary/ethical-ai-requires-state-regulatory-frameworks-capacity-building-by-gabriela-ramos-and-mariana-mazzucato-2022-12.
Sabri, S. , Winter, S. , & Rajabifard, A. (2023, March 2). Creating digital twins to save our cities. PURSUIT. https://pursuit.unimelb.edu.au/articles/creating-digital-twins-to-save-our-cities.
Sisson, P. (2022, August 8). The tech that tries to tackle NIMBYs. Bloomberg. https://www.bloomberg.com/news/features/2022-08-08/the-virtual-tools-built-to-fix-real-world-housing-problems.
UNESCO. (2023, May 16). Recommendation on the ethics of artificial intelligence. https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence.
Witt, A. (2023, June 13). Data, digital media, and a different design office. Harvard Graduate School of Design. https://www.gsd.harvard.edu/2023/06/andrew-witt-on-data-artifical-intelligence-and-architecture

Smart Architecture to Reduce Whole-Life Carbon in Buildings and Infrastructure

Allwood, J. , and Cullen, J. (2015). Sustainable Materials—Without the Hot Air: Making Buildings, Vehicles and Products Efficiently and with Less New Material. 2nd Revised edition. Cambridge: UIT, 408 p.
Architecture 2030 . (2019). Why Buildings? Retrieved 27 December, 2023, from https://www.architecture2030.org/why-the-built-environment/why-buildings/#:~:text=BUILDINGS%20ARE%20A%20SIGNIFICANT%20END%20USE%20OF%20HIGH%20IMPACT%20MATERIALS&text=It%20is%20therefore%20crucial%20to,be%20taken%20back%20or%20reduced.sector matters.
Bere, J. (2019). An Introduction to Passive House. London: Routledge, p 112.
BSI. (2023). PAS 2080:2023 Carbon Management in Buildings and Infrastructure. 2nd edition. London: BSI Publishing, p 68.
BSI. (2023a). PAS 2080 Guidance Document. Retrieved 29 December, 2023, from https://knowledge.bsigroup.com/products/carbon-management-in-buildings-and-infrastructure?version=standard.
Cembureau, (2020). Carbon Neutrality Roadmap 2050. Retrieved 2 January, 2024, from https://cembureau.eu/library/reports/2050-carbon-neutrality-roadmap/.
Cheshire, D. (2021). Handbook to Building a Circular Economy. 2nd edition. London: RIBA publishing, p 160.
Esau, R. , Jungclaus, M. , Olgyay, V. , and Rempher, A. (2012). Reducing Embodied Carbon in Buildings: Low-Cost, High-Value Opportunities. Retrieved 4 January, 2024, from https://rmi.org/insight/reducing-embodied-carbon-in-buildings/.
Hopfe, C. , and Robert McLeod, R. (eds) (2015). The Passivhaus Designer’s Manual: A Technical Guide to Low and Zero Energy Buildings. 1st edition. London: Routledge, p 346.
International Passive House Association, IPHA. (n.d) . The Passive House Platform. Retrieved 3 January, 2024, from https://passivehouse-international.org/index.php?page_id=65#:~:text=The%20global%20Passive%20House%20platform&text=Many%20of%20these%20quality%2Dassured,than%205%2C600%20Passive%20House%20buildings.
Johnson, E. , and Vaden Youmas, A. (2023). Sustainability Case Study: Rob and Melani Walton Center for Planetary Boundaries, Arizona State University. Retrieved 30 December, 2023, from https://grimshaw.global/assets/uploads/ASU_Walton_Center_Case_Study_1.pdf.
Lei, T. , Wang, D. , Yu, X. , et al. (2023). Global Iron and Steel Plant CO2 Emissions and Carbon-Neutrality Pathways. Nature, 622: 514–520.
LETI. (2019). Net Zero Operational Carbon: Ten Key Requirements for New Buildings. Retrieved 29 December, 2023, from https://www.leti.uk/_files/ugd/252d09_d2401094168a4ee5af86b147b61df50e.pdf.
LETI. (2020). LETI Climate Emergency Design Guide: How New Buildings Can Meet UK Climate Change Targets. Jan 2020 Edition. Retrieved 29 December, 2023, from https://www.leti.uk/_files/ugd/252d093b0f2acf2bb24c019f5ed9173fc5d9f4.pdf.

LETI. (2020a). Embodied Carbon Primer. Retrieved 2 January, 2024, from jnahttps://www.leti.uk/_files/ugd/252d09_8ceffcbcafdb43cf8a19ab9af5073b92.pdf.

MacKay, D. , Bock, M. , Cebon, D. , Cullen, J. , Doig, K. , Drewniok. M.P. , Gustafsson, J. , Guthrie, G. , Nibbert, A. , Smith. S. , Swallow, P. , Symons, K. , Tzokova, P. and Williams, B. (2020). Energy Cost Metric: Energy Design Guide for the Civil Engineering Building in West Cambridge. Retrieved 2 January, 2024, from https://www.refficiency.org/wp-content/uploads/2020/05/Energy-Cost-Metric-v7.0-FINAL_on_line.pdf.

Milnes, C. Aellig, P. , Gaullier, N. , Schneider Roos, K. , Huber, D. , Wiener, D. , and Guldimann, R. (2014) 4th Global Infrastructure Basel Foundation Summit Report. Retrieved 2 January, 2024, from https://gib-foundation.org/wp-content/uploads/2020/01/Summit-Report_ext_Fin_sml.pdf.

PassiveHouse. (2023). Component Database. Retrieved 27 December, 2023, from https://database.passivehouse.com/en/components/https://database.passivehouse.com/en/components/.

RICS. (2023). Whole Life Carbon Assessment for the Built Environment. 2nd edition. Retrieved 27 December, 2023, from https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment.

Rong, H. , Zhang, H. , Xiao, S. , et al. (2016). Optimizing Energy Consumption for Data Centers. Renewable and Sustainable Energy Reviews, 58: 674–691.

Sangiorgio, A. (2020). Sustainability Case Study of Woodside Building, Melbourne. Retrieved 27 December, 2023, from https://grimshaw.global/assets/uploads/Monash_Case_Study_3.pdf.

Sembroiz, D. , Careglio, D. , Ricciardi, S. , and Fiore, U. (2019). Planning and Operational Energy Optimization Solutions for Smart Buildings. Information Sciences, 476: 439–452. https://doi.org/10.1016/j.ins.2018.06.003.

Shah, A.S. , Nasir, H. , Fayaz, M. , Lajis, A. , and Shah, A. (2019). A Review on Energy Consumption Optimization Techniques in IoT Based Smart Building Environments. Information, 10: 108. https://doi.org/10.3390/info10030108.

Sidor, N. , and Swallow, P. (2022). Sustainability Case Study: Civil Engineering Building. Retrieved 2 January, 2024, from https://grimshaw.global/assets/uploads/Cambs_Civil_Eng_Bldg_Case_Study_FINAL_compressed.pdf.

Subramanian, C.V. , Ramachandran, N. , and Senthamil Kumar, S. (2017). Review of Passive Cooling Architectural Design Interventions for Thermal Comfort in Residential Buildings. Indian Journal of Scientific Research, 14(1): 163–172.

Swallow, P. , and Green, A. (2020). Sustainability Case Study on Bath School of Art and Design. Retrieved 29 December, 2023, from https://grimshaw.global/assets/uploads/Grimshaw_BathSchool_Case_Study.pdf.

Tian, Zhichao , Zhang, Xinkai , Jin, Xing , et al. (2018). Towards Adoption of Building Energy Simulation and Optimization for Passive Building Design: A Survey and a Review. Energy and Buildings, 158: 1306–1316.

Transparency Market Research. (2021). ‘Construction Market Research’ Construction Waste Market—Global Industry Analysis, Size, Share, Trends and Forecast 2017–2025. Retrieved 27 December, 2023, from https://www.transparencymarketresearch.com/construction-waste-market.html.

United Nations, Department of Economic and Social Affairs, Population Division. (2019). World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420). New York: United Nations.

United Nations Environment Programme, UNEP. (2020). 2020 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector. Nairobi. Retrieved 27 December, 2023, from https://globalabc.org/sites/default/files/inline-files/2020%20Buildings%20GSR_FULL%20REPORT.pdf.

United Nations Environment Programme, UNEP. (2021). 2021 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector. Nairobi. Retrieved 27 December, 2023, from https://globalabc.org/sites/default/files/2021-10/GABC_Buildings-GSR-2021_BOOK.pdf.

United Nations Environment Programme, UNEP. (2023). Broken Record: Temperatures Hit New Highs, Yet World Fails to Cut Emissions (Again). Retrieved 28 December, 2023, from https://wedocs.unep.org/bitstream/handle/20.500.11822/43922/EGR2023.pdf?sequence=3&isAllowed=y.

Vandenbogaerde, L. , Verbeke, S. , and Audenaert, A. (2023). Optimizing Building Energy Consumption in Office Buildings: A Review of Building Automation and Control Systems and Factors Influencing Energy Savings. Journal of Building Engineering, 76: 107233.

White, J. (2022). Sustainability Case Study: London Bridge Station. Retrieved 2 January, 2024, from https://grimshaw.global/assets/uploads/Grimshaw_London_Bridge_CS.pdf.

Blockchain Technology for Smart Thinking

Boogaard, K. 2021. How to Write SMART Goals [Online]. Altassian. Available: https://www.atlassian.com/blog/productivity/how-to-write-smart-goals [Accessed 19 September 2023].

Boudon, R. 2001. Sociology: Overview. In: Smelser, N. J. & Baltes, P. B. (eds.), International Encyclopedia of the Social & Behavioral Sciences (pp. 14581–14585). Oxford: Pergamon.

Chen, R. , Li, Y. , Yu, Y. , Li, H. , Chen, X. & Susilo, W. 2020. Blockchain-based dynamic provable data possession for smart cities. IEEE Internet of Things Journal, 7, 4143–4154.

Doran, G. T. 1981. There's a S.M.A.R.T. way to write managements's goals and objectives. Management Review, 70, 35–36.

Farr, E. R. P. & Piroozfar, P. 2022. Enabling circular economy in the AEC industry through digitalization. In: Kanaani, M. (ed.), The Routledge Companion to Ecological Design Thinking: Healthful Ecotopian Visions for Architecture and Urbanism (pp. 339–350). New York: Routledge.

Foti, M. , Mavromatis, C. & Vavalis, M. 2021. Decentralized blockchain-based consensus for optimal power flow solutions. Applied Energy, 283, 116100.

Geels, F. W. 2002. Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy, 31, 1257–1274.

Geels, F. W. 2005. The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). Technology Analysis & Strategic Management, 17, 445–476.

Geels, F. W. 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1, 24–40.

Grigg, I. 2005. Triple Entry Accounting [Online]. Satoshi Nakamoto Institute. Available: https://nakamotoinstitute.org/triple-entry-accounting/ [Accessed 19 September 2023].

Hayes, A. 2023. Blockchain Facts: What Is It, How It Works, and How It Can Be Used? [Online]. Investopedia [Accessed 19 September 2023]. https://www.investopedia.com/terms/b/blockchain.asp

Hribernik, M. , Zero, K. , Kummer, S. & Herold, D. M. 2020. City logistics: Towards a blockchain decision framework for collaborative parcel deliveries in micro-hubs. Transportation Research Interdisciplinary Perspectives, 8, 100274.

James, W. 1907. Lecture 6 in Pragmatism: A new name for some old ways of thinking. In: James, W. (ed.), Pragmatism's Conception of Truth (pp. 76–91). New York: Longman Green and Co.

Karale, S. & Ranaware, V. 2019. Applications of blockchain technology in smart city development: A research. International Journal of Innovative Technolology and Exploring Engineering, 8, 556–559.

Merton, R. K. 1968. Social Theory and Social Structure. New York: Free Press.

Mills, C. W. 1959. The Sociological Imagination. Oxford University Press, Incorporated.

Parsons, T. & Shils, E. 1951. Toward a General Theory of Action. Cambridge, MA: Harvard University Press.

PSA. 2023. Artifical Intelligence (AI) Enabled Technologies [Online]. Office of the Principal Scientific Adviser (PSA) to the Government of India. Available: https://www.psa.gov.in/technology-frontiers/artificial-intelligence-ai-enabled-technologies/261 [Accessed 4 November 2023].

Rip, A. & Kemp, R. 1998. Technological change. Human Choice and Climate Change, 2, 327–399.

Ross, C. 2023. Can AI Be As Unethical And Biased As Humans? [Online]. Forbes. Available: https://www.forbes.com/sites/forbesbusinesscouncil/2023/08/14/can-ai-be-as-unethical-and-biased-as-humans/?sh=2d6274ec6878 [Accessed 4 November 2023].

Scott, D. J. , Broyd, T. & Ma, L. 2021. Exploratory literature review of blockchain in the construction industry. Automation in Construction, 132, 103914.

Wang, Y. , Chen, C. H. & Zghari-Sales, A. 2021. Designing a blockchain enabled supply chain. International Journal of Production Research, 59, 1450–1475.

Considering Smart Design Methodology as Research-Informed Design

Almusaed, A. , and Yitmen, I. (2023). Architectural reply for smart building design concepts based on artificial intelligence simulation models and digital twins. Sustainability, 15 (6), 4955. doi: 10.3390/su15064955.

Applied Research and Development Group. (ARD). (2022). The data challenge for machine learning in AECO. In Artificial Intelligence and Architecture: From Research to Practice, edited by S. Chaillou , 136–145. Basel, Switzerland: Birkhäuser.

Bautista, M. A. , Guo, P. , Abnar, S. , Talbott, W. , Toshev, A. , Chen, Z. et al. (2022). GAUDI: A neural architect for immersive 3D scene generation. In 36th Conference on Neural Information Processing Systems (NeurIPS 2022). doi: 10.48550/arXiv.2207.1351.

Bernstein, P. (2022). Machine Learning: Architecture in the Age of Artificial Intelligence. London: RIBA.
Bjerke, M. J. , and Renger, R. (2017). Being smart about writing SMART objectives. Evaluation and Program Planning, 61 (April), 125–127. doi: 10.106/j.evalprogplan.2016.12.009.
Bölek, B. , Tutal, O. , and Özbaşarn, H. (2023). A systematic review on artificial intelligence applications in architecture. Journal of Design for Resilience in Architecture and Planning, 4 (1), 91–104.
Bolojan, D. , and Vermisso, E. (2020). Deep Learning as heuristic approach for architectural concept generation. In Proceedings of the 11th International Conference on Computational Creativity (ICCC'20), 7-11 September, Coimbra, Portugal. Association for Computational Creativity, 98–105.
Braun, K. , Kropp, C. , and Boeva, Y. (2022). Constructing platform capitalism: inspecting the political techno-economy of Building Information Modelling. ARQ 26 (3), 267–278. doi: 10.1017/S1355220046X.
Chaillou, S. (2022). Artificial Intelligence and Architecture: From Research to Practice. Basel, Switzerland: Birkhäuser.
Choi, J. (2020). The cognitive dimension: The role of research in performative design process, theory put in practice. In The Routledge Companion to Paradigms of Performativity in Design and Architecture edited by M. Kanaani , 132–145. New York and London: Routledge.
Danhaive, R. and Mueller, C. (2022). Artificial intelligence for human design in architecture. In Artificial Intelligence and Architecture: From Research to Practice edited by S. Chaillou , 126–133. Basel, Switzerland: Birkhäuser.
Del Campo, M. (2022). Neural Architecture {Design and Artificial Intelligence}. Novato, CA: ORO Editions.
Ekahau (21 March 2024). How to measure wall attenuation for spotless Wi-Fi network designs. Ekahau. Retrieved from https://www.ekahau.com/blog/how-to-measure-wall-attenuation-for-spotless-wi-fi-network-designs/
Fontana, L. (12 October 2018). And cut! Brave lord of the rings warriors running away in the thousands. Digitec. Retrieved from https://www.digitec.ch.
Gericke, K. , Eckert, C. , and Stacey, M. (2022). Elements of a design method—a basis for describing and evaluating design methods. Design Science, 8, e29. doi: 10.1017/dsj.2022.23, 1-28.
Ikudayisi, A.E. , Chan, A. P. C. , Darko, A. , and Adedeji, Y. M. D. (2023). Integrated practices in the Architecture, Engineering, and Construction Industry: Current scope and pathway towards Industry 5.0. Journal of Building Engineering 73, 106788, 1–21. doi: 10.1016/j.jobe.2023.106788.
Kaicker, A. , Blum, U. , Siedler, P. , and Espaillat, L. (2019). Enhancing workplace design through advanced floor plate analytics. TAD, 3 (2), 151–160.
Kamari, A. Holistic Building Design: (September 2020). An integrated building design methodology based on systems thinking for reaching sustainability. In Conference: eCAADe 2020 (the 38th Education and Research in Computer Aided Architectural Design in Europe) Berlin, Germany, 505–514. doi: 10.52842/conf.ecaade.2020.1.505.
Kanaani, M. (2020). Preface. In The Routledge Companion to Paradigms of Performativity in Design and Architecture, xvii–xix. New York and London: Routledge.
Koh, I. (2023). Architectural sampling: Three possible preconditions for machine learning architectural forms. Artificial Intelligence, 2 (7), 1–21. doi: 10.1007/s44223-023-00024-1.
Lavrsen, J. C. , Dallhuizen, J. , Domler, S. , and Fisker, K. (2022). Towards a lifecycle of design methods. In DRS2022: Bilbao Conference Proceedings, edited by D. Lockton , S. Lenzi , P. Hekkert , A. Oak , J. Sadaba , and P. Lloyd . 25 June–3 July, Bilbao, Spain. doi: 10.21606/drs.2022.542.
Marsh, M. (24 March 2020). Social data brings new life to AI for architecture. Work Design Magazine. Retrieved from https://www.workdesign.com/2020/03/social-data-brings-new-life-to-ai-for-architecture.
Moreno-De-Luca, L. , and Begambre Carrillo, O. J. (2013). Multi-Objective heuristic computation applied to architectural and structural design: A review. International Journal of Architectural Computing, 11 (4), 363–392. doi: 10.1260/1478-0771.11.4.363.
Nagy, D. , Lau, D. , Locke, J. , Stoddart, J. , Villaggi, L. , Wang, R. , Zhao, D. , and Benjamin, D. (2017). Project Discover: An application of generative design for architectural space planning. In 2017 Proceedings of the Symposium on Simulation for Architecture & Urban Design, edited by M. Turin , B. Peters , W. O'Brien , R. Stouffs , and T. Dogan , 59–66. The Society for Modeling & Simulation International (SCS). doi: 10.22360/simaud.2017.simaud.007
Newth, J. Danielsen (20 December 2019). Which building materials can block wi-fi signals? Eye Networks. Retrieved from https://eyenetworks.no/en/wifi-signal-loss-by-material/
Pessoa, M. V.P. , and Juaregui-Becker, J. M. (2020). Smart design engineering: A literature review of the impact of the 4th revolution on product design and development. Research in Engineering Design, 31 (15), 1–21. doi: 10.1007/s00163-020-00330-z.
Qiang, Z. , Hands, S. , Taylor, K. , Sethuvenkatraman, S. , Hugo, D. , Omran, P. G. , Perera, M. , and Haller, A. (2023). A systematic comparison and evaluation of building ontologies for deploying data-driven analytics in smart buildings. Energy and Buildings, 292 (August), 113054. doi: 10.1016/j.enbuild.2023.113054.

Racha-Pacheco, P. , Ribeiro, J. T. , and Afonso . (2023). Architecture towards Technology—A prototype design of a smart home. Buildings, 13 (7). doi.org/10.3390/buildings13071859.
Saeidi, S. , Anderson, M. D. , and Davidova, M. (2023). Kindness in architecture: The Multispecies co-living and co-design. Buildings, 13 (1), 1–21. doi: 10.3390/buildings13081931.
Thieme, W. (3 September 2020). Four common pitfalls to avoid in smart building deployment. Forbes Innovation. Forbes. Retrieved from http://forbes.com.
United States. US Department of Energy. Office of Energy Efficiency & Renewable Energy (2011). Building Performance Database (BPD). https://www.energy.gov/eere/buildings/building-performance-database-bpd
Yoon, S. (2023). Building digital twining: Data, information and models. Journal of Building Engineering, 76 (1 October), 107021. doi: 10.1016/j.jobe.2023.107021.
Žáček, M. , and Janošek, M. (2017). SBONTO: Ontology of smart building. Far East Journal of Electronics and Communications, 17 (5), 1101–1109. doi: 10.17654/EC017051101.
Zhang, J. , Luo, H. , and Xu, J. (2022). Towards fully BIM-enabled building automation and robotics: A perspective of lifecycle information flow. Computers in Industry, 135 (February), 103570. doi: 10.106/j.compind.2021.103570.
Witt, A. (2022). Shadowplays: Models, drawings, cognitions. In Artificial Intelligence and Architecture: From Research to Practice edited by S. Chaillou , 146–161. Basel, Switzerland: Birkhäuser.
Brand, S. (1995). How Buildings Learn: What Happens after They Are Built. Penguin Books.
Brautigan, R. (1967). All Watched Over by Machines of Loving Grace. In a Pamphlet with the same title.
Evans, R. (1997). Translations from Drawing to Building and other Documents. AA Publications.
Hardingham, S. (Ed.) (2020). Cedric Price Works 1952–2003: A Forward-Minded Retrospective. AA Publications.
Keaton, D. (2017). The House that Pinterest Built. Rizzoli
Lanier, J. (2010). You are not a Gadget: A Manifesto. Vintage.
Schoffer, N. (1969). La Ville Cybernetique. Denoel.
Selinger, E. , & Crease, R. P. (2006). The Philosophy of Expertise. Columbia University Press.
Simon, H. (1996). The Sciences of the Artificial. MIT Press.
Toyo, T. (2011). The Logic of Uselessness, in Ito, T. , (Ed.)., Tarzans in the Media Forest: Architectural Words 8. AA Publications.

Searching Through Smart Design Methods for Architecture

Almusaed, A. , and Yitmen, I. (2023). Architectural reply for smart building design concepts based on artificial intelligence simulation models and digital twins. Sustainability, 15 (6), 4955. doi: 10.3390/su15064955.
Applied Research and Development Group. (ARD). (2022). The data challenge for machine learning in AECO. In Artificial Intelligence and Architecture: From Research to Practice, edited by S. Chaillou , 136–145. Basel, Switzerland: Birkhäuser.
Bautista, M. A. , Guo, P. , Abnar, S. , Talbott, W. , Toshev, A. , Chen, Z. et al. (2022). GAUDI: A neural architect for immersive 3D scene generation. In 36th Conference on Neural Information Processing Systems (NeurIPS 2022). doi: 10.48550/arXiv.2207.1351.
Bernstein, P. (2022). Machine Learning: Architecture in the Age of Artificial Intelligence. London: RIBA.
Bjerke, M. J. , and Renger, R. (2017). Being smart about writing SMART objectives. Evaluation and Program Planning, 61 (April), 125–127. doi: 10.106/j.evalprogplan.2016.12.009.
Bölek, B. , Tutal, O. , and Özbaşarn, H. (2023). A systematic review on artificial intelligence applications in architecture. Journal of Design for Resilience in Architecture and Planning, 4 (1), 91–104.
Bolojan, D. , and Vermisso, E. (2020). Deep Learning as heuristic approach for architectural concept generation. In Proceedings of the 11th International Conference on Computational Creativity (ICCC'20), 7-11 September, Coimbra, Portugal. Association for Computational Creativity, 98–105.
Braun, K. , Kropp, C. , and Boeva, Y. (2022). Constructing platform capitalism: inspecting the political techno-economy of Building Information Modelling. ARQ 26 (3), 267–278. doi: 10.1017/S1355220046X.
Chaillou, S. (2022). Artificial Intelligence and Architecture: From Research to Practice. Basel, Switzerland: Birkhäuser.
Choi, J. (2020). The cognitive dimension: The role of research in performative design process, theory put in practice. In The Routledge Companion to Paradigms of Performativity in Design and Architecture edited by M. Kanaani , 132–145. New York and London: Routledge.
Danhaive, R. and Mueller, C. (2022). Artificial intelligence for human design in architecture. In Artificial Intelligence and Architecture: From Research to Practice edited by S. Chaillou , 126–133. Basel,

Switzerland: Birkhäuser.
Del Campo, M. (2022). Neural Architecture {Design and Artificial Intelligence}. Novato, CA: ORO Editions.
Ekahau (21 March 2024). How to measure wall attenuation for spotless Wi-Fi network designs. Ekahau. Retrieved from https://www.ekahau.com/blog/how-to-measure-wall-attenuation-for-spotless-wi-fi-network-designs/
Fontana, L. (12 October 2018). And cut! Brave lord of the rings warriors running away in the thousands. Digitec. Retrieved from https://www.digitec.ch.
Gericke, K. , Eckert, C. , and Stacey, M. (2022). Elements of a design method—a basis for describing and evaluating design methods. Design Science, 8, e29. doi: 10.1017/dsj.2022.23, 1-28.
Ikudayisi, A.E. , Chan, A. P. C. , Darko, A. , and Adedeji, Y. M. D. (2023). Integrated practices in the Architecture, Engineering, and Construction Industry: Current scope and pathway towards Industry 5.0. Journal of Building Engineering 73, 106788, 1–21. doi: 10.1016/j.jobe.2023.106788.
Kaicker, A. , Blum, U. , Siedler, P. , and Espaillat, L. (2019). Enhancing workplace design through advanced floor plate analytics. TAD, 3 (2), 151–160.
Kamari, A. Holistic Building Design: (September 2020). An integrated building design methodology based on systems thinking for reaching sustainability. In Conference: eCAADe 2020 (the 38th Education and Research in Computer Aided Architectural Design in Europe) Berlin, Germany, 505–514. doi: 10.52842/conf.ecaade.2020.1.505.
Kanaani, M. (2020). Preface. In The Routledge Companion to Paradigms of Performativity in Design and Architecture, xvii–xix. New York and London: Routledge.
Koh, I. (2023). Architectural sampling: Three possible preconditions for machine learning architectural forms. Artificial Intelligence, 2 (7), 1–21. doi: 10.1007/s44223-023-00024-1.
Lavrsen, J. C. , Dallhuizen, J. , Domler, S. , and Fisker, K. (2022). Towards a lifecycle of design methods. In DRS2022: Bilbao Conference Proceedings, edited by D. Lockton , S. Lenzi , P. Hekkert , A. Oak , J. Sadaba , and P. Lloyd . 25 June–3 July, Bilbao, Spain. doi: 10.21606/drs.2022.542.
Marsh, M. (24 March 2020). Social data brings new life to AI for architecture. Work Design Magazine. Retrieved from https://www.workdesign.com/2020/03/social-data-brings-new-life-to-ai-for-architecture.
Moreno-De-Luca, L. , and Begambre Carrillo, O. J. (2013). Multi-Objective heuristic computation applied to architectural and structural design: A review. International Journal of Architectural Computing, 11 (4), 363–392. doi: 10.1260/1478-0771.11.4.363.
Nagy, D. , Lau, D. , Locke, J. , Stoddart, J. , Villaggi, L. , Wang, R. , Zhao, D. , and Benjamin, D. (2017). Project Discover: An application of generative design for architectural space planning. In 2017 Proceedings of the Symposium on Simulation for Architecture & Urban Design, edited by M. Turin , B. Peters , W. O'Brien , R. Stouffs , and T. Dogan , 59–66. The Society for Modeling & Simulation International (SCS). doi: 10.22360/simaud.2017.simaud.007
Newth, J. Danielsen (20 December 2019). Which building materials can block wi-fi signals? Eye Networks. Retrieved from https://eyenetworks.no/en/wifi-signal-loss-by-material/
Pessoa, M. V.P. , and Juaregui-Becker, J. M. (2020). Smart design engineering: A literature review of the impact of the 4th revolution on product design and development. Research in Engineering Design, 31 (15), 1–21. doi: 10.1007/s00163-020-00330-z.
Qiang, Z. , Hands, S. , Taylor, K. , Sethuvenkatraman, S. , Hugo, D. , Omran, P. G. , Perera, M. , and Haller, A. (2023). A systematic comparison and evaluation of building ontologies for deploying data-driven analytics in smart buildings. Energy and Buildings, 292 (August), 113054. doi: 10.1016/j.enbuild.2023.113054.
Racha-Pacheco, P. , Ribeiro, J. T. , and Afonso . (2023). Architecture towards Technology—A prototype design of a smart home. Buildings, 13 (7). doi.org/10.3390/buildings13071859.
Saeidi, S. , Anderson, M. D. , and Davidova, M. (2023). Kindness in architecture: The Multispecies co-living and co-design. Buildings, 13 (1), 1–21. doi: 10.3390/buildings13081931.
Thieme, W. (3 September 2020). Four common pitfalls to avoid in smart building deployment. Forbes Innovation. Forbes. Retrieved from http://forbes.com.
United States. US Department of Energy. Office of Energy Efficiency & Renewable Energy (2011). Building Performance Database (BPD). https://www.energy.gov/eere/buildings/building-performance-database-bpd
Yoon, S. (2023). Building digital twining: Data, information and models. Journal of Building Engineering, 76 (1 October), 107021. doi: 10.1016/j.jobe.2023.107021.
Žáček, M. , and Janošek, M. (2017). SBONTO: Ontology of smart building. Far East Journal of Electronics and Communications, 17 (5), 1101–1109. doi: 10.17654/EC017051101.
Zhang, J. , Luo, H. , and Xu, J. (2022). Towards fully BIM-enabled building automation and robotics: A perspective of lifecycle information flow. Computers in Industry, 135 (February), 103570. doi: 10.106/j.compind.2021.103570.
Witt, A. (2022). Shadowplays: Models, drawings, cognitions. In Artificial Intelligence and Architecture: From Research to Practice edited by S. Chaillou , 146–161. Basel, Switzerland: Birkhäuser.

For(m) and Against Architectural Intelligence

Brand, S. (1995). How Buildings Learn: What Happens after They Are Built. Penguin Books.
Brautigan, R. (1967). All Watched Over by Machines of Loving Grace. In a Pamphlet with the same title.
Evans, R. (1997). Translations from Drawing to Building and other Documents. AA Publications.
Hardingham, S. (Ed.) (2020). Cedric Price Works 1952–2003: A Forward-Minded Retrospective. AA Publications.
Keaton, D. (2017). The House that Pinterest Built. Rizzoli
Lanier, J. (2010). You are not a Gadget: A Manifesto. Vintage.
Schoffer, N. (1969). La Ville Cybernetique. Denoel.
Selinger, E. , & Crease, R. P. (2006). The Philosophy of Expertise. Columbia University Press.
Simon, H. (1996). The Sciences of the Artificial. MIT Press.
Toyo, T. (2011). The Logic of Uselessness, in Ito, T. , (Ed.)., Tarzans in the Media Forest: Architectural Words 8. AA Publications.

Br(AI)n City

Ahmed, M. (2015, January 30). Lunch with the FT: Demis Hassabis. Financial Times. https://www.ft.com/content/47aa9aa4-a7a5-11e4-be63-00144feab7de
Alibaba . (2019). City Brain Now in 23 Cities in Asia. Alibaba Cloud Blog. 28 October 2019 https://www.alibabacloud.com/blog/city-brain-now-in-23-cities-in-asia_595479.
Alibaba . (2023). Alibaba Cloud Intelligence Brain. https://www.alibabacloud.com/solutions/intelligence-brain.
Alibaba DAMO Academy . (2018). City Brain Lab. https://damo.alibaba.com/labs/city-brain
Allen, S. (1997). From object to field. Architectural Design, 67(5/6): 24–31.
Andersson, N. , Broberg, A. , Bränberg, A. , Jonsson, E. , Holmlund, K. , & Janlert, L.-E. (2003). Emergent interaction systems—designing for emergence. In Paper Presented at the Momuc Workshop. München, Germany. http://www8.cs.umu.se/~bopspe/publications/.
Ashby, W. R. (2018). Design for a Brain: The Origin of Adaptive Behavior. London: Chapman and Hall.
Beall, A. (2018, May 30). In China, Alibaba's data-hungry AI is controlling (and watching) cities. Wired. https://www.wired.co.uk/article/alibaba-city-brain-artificial-intelligence-china-kuala-lumpur=
Brown, R. K. (1969). City cybernetics. Land Economics, 45(4): 406–412. Accessed July 13, 2021 . doi:10.2307/3145438.
Cannon, B. (1929). Organization for physiological homeostasis. Physiological Reviews, 9: 399–431.
Coop Himmelb(l)au. (2009). Future Revisited. http://www.coop-himmelblau.at/architecture/projects/coop-himmelblau-future-revisited/
Chalmers, D. J. (2006). Strong and weak emergence. In Davies, P. , & Clayton, P. (eds.), The Re-Emergence of Emergence: The Emergentist Hypothesis From Science to Religion. Oxford University Press.
Damasio, A. (2019). The Strange Order of Things: Life, Feeling and the Making of Cultures. New York: Vintage.
Damasio, A. , & Carvalho, G. (2013). The nature of feelings: Evolutionary and neurobiological origins. Neuroscience, 14: 143.
Daugman, J. (1993). Brain metaphors and brain theory. In Computational Neuroscience. Cambridge, MA: MIT Press.
DeLanda, M. (2002). Deleuze and the use of the genetic algorithm in architecture. In Leach, N. (ed.), Designing for a Digital World. London: John Wiley & Sons.
Fan, S. (2020, January 14). Scientists discovered 'Mini-Computers'. In Human Neurons—and That's Great News for AI, SingularityHub. https://singularityhub.com/2020/01/14/scientists-discovered-mini-computers-in-human-neurons-and-thats-great-news-for-ai/.
Feng, L. (2018). City brain, a new architecture of smart city based on the internet brain. arXiv, 1710.04123v3.
Feng, L. , & Peng, G. (2008). Discovery and analysis of iEvolution laws. China Science Paper Online. https://arxiv.org/pdf/1806.10095.pdf
Heylighen, F. (1989). Self-organization, emergence and the architecture of complexity. In Proceedings of the 1st European Conference on System Science (Vol. 18, pp. 23–32). Paris: AFCET.
Holland, J. (1999). Emergence: From Chaos to Order. Perseus.
Jiang, W. (2019, July 2). City brain: Rethinking the relationship between technology and city. ULI Asia Pacific [Video]. YouTube. https://www.youtube.com/watch?v=RTPjzeQKg2w.

Johnson, S. (2002). Emergence: The Connected Lives of Ants, Cities and Software. Schribner.
Kelleher, J. (2019). Deep Learning. MIT Press.
Kubara, K. (2019, July 10). Artificial intelligence meets the internet of things. Towards Data Science. https://towardsdatascience.com/artificial-intelligence-meets-the-internet-of-things-a38a46210860
Leach, N. (2014). Swarm tectonics. In Leach, N. , Turnbull, D. , & Williams, C. (eds.), Digital Tectonics. Wiley.
Legg, S. , & Hutter, M. (2007). Universal intelligence: A definition of machine intelligence. Minds and Machines, 17(4): 391–444.
Lovelock, J. (1979). Gaia: A New Look at Life on Earth. Oxford University Press.
Marr, B. (2019, December 20). What is the artificial intelligence of things? When AI meets IoT.T. Forbes. https://www.forbes.com/sites/bernardmarr/2019/12/20/what-is-the-artificial-intelligence-of-things-when-ai-meets-iot/#7cb3a13ab1fd.
McPhearson, T. , Parnell, S. , Simon, D. , Gaffney, O. , Elmqvist, T. , Bai, X. , Roberts, D. , & Revi , A., (2016). Scientists must have a say in the future of cities. Nature News, 538(7624):165.
Musk, E. (2020, October 24). Elon’s message on artificial superintelligence—ASI. Science Time. [Video]. YouTube. https://www.youtube.com/watch?v=ZCeOsdcQObI&feature=youtu.behttps://www.youtube.com/watch?v=ZCeOsdcQObI&feature=youtu.be.
Narlakha, S. , & Suen, J. (2017). Using inspiration from synaptic plasticity rules to optimize traffic flow in distributed engineered networks. Neural Computation, 29(5): 1204–1228.
Nixon, M. , & Young, J. Z. (2003). The Brains and Lives of Cephalopods. Oxford University Press.
Saieed, Z. (2019, April 25). Kuala Lumpur set to become smart city next year. The Star. https://www.thestar.com.my/business/business-news/2019/04/25/kuala-lumpur-set-to-become-smart-city-next-year
Singer, W. (1997). Die Architektur des Gehirns als Modell für komplexe Stadtstrukturen? In Maar, C. , & Rötzer, F (eds.). Virtual Cities (pp. 153–161). Birkhauser.
Snooks, R. (2017). Behavioral matter. In Leach, N. , & Snooks, R. (eds.), Swarm Intelligence: Architectures of Multi-Agent Systems.Tongji UP.
Stibel, J. (2008, June 23). The internet is a brain. Harvard Business Review. https://hbr.org/2008/06/the-internet-is-a-brain.html
Stibel, J. (2009). Wired for Thought: How the Brain Is Shaping the Future of the Internet. Harvard Business Press.
Suen, J. (2017, February 9). The internet and your brain are more alike than you think. Salk News. https://www.salk.edu/news-release/internet-brain-alike-think/
Tom Tom . (2023). Hangzhou Traffic. https://www.tomtom.com/traffic-index/hangzhou-traffic/.
Turing, A. (1946). Letter to William Ashby. The W. Ross Ashby Archive. http://www.rossashby.info/letters/turing.html.
Waldrop, M. (1992). Complexity: The Emerging Science at the Edge of Order and Chaos. Simon and Schuster.

City as Spaceship – Spaceship as City

Bannova, O. , Alifanov, O. , Clar, R. , Harrison, A. , Sherwood, B. , Mohanty, S. , Payson, D. , and Tolyarenko, N. (2013) IAAA Final Report SG6 9.
Beck, U. (1996). Die offene Stadt, DeutschesArchitektenBlatt, 3/96, Bonn pp. 362–364. http://www.kulturregion-stuttgart.de/offeneraeume/texte/beck_offene (accessed 15/08/2014).
Boisot, M. (2010). “The city as a complex adaptive system: Lessons from the ATLAS experiment at the Large Hadron Collider (LHC)”. In Presented at Glasgow Centre for Population Health Seminar Series 7, Seminar 1, Summary Paper. https://edshare.gcu.ac.uk/143/ (accessed 1 May 2014).
Davis, M. (2010). “Who will build the Ark”. In ARCH+ No. 196/197: Post-Oil City, The History of the Cities Future, edited by Elke aus dem Moore , Iris Lenz , Nikolaus Kuhnert , Anh-Linh Ngo , ARCH+ Verlag GmbH, Stuttgart/Aachen.
Fuller, R.B. (1969). Operating Manual for Spaceship Earth, Southern Illinois University Press, 144 pp.
Krausse, J. and Lichtenstein, C. (Eds.) (1999). Your Private Sky. R. Buckminster Fuller, Lars Mueller Publishers, 528 p.
Mohanty, S. (2012). “What Has Outer Space Got to Do with Dharavi?” Invited lecture “Low Tech, High Tech”. In International Artmap Workshop, Paris.

Sassen, S. (2009). “Cities Are at the Center of our Environmental Future”. S.A.P.I.E.N.S [Online]. http://sapiens.revues.org/948 (accessed 30/08/2014).
Sassen, S. (2012). “Cities and the Biosphere”. In The Berkshire Encyclopedia of Sustainability: The Future of Sustainability, Berkshire Publishing, 36 p.
Aliyu, M. , Hassan, G. , Said, S. A. , Siddiqui, M. U. , Alawami, A. T. , & Elamin, I. M. (2018). A review of solar-powered water pumping systems. Renewable and Sustainable Energy Reviews, 87, 61–76.
Allam, Z. , & Dhunny, Z. A. (2019). On big data, artificial intelligence and smart cities. Cities, 89, 80–91.
Berson, A. (1996). Client/Server Architecture. McGraw-Hill, Inc.
Boretti, A. , Castelletto, S. , & Al-Zubaidy, S. (2019). Concentrating solar power tower technology: Present status and outlook. Nonlinear Engineering, 8(1), 10–31.
Boroson, D. M. , Robinson, B. S. , Murphy, D. V. , Burianek, D. A. , Khatri, F. , Kovalik, J. M. , … & Cornwell, D. M. (2014, March). Overview and results of the lunar laser communication demonstration. In Free-Space Laser Communication and Atmospheric Propagation XXVI (Vol. 8971, pp. 213–223). SPIE.
Carrer, L. , Pozzobon, R. , Sauro, F. , Castelletti, T. , Patterson, G. W. , & Bruzzone, L. (2024). Radar evidence of an accessible cave conduit on the Moon below the Mare Tranquillitatis pit. Nat Astron. https://doi.org/10.1038/s41550-024-02302-y
Collier, C. G. (2006). The impact of urban areas on weather. Quarterly Journal of the Royal Meteorological Society: A Journal of the Atmospheric Sciences, Applied Meteorology and Physical Oceanography, 132(614), 1–25.
Cooper, M. , Douglas, G. , & Perchonok, M. (2011). Developing the NASA food system for long-duration missions. Journal of Food Science, 76(2), R40–R48.
Davies, D. , Ederer, G. , Olsina, O. , Wong, M. , Cechini, M. , & Boller, R. (2019, October). NASA’s fire information for resource management system (FIRMS): Near real-time global fire monitoring using data from modis and viirs. In EARSel Forest Fires SIG Workshop (No. GSFC-E-DAA-TN73770).
Fiore, G. M. (2020). Space for Cities: Satellite Applications Enhancing Quality of Life in Urban Areas. Space Capacity Building in the XXI Century, 251–263. New York: Springer Publication.
Frank, J. D. (2015, August). Demonstrating autonomous mission operations onboard the international space station. In AIAA Space Forum 2015 (No. ARC-E-DAA-TN25586). Pasadena, California.
Giacomelli, G. , Furfaro, R. , Kacira, M. , Patterson, L. , Story, D. , Boscheri, G. , … & Catalina, M. (2012, July). Bio-regenerative life support system development for Lunar/Mars habitats. In 42nd International Conference on Environmental Systems, San Diego, California. https://ices.space/about-us/
Gibson, M. A. , Oleson, S. R. , Poston, D. I. , & McClure, P. (2017, March). NASA’s kilopower reactor development and the path to higher power missions. In 2017 IEEE Aerospace Conference (pp. 1–14). IEEE.
Henderson, S. (2016). Tensions, strains and patterns of concentration in England’s City-Regions. In The City’s Hinterland (pp. 119–153). Routledge.
Horz, F. (1985). Lava tubes-potential shelters for habitats. In Lunar Bases and Space Activities of the 21st Century (pp. 405–412). Lunar and Planetary Institute, Houston, Texas.
Huang, X. , & Hinze, J. (2003). Analysis of construction worker fall accidents. Journal of Construction Engineering and Management, 129(3), 262–271.
Imaoka, K. , Kachi, M. , Fujii, H. , Murakami, H. , Hori, M. , Ono, A. , … Shimoda, H. (2010). Global change observation mission (GCOM) for monitoring carbon, water cycles, and climate change. Proceedings of the IEEE, 98(5), 717–734.
Jin, C. , Bai, X. , Yang, C. , Mao, W. , & Xu, X. (2020). A review of power consumption models of servers in data centers. Applied Energy, 265, 114806.
Keirstead, J. , Jennings, M. , & Sivakumar, A. (2012). A review of urban energy system models: Approaches, challenges and opportunities. Renewable and Sustainable Energy Reviews, 16(6), 3847–3866.
Khoshnevis, B. , Thangavelu, M. , Yuan, X. , & Zhang, J. (2013). Advances in contour crafting technology for extraterrestrial settlement infrastructure buildup. In AIAA SPACE 2013 Conference and Exposition (p. 5438).
Kim, T. H. , Ramos, C. , & Mohammed, S. (2017). Smart city and IoT. Future Generation Computer Systems, 76, 159–162.
Kitmacher, G. H. , Gerstenmaier, W. H. , Bartoe, J. D. F. , & Mustachio, N. (2005). The international space station: A pathway to the future. Acta Astronautica, 57(2–8), 594–603
Kleerekoper, L. , Van Esch, M. , & Salcedo, T. B. (2012). How to make a city climate-proof, addressing the urban heat island effect. Resources, Conservation and Recycling, 64, 30–38.
Lauer, D. T. , Morain, S. A. , & Salomonson, V. V. (1997). The Landsat program: Its origins, evolution, and impacts. Photogrammetric Engineering and Remote Sensing, 63(7), 831–838.
Linden, E. (1996). The exploding cities of the developing world. Foreign Affairs, 75, 52.
Maiwald, V. , Kyunghwan, K. , Vrakking, V. , & Zeidler, C. (2023). From Antarctic prototype to ground test demonstrator for a lunar greenhouse. Acta Astronautica, 212, 246–260
Mankins, J. C. (1997). A fresh look at space solar power: New architectures, concepts and technologies. Acta Astronautica, 41(4–10), 347–359.

McKay, B. (2017). A farm grows in the city. Wall Street Journal. https://www.wsj.com/articles/a-farm-grows-in-the-city-1494813900
Mignacca, B. , & Locatelli, G. (2020). Economics and finance of small modular reactors: A systematic review and research agenda. Renewable and Sustainable Energy Reviews, 118, 109519.
Mitra, A. , & Murayama, M. (2009). Rural to urban migration: A district-level analysis for India. International Journal of Migration, Health and Social Care, 5(2), 35–52.
Mora, L. , Deakin, M. , & Reid, A. (2019). Strategic principles for smart city development: A multiple case study analysis of European best practices. Technological Forecasting and Social Change, 142, 70–97.
National Research Council. (2013). Underground Engineering for Sustainable Urban Development. National Academies Press.
Nordhoff, S. , Lee, J. D. , Calvert, S. C. , Berge, S. , Hagenzieker, M. , & Happee, R. (2023). (Mis-) use of standard Autopilot and Full Self-Driving (FSD) Beta: Results from interviews with users of Tesla's FSD Beta. Frontiers in Psychology, 14, 1101520.
O'Neill, D. W. , Fanning, A. L. , Lamb, W. F. , & Steinberger, J. K. (2018). A good life for all within planetary boundaries. Nature Sustainability, 1(2), 88–95.
Pelton, J. N. , & Allahdadi, F. (2015). Introduction to the handbook of cosmic hazards and planetary defense. In Handbook of Cosmic Hazards and Planetary Defense (pp. 3–33). Switzerland: Springer International Publishing.
Perchonok, M. , & Bourland, C. (2002). NASA food systems: Past, present, and future. Nutrition, 18(10), 913–920.
Pettorelli, N. , Laurance, W. F. , O'Brien, T. G. , Wegmann, M. , Nagendra, H. , & Turner, W. (2014). Satellite remote sensing for applied ecologists: Opportunities and challenges. Journal of Applied Ecology, 51(4), 839–848.
Qu, Z. , Zhang, G. , Cao, H. , & Xie, J. (2017). LEO satellite constellation for internet of things. IEEE Access, 5, 18391–18401.
Reddy, V. S. (2018). The SpaceX effect. New Space, 6(2), 125–134.
Rehm, T. E. (2023). Advanced nuclear energy: The safest and most renewable clean energy. Current Opinion in Chemical Engineering, 39, 100878.
Rockström, J. , Steffen, W. , Noone, K. , Persson, Å. , Chapin III, F. S. , Lambin, E. , … Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. Ecology and Society, 14(2).
Rosenthal, M. W. , Kasten, P. R. , & Briggs, R. B. (1970). Molten-salt reactors—history, status, and potential. Nuclear Applications and Technology, 8(2), 107–117. https://doi.org/10.13182/NT70-A28619
Steffen, W. , Richardson, K. , Rockström, J. , Cornell, S. E. , Fetzer, I. , Bennett, E. M. , … Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. Science, 347(6223), 1259855.
Thangavelu, M. (2014). Planet moon: The future of astronaut activity and settlement. Architectural Design, 84(6), 20–29.
Thangavelu, M. (2020). Outer space activities and city evolution. In ASCEND Conference 2020, (p. 4059). Las Vegas, Nevada: American Institute of Aeronautics and Astronautics.
Thangavelu, M. (2022). Futures of architecture on earth and in space: Lessons and synergies: Essay two: A space architecture primer for 21st-century civil architects and future city evolution. In The Routledge Companion to Ecological Design Thinking (pp. 502–514). Routledge.
Tramutoli, V. (2007, July). Robust satellite techniques (RST) for natural and environmental hazards monitoring and mitigation: Theory and applications. In 2007 International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (pp. 1–6). IEEE.
UN Habitat, Urban Energy . https://unhabitat.org/topic/urban-energy
Verduci, R. , Romano, V. , Brunetti, G. , Yaghoobi Nia, N. , Di Carlo, A. , D'Angelo, G. , & Ciminelli, C. (2022). Solar energy in space applications: Review and technology perspectives. Advanced Energy Materials, 12(29), 2200125.
Winzer, Peter J. , Neilson, David T. , & Chraplyvy , Andrew R. (2018). Fiber-optic transmission and networking: The previous 20 and the next 20 years. Optics Express, 26(18), 24190–24239.
Wulder, M. A. , Roy, D. P. , Radeloff, V. C. , Loveland, T. R. , Anderson, M. C. , Johnson, D. M. , … Cook, B. D. (2022). Fifty years of Landsat science and impacts. Remote Sensing of Environment, 280, 113195.
Ximenes, S. W. , Elliott, J. O. , & Bannova, O. (2012). Defining a mission architecture and technologies for lunar lava tube reconnaissance. In Earth and Space 2012: Engineering, Science, Construction, and Operations in Challenging Environments (pp. 344–354).
Yeager, N. J. , & McGrath, R. E. (1996). Web Server Technology. Morgan Kaufmann.

City As A Spaceship (CAAS)

Bannova, O. , Alifanov, O. , Clar, R. , Harrison, A. , Sherwood, B. , Mohanty, S. , Payson, D. , and Tolyarenko, N. (2013) IAAA Final Report SG6 9.

Beck, U. (1996). Die offene Stadt, DeutschesArchitektenBlatt, 3/96, Bonn pp. 362–364. http://www.kulturregion-stuttgart.de/offeneraeume/texte/beck_offene (accessed 15/08/2014).

Boisot, M. (2010). “The city as a complex adaptive system: Lessons from the ATLAS experiment at the Large Hadron Collider (LHC)”. In Presented at Glasgow Centre for Population Health Seminar Series 7, Seminar 1, Summary Paper. https://edshare.gcu.ac.uk/143/ (accessed 1 May 2014).

Davis, M. (2010). “Who will build the Ark”. In ARCH+ No. 196/197: Post-Oil City, The History of the Cities Future, edited by Elke aus dem Moore , Iris Lenz , Nikolaus Kuhnert , Anh-Linh Ngo , ARCH+ Verlag GmbH, Stuttgart/Aachen.

Fuller, R.B. (1969). Operating Manual for Spaceship Earth, Southern Illinois University Press, 144 pp.

Krausse, J. and Lichtenstein, C. (Eds.) (1999). Your Private Sky. R. Buckminster Fuller, Lars Mueller Publishers, 528 p.

Mohanty, S. (2012). “What Has Outer Space Got to Do with Dharavi?” Invited lecture “Low Tech, High Tech”. In International Artmap Workshop, Paris.

Sassen, S. (2009). “Cities Are at the Center of our Environmental Future”. S.A.P.I.E.N.S [Online]. http://sapiens.revues.org/948 (accessed 30/08/2014).

Sassen, S. (2012). “Cities and the Biosphere”. In The Berkshire Encyclopedia of Sustainability: The Future of Sustainability, Berkshire Publishing, 36 p.

Outer Space Activities and the Future of Smart Habitats on Earth

Aliyu, M. , Hassan, G. , Said, S. A. , Siddiqui, M. U. , Alawami, A. T. , & Elamin, I. M. (2018). A review of solar-powered water pumping systems. Renewable and Sustainable Energy Reviews, 87, 61–76.

Allam, Z. , & Dhunny, Z. A. (2019). On big data, artificial intelligence and smart cities. Cities, 89, 80–91.

Berson, A. (1996). Client/Server Architecture. McGraw-Hill, Inc.

Boretti, A. , Castelletto, S. , & Al-Zubaidy, S. (2019). Concentrating solar power tower technology: Present status and outlook. Nonlinear Engineering, 8(1), 10–31.

Boroson, D. M. , Robinson, B. S. , Murphy, D. V. , Burianek, D. A. , Khatri, F. , Kovalik, J. M. , … & Cornwell, D. M. (2014, March). Overview and results of the lunar laser communication demonstration. In Free-Space Laser Communication and Atmospheric Propagation XXVI (Vol. 8971, pp. 213–223). SPIE.

Carrer, L. , Pozzobon, R. , Sauro, F. , Castelletti, T. , Patterson, G. W. , & Bruzzone, L. (2024). Radar evidence of an accessible cave conduit on the Moon below the Mare Tranquillitatis pit. Nat Astron. https://doi.org/10.1038/s41550-024-02302-y

Collier, C. G. (2006). The impact of urban areas on weather. Quarterly Journal of the Royal Meteorological Society: A Journal of the Atmospheric Sciences, Applied Meteorology and Physical Oceanography, 132(614), 1–25.

Cooper, M. , Douglas, G. , & Perchonok, M. (2011). Developing the NASA food system for long-duration missions. Journal of Food Science, 76(2), R40–R48.

Davies, D. , Ederer, G. , Olsina, O. , Wong, M. , Cechini, M. , & Boller, R. (2019, October). NASA’s fire information for resource management system (FIRMS): Near real-time global fire monitoring using data from modis and viirs. In EARSel Forest Fires SIG Workshop (No. GSFC-E-DAA-TN73770).

Fiore, G. M. (2020). Space for Cities: Satellite Applications Enhancing Quality of Life in Urban Areas. Space Capacity Building in the XXI Century, 251–263. New York: Springer Publication.

Frank, J. D. (2015, August). Demonstrating autonomous mission operations onboard the international space station. In AIAA Space Forum 2015 (No. ARC-E-DAA-TN25586). Pasadena, California.

Giacomelli, G. , Furfaro, R. , Kacira, M. , Patterson, L. , Story, D. , Boscheri, G. , … & Catalina, M. (2012, July). Bio-regenerative life support system development for Lunar/Mars habitats. In 42nd International Conference on Environmental Systems, San Diego, California. https://ices.space/about-us/

Gibson, M. A. , Oleson, S. R. , Poston, D. I. , & McClure, P. (2017, March). NASA’s kilopower reactor development and the path to higher power missions. In 2017 IEEE Aerospace Conference (pp. 1–14). IEEE.

Henderson, S. (2016). Tensions, strains and patterns of concentration in England’s City-Regions. In The City’s Hinterland (pp. 119–153). Routledge.

Horz, F. (1985). Lava tubes-potential shelters for habitats. In Lunar Bases and Space Activities of the 21st Century (pp. 405–412). Lunar and Planetary Institute, Houston, Texas.
Huang, X. , & Hinze, J. (2003). Analysis of construction worker fall accidents. Journal of Construction Engineering and Management, 129(3), 262–271.
Imaoka, K. , Kachi, M. , Fujii, H. , Murakami, H. , Hori, M. , Ono, A. , … Shimoda, H. (2010). Global change observation mission (GCOM) for monitoring carbon, water cycles, and climate change. Proceedings of the IEEE, 98(5), 717–734.
Jin, C. , Bai, X. , Yang, C. , Mao, W. , & Xu, X. (2020). A review of power consumption models of servers in data centers. Applied Energy, 265, 114806.
Keirstead, J. , Jennings, M. , & Sivakumar, A. (2012). A review of urban energy system models: Approaches, challenges and opportunities. Renewable and Sustainable Energy Reviews, 16(6), 3847–3866.
Khoshnevis, B. , Thangavelu, M. , Yuan, X. , & Zhang, J. (2013). Advances in contour crafting technology for extraterrestrial settlement infrastructure buildup. In AIAA SPACE 2013 Conference and Exposition (p. 5438).
Kim, T. H. , Ramos, C. , & Mohammed, S. (2017). Smart city and IoT. Future Generation Computer Systems, 76, 159–162.
Kitmacher, G. H. , Gerstenmaier, W. H. , Bartoe, J. D. F. , & Mustachio, N. (2005). The international space station: A pathway to the future. Acta Astronautica, 57(2–8), 594–603
Kleerekoper, L. , Van Esch, M. , & Salcedo, T. B. (2012). How to make a city climate-proof, addressing the urban heat island effect. Resources, Conservation and Recycling, 64, 30–38.
Lauer, D. T. , Morain, S. A. , & Salomonson, V. V. (1997). The Landsat program: Its origins, evolution, and impacts. Photogrammetric Engineering and Remote Sensing, 63(7), 831–838.
Linden, E. (1996). The exploding cities of the developing world. Foreign Affairs, 75, 52.
Maiwald, V. , Kyunghwan, K. , Vrakking, V. , & Zeidler, C. (2023). From Antarctic prototype to ground test demonstrator for a lunar greenhouse. Acta Astronautica, 212, 246–260
Mankins, J. C. (1997). A fresh look at space solar power: New architectures, concepts and technologies. Acta Astronautica, 41(4–10), 347–359.
McKay, B. (2017). A farm grows in the city. Wall Street Journal. https://www.wsj.com/articles/a-farm-grows-in-the-city-1494813900
Mignacca, B. , & Locatelli, G. (2020). Economics and finance of small modular reactors: A systematic review and research agenda. Renewable and Sustainable Energy Reviews, 118, 109519.
Mitra, A. , & Murayama, M. (2009). Rural to urban migration: A district-level analysis for India. International Journal of Migration, Health and Social Care, 5(2), 35–52.
Mora, L. , Deakin, M. , & Reid, A. (2019). Strategic principles for smart city development: A multiple case study analysis of European best practices. Technological Forecasting and Social Change, 142, 70–97.
National Research Council. (2013). Underground Engineering for Sustainable Urban Development. National Academies Press.
Nordhoff, S. , Lee, J. D. , Calvert, S. C. , Berge, S. , Hagenzieker, M. , & Happee, R. (2023). (Mis-) use of standard Autopilot and Full Self-Driving (FSD) Beta: Results from interviews with users of Tesla's FSD Beta. Frontiers in Psychology, 14, 1101520.
O'Neill, D. W. , Fanning, A. L. , Lamb, W. F. , & Steinberger, J. K. (2018). A good life for all within planetary boundaries. Nature Sustainability, 1(2), 88–95.
Pelton, J. N. , & Allahdadi, F. (2015). Introduction to the handbook of cosmic hazards and planetary defense. In Handbook of Cosmic Hazards and Planetary Defense (pp. 3–33). Switzerland: Springer International Publishing.
Perchonok, M. , & Bourland, C. (2002). NASA food systems: Past, present, and future. Nutrition, 18(10), 913–920.
Pettorelli, N. , Laurance, W. F. , O'Brien, T. G. , Wegmann, M. , Nagendra, H. , & Turner, W. (2014). Satellite remote sensing for applied ecologists: Opportunities and challenges. Journal of Applied Ecology, 51(4), 839–848.
Qu, Z. , Zhang, G. , Cao, H. , & Xie, J. (2017). LEO satellite constellation for internet of things. IEEE Access, 5, 18391–18401.
Reddy, V. S. (2018). The SpaceX effect. New Space, 6(2), 125–134.
Rehm, T. E. (2023). Advanced nuclear energy: The safest and most renewable clean energy. Current Opinion in Chemical Engineering, 39, 100878.
Rockström, J. , Steffen, W. , Noone, K. , Persson, Å. , Chapin III, F. S. , Lambin, E. , … Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. Ecology and Society, 14(2).
Rosenthal, M. W. , Kasten, P. R. , & Briggs, R. B. (1970). Molten-salt reactors—history, status, and potential. Nuclear Applications and Technology, 8(2), 107–117. https://doi.org/10.13182/NT70-A28619
Steffen, W. , Richardson, K. , Rockström, J. , Cornell, S. E. , Fetzer, I. , Bennett, E. M. , … Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. Science, 347(6223), 1259855.

Thangavelu, M. (2014). Planet moon: The future of astronaut activity and settlement. Architectural Design, 84(6), 20–29.
Thangavelu, M. (2020). Outer space activities and city evolution. In ASCEND Conference 2020, (p. 4059). Las Vegas, Nevada: American Institute of Aeronautics and Astronautics.
Thangavelu, M. (2022). Futures of architecture on earth and in space: Lessons and synergies: Essay two: A space architecture primer for 21st-century civil architects and future city evolution. In The Routledge Companion to Ecological Design Thinking (pp. 502–514). Routledge.
Tramutoli, V. (2007, July). Robust satellite techniques (RST) for natural and environmental hazards monitoring and mitigation: Theory and applications. In 2007 International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (pp. 1–6). IEEE.
UN Habitat, Urban Energy . https://unhabitat.org/topic/urban-energy
Verduci, R. , Romano, V. , Brunetti, G. , Yaghoobi Nia, N. , Di Carlo, A. , D'Angelo, G. , & Ciminelli, C. (2022). Solar energy in space applications: Review and technology perspectives. Advanced Energy Materials, 12(29), 2200125.
Winzer, Peter J. , Neilson, David T. , & Chraplyvy , Andrew R. (2018). Fiber-optic transmission and networking: The previous 20 and the next 20 years. Optics Express, 26(18), 24190–24239.
Wulder, M. A. , Roy, D. P. , Radeloff, V. C. , Loveland, T. R. , Anderson, M. C. , Johnson, D. M. , … Cook, B. D. (2022). Fifty years of Landsat science and impacts. Remote Sensing of Environment, 280, 113195.
Ximenes, S. W. , Elliott, J. O. , & Bannova, O. (2012). Defining a mission architecture and technologies for lunar lava tube reconnaissance. In Earth and Space 2012: Engineering, Science, Construction, and Operations in Challenging Environments (pp. 344–354).
Yeager, N. J. , & McGrath, R. E. (1996). Web Server Technology. Morgan Kaufmann.

Smart Assistive Design Concepts for Enhancing Independent Living in Domestic Environments

Abdo, N. , Stachniss, C. , Spinello, L. , and Burgard, W. (2015). “Robot, organize my shelves! Tidying up objects by predicting user preferences”. In IEEE International Conference on Robotics and Automation (ICRA), Seattle, WA, pp. 1557–1564. doi: 10.1109/ICRA.2015.7139396.
AutoStore. (n.d.). Retrieved June 2022 from https://www.autostoresystem.com/.
Bangor, A. , Kortum, P. , and Miller, J. (2009). “Determining what individual SUS scores mean: Adding an adjective rating scale”. Journal of Usability Studies, 4, 114–123.
Brooke, J. (1996). “SUS: A ‘quick and dirty’ usability scale”. In P. W. Jordan , B. Thomas , B. A. Weerdmeester , and A. L. McClelland (Eds.), Usability Evaluation in Industry. London: Taylor and Francis, 189–194.
CDC, Centers for Disease Control and Prevention, “Organization of Work: Generic Job Stress Questionnaire” . https://www.cdc.gov/niosh/topics/workorg/detail088.html
Fukui, R. , Morishita, H. , Mori, T. , and Sato, T. (2008) “Development of a home-use automated container storage/retrieval system”. In IEEE/RSJ International Conference on Intelligent Robots and Systems, Nice, France: Institute of Electrical and Electronics Engineers (IEEE), pp. 2875–2882. doi: 10.1109/IROS.2008.4650946.
Gaspar, J. M. , Christie, G. J. , Prime, D. J. , Jolicoeur, P. , and McDonald, J. J. (2016). “Inability to suppress salient distractors predicts low visual working memory capacity”. Proceedings of the National Academy of Sciences, 113, 3693–3698. doi: 10.1073/pnas.1523471113
Kitai, S. , Tsuru, K. , and Hirose, S. (2005) “The proposal of swarm type wall climbing robot system ‘Anchor Climber’ the design and examination of adhering mobile unit”. In IEEE/RSJ International Conference on Intelligent Robots and Systems, Edmonton, AB: Institute of Electrical and Electronics Engineers (IEEE), pp. 475–480, doi: 10.1109/IROS.2005.1545593.
Larkin, E. (2022). “10 things to do daily to be more organized”. Retrieved June 2022 from https://www.thespruce.com/be-more-organized-on-daily-basis-2648474.
MIT App Inventor . (2022). Retrieved in 2022 from https://appinventor.mit.edu/.
PAR Systems , (n.d.). Retrieved June 2022 https://www.par.com/capabilities/automated-assembly/handling/.
Roster, C. A. , Ferrari, J. R. , and Jurkat, M. P. (2016). “The dark side of home: Assessing possession ‘clutter’ on subjective well-being”. Journal of Environmental Psychology, 46, 32–41. doi: 10.1016/j.jenvp.2016.03.003
Saboori, P. , Morris, W. , Xiao, J. , and Sadegh, A. (2007). “Aerodynamic analysis of City-Climber robots”. In IEEE International Conference on Robotics and Biomimetics (ROBIO), Sanya, China: Institute of Electrical and Electronics Engineers (IEEE), pp. 1855–1860, doi: 10.1109/ROBIO.2007.4522449.

Sattin, R. W. , Rodriguez, J. G. , DeVito, C. A. , Wingo, P. A. (2015). “Home environmental hazards and the risk of fall injury events among community-dwelling older persons”. Journal of the American Geriatrics Society. doi: 10.1111/j.1532-5415.1998.tb03799.x

Saxbe, D. E. , and Repetti, R. (2009). “No place like home: Home tours correlate with daily patterns of mood and cortisol”. Personality and Social Psychology Bulletin, 36(1), 71–81. doi: 10.1177/0146167209352864.

Schafer, G. , Green, K. E. , Walker, I. D. , and Fullerton, S. K. (2018). “Words become worlds: The LIT room, a literacy support tool at room-scale”. In Proceedings of the 2018 Designing Interactive Systems Conference (DIS ‘18). New York: ACM, pp. 511–522. doi: 10.1145/3196709.3196728

Taylor, A. S. , and Swan, L. (2005). “Artful systems in the home”. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI ‘05). New York: Association for Computing Machinery, pp. 641–650. doi: 10.1145/1054972.1055060

Verma, S. , Gonthina, P. , Hawks, Z. , Nahar, D. , Brooks, J. O. , Walker, I. D. , Wang, Y. , Aguiar, C , and Green, K. E. (2018). “Design and evaluation of two robotic furnishings partnering with each other and their users to enable independent living”. In Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth ‘18). New York: Association for Computing Machinery, pp. 35–44. doi: 10.1145/3240925.3240978.

Whitney, D. , and Levi, D. M. (2011). “Visual crowding: A fundamental limit on conscious perception and object recognition”. Trends in Cognitive Sciences, 15(4), 160–168. doi: 10.1016/j.tics.2011.02.005.

Zhang, M. , Hardin, J. , Cai, J. J. , Brooks, J. , and Green., K. E. (2026) “Self-Organizing Robot team (SORT): A multi-robot, wall climbing organizer-and-delivery system for living spaces”. Springer Series in Adaptive Environments (In press).

Zhang, M. , Xu, T. , Hardin, J. , Cai, J. J. , Brooks, J. , and Green, K. E. (2021). “How many robots do you want? A cross-cultural exploration on user preference and perception of an assistive multi-robot system”. In 30th IEEE International Conference on Robot & Human Interactive Communication (RO-MAN), Vancouver, BC: Institute of Electrical and Electronics Engineers (IEEE), pp. 580–585, doi: 10.1109/RO-MAN50785.2021.9515396.

Smart Architecture for the Blind

Arbib, M.A. 2021. When Brains Meet Buildings: A Conversation between Neuroscience and Architecture. New York: Oxford University Press.

Fernández, E. , A. Alfaro , and P. González-López . 2020. “Toward Long-Term communication with the brain in the blind by intracortical stimulation: challenges and future prospects.” Frontiers in Neuroscience 14, article 681.

Folska, C.L. 2012. “In blind sight: Wayfinding in the absence of vision.” Ph.D. Thesis, University of Colorado at Denver.

Gibson, J.J. 1977. The Ecological Approach to Visual Perception. Boston: Houghton Mifflin.

Kebede, G.A. , and Y.K. Shiferaw . 2023. “Assistive smart cane technology for visually impaired peoples: A review.” In Artificial Intelligence and Digitalization for Sustainable Development, edited by B.H. Woldegiorgis , K. Mequanint , M.A. Bitew , T.B. Beza and A.M. Yibre , 196–208. Cham: Springer Nature Switzerland.

Lestak, J. , J. Chod , J. Rosina , and K. Hana . 2022. “Visual neuroprosthesis: Present and possible perspectives.” Biomedical Papers of the Medical Faculty of the University Palacký, Olomouc, Czechoslovakia 166: 251–257.

Pallasmaa, J. 2012. The Eyes of the Skin: Architecture and the Senses 3rd Edition. Chichester, UK: Wiley.

Passini, R. , and G. Proulx . 1988. “Wayfinding without vision: An experiment with congenitally totally blind people.” Environment and Behavior 20 (2): 227–252.

Tidwell, P. , ed. 2014. Architecture and Atmosphere. Espoo, Finland: Tapio Wirkkala—Rut Bryk Foundation.

People-Centered Smart Learning Ecosystems

As an example see Sahin I. , & Shelly, M. Eds. (2020). Educational Practices during the COVID-19 Viral Outbreak: International Perspectives, ITES Organization.

Giovannella, C. , Passarelli, M. , & Persico, D. (2020). “The Effects of the Covid-19 Pandemic on Italian Learning Ecosystems: The School Teachers’ Perspective at the Steady State”. Interaction Design and Architecture(s) Journal - IxD&A, 4: 264–286. https://doi.org/10.55612/s-5002-045-012

Giovannella, C. , Passarelli, M. , Alkhafaji, A. S. A. , & Pérez Negrón, A. P. (2021). “A Model for the Attitude to get Engaged in Technological Innovation (MAETI) Derived from a Comparative Study on the Effects of the

SARS-CoV2 Pandemic seen through the Lens of the University Teachers of three different National Learning Ecosystems: Iraq, Italy and Mexico". Interaction Design and Architecture(s) Journal - IxD&A, 47: 167–190. https://doi.org/10.55612/s-5002-047-008

Giovannella, C. , Cianfriglia, L. , & Giannelli, A. (2022). "The Italian School Ecosystems Two Years After the Lockdown: An Overview on the 'Digital Shock' Triggered by the Pandemic in the Perceptions of Schools' Principals and Teachers in Polyphonic Construction of Smart Learning Ecosystems". Springer, vol. 908: 47–76. https://doi.org/10.1007/978-981-19-5240-1_4

Wikipedia. (n.d.). "Factory Model School". Retrieved October 3, 2023 from https://en.wikipedia.org/wiki/Factory_model_school

Robinson, K. (2010). "Changing Education Paradigms". TED Talk, Retrieved October 3, 2023 from https://www.ted.com/talks/sir_ken_robinson_changing_education_paradigms

CEDEFOP. (2010). "The Skill Matching Challenge: Analyzing Skill Mismatch & Policy Implications". Luxemburg, Available online at: http://www.cedefop.europa.eu/EN/Files/3056en.pdf.

McGuinness, S. , & Ortiz, L. (2015). Skill Gaps in the Workplace: Measurement, Determinants and Impacts, IZA DP No. 9278.

UNICEF. (n.d.). "Inclusive Education". Retrieved October 3, 2023 from https://www.unicef.org/education/inclusive-education

Leijen , Ä, Arcidiacono, F. , & Baucal, A. (2021). "The Dilemma of Inclusive Education: Inclusion for Some or Inclusion for All". Frontiers in Psychology, 12: 633066.

UNESCO. (n.d.). Digital Competence Framework for Teachers, Learners and Citizens. Retrieved October 3, 2023 from https://unevoc.unesco.org/home/Digital+Competence+Frameworks/lang=en/id=4.

European Commission. (n.d.). DigiComp Framework. Retrieved October 3, 2023 from https://joint-research-centre.ec.europa.eu/digcomp/digcomp-framework_en.

Giovannella, C. (2023). " 'Learning by being': Integrated thinking and Competencies to Mark the Difference from AIs". Interaction Design & Architecture(s) Journal – IxD&A, 57: 8–26, https://doi.org/10.55612/s-5002-057-001

Bečko, B. , & Ferrari, A. (2016). Vuorikari R. , Punie Y. Eds. The Digital Competence Framework for Consumers. EUR 28133 EN. Luxembourg (Luxembourg): Publications Office of the European Union. JRC103155

Lee, S. Ho , Han, J. Hoon , Leem, Y. Taik , & Yigitcanlar, T. (2008). "Towards Ubiquitous City: Concept, Planning, and Experiences in the Republic of Korea". Knowledge-Based Urban Development: Planning and Applications in the Information Era (pp. 148–169).

Deakin, M. , & Al Waer, H. (2011). "From Intelligent to Smart Cities". Journal of Intelligent Buildings International: From Intelligent Cities to Smart Cities, 3(3): 140–152.

Giffinger, R. , & Gudrun, H. (2010). Smart Cities Ranking: An Effective Instrument for the Positioning of Cities? ACE: Architecture, City and Environment, 4(12): 7–25.

Hollands, R. (2008). "Will the Real Smart City Please Stand Up?". City, 12(3): 303–320.

Fitsilis, P. Ed. (2022). Building on Smart Cities Skills and Competences. Springer Publisher.

Giovannella, C. , Dascalu, M. , & Scaccia, F. (2014). "Smart City Analytics: State of the Art and Future [Perspectives". Interaction Design and Architecture(s) Journal - IxD&A, 20: 72–87.

Giovannella, C. (2013). "Territorial Smartness and Emergent Behaviors". In ICSCS 2013 (pp. 170–176). IEEE Publisher.

Giovannella, C. , Gobbi, A. , Zhang, B. , Elsner, J. , Del Fatto, V. , Pérez-Sanagustín, M. , Avouris, N. , & Zualkernan, I. (2013). "Villard-de-Lans: A Case Study for Collaborative People-Centered Smart City Learning Design". In ICALT 2013 (pp. 459–460). IEEE Publisher.

The origin of the "Person in Place Centered Design" Vision is Documented in Giovannella C. (2008). "Person- in-Place Centered Design: Educare 'Istructional Designer' e Operatori dei Futuri 'Learning Places'". In Didamatica 2008. Ed. Andronico, A. , Roselli, T. , & Lamborghini, B. Bari , p. 973.

The Human Smart Cities Cookbook. (2014). Planum. 28. Retrieved October 3, 2023 from https://issuu.com/planumnet/docs/cookbook_planum.

Concilio, G. , & Rizzo, F. Eds., (2016). Human Smart Cities. Rethinking the Interplay between Design and Planning. Springer.

Giovannella, C. (2022). "At the Root of the Smart Cities: Smart Learning Ecosystems to train Smart Citizens". In Building on Smart Cities Skills and Competences. Springer Publisher, pp. 217–228.

Giovannella, C. (2014). "'Smartness' as Complex Emergent Property of a Process. The Case of Learning Ecosystems". ICWOAL. IEEE Publisher, p. 1–5.

Sergis, S. , Zervas, P. , & Sampson, D. G. (2014). "A Holistic Approach for Managing School ICT Competence Profiles towards Supporting School ICT Uptake". International Journal of Digital Literacy and Digital Competence, 5(4): 33–46.

Kampylis, P. , Punie, Y. , & Devine, J. (2015). Promoting Effective Digital-Age Learning: A European Framework for Digitally-Competent Educational Organisations, EUR 27599 EN, Publications Office of the

European Union, Luxembourg. JRC98209.
ASLERD: Association for Smart Learning Ecosystems and Regional Development . Retrieved October 3, 2023 from http://www.aslerd.org
Maslow, A. H. (1943). “A Theory of Human Motivation”. Psychological Review, 50(4): 370–396.
Czisikszentmihalyi, M. (1990). Flow—The Psychology of Optimal Experience. Harper & Row.
Giovannella, C. (2022). “From Simplex to Complex: Designing for Wellbeing at Scale”. Interaction Design and Architecture(s) Journal - IxD&A, 55: 123–138, doi: https://doi.org/10.55612/s-5002-055-006
Momentum. (2022). Treccani 2022. Retrieved October 3, 2023, from https://www.treccani.it/magazine/lingua_italiana/articoli/parole/Figitale.html.
Ghel, J. (1971). Life between the Building: Using Public Spaces. The Danish Architectural Press.
Hillier, B. (1984). The Social Logic of Space.
Hassenzahl, M. (2010). “Experience Design: Technology for all the Right Reasons”. Synthesis Lectures on Human-Centered Informatics, Cambridge University Press, 3(1): 1–95.
Giovannella, C. (2012). “Is Complexity Tameable? Toward a Design for the Experience in a Complex World”. Interaction Design and Architecture(s) Journal - IxD&A, 15: 18–30.
Fröbel, F. (1826). On the Education of Man (Die Menschenerziehung), Keilhau/Leipzig, Wienbrach.
Wikipedia. (n.d.). Jean Piaget. Retrieved October 3, 2023, from https://en.wikipedia.org/wiki/Jean_Piaget.
Montessori, M. (1935). Il Metodo Della Pedagogia Scientifica Applicato All’educazione Infantile Nelle Case Dei Bambini. Loescher, Roma.
Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes. Cambridge, MA, Harvard University Press.
Vygotsky, L. S. (1934/1986). Thought and Language. Cambridge, MA, MIT Press.
DeVries, R. (2000). “Vygostky, Piaget and Education: A Reciprocal Assimilation of Theories and Educational Practices”. New Ideas in Psychology, 18: 187–213.
Mayer, S. J. (2008). “Dewey’s Dynamic Integration of Vygotsky and Piaget”. Education and Culture, 24(2): 6–24.
Mascolo, M. F. , & Fischer, K. W. (2005). Constructivist Theories. Cambridge Encyclopedia of Child Development (pp. 49–63). Cambridge, Cambridge University Press.
Steiner, R. (1924). “Human Values in Education GA 310 IV. Three Epochs of Childhood”. Rudolf Steiner Archive. Steiner Online Library. Retrieved October 3, 2023, from https://rsarchive.org/Lectures/19240720a01.html
Malaguzzi, L. (1993). “For an Education Based on Relationships”. Young Children, 49: 9–12.
HEFCE. (2006). Design Spaces for Effective Learning. A Guide to 21st Century Learning Space Design. Retrieved October 3, 2023, from https://www.d41.org/cms/lib/IL01904672/Centricity/Domain/422/learningspaces.pdf
REMI. (2021). The New Architecture of Schools. The School of the Future is Flexible, Adaptable, and Healthy. Retrieved October 3, 2023 from https://www.reminetwork.com/articles/the-new-architecture-of-schools/
INDIRE . (n.d.). Quando lo Spazio Insegna. Retrieved October 3, 2023 from https://www.indire.it/quandolospazioinsegna/eventi/2012/miur/
ARM Architecture. (2023). Six New Primary Schools, 2023. Retrieved October 3, 2023 from https://armarchitecture.com.au/projects/six-new-primary-schools-2023/
Kitchen N. R. , Snyder C. J. , Franzen D. , & Wiebold W. J. (2022). “Educational Needs of Precision Agriculture”. Precision Agriculture, 3(4): 341–351.
Dessus, P. (2023). Context-Aware Classrooms as Places for an Automated Analysis of Instructional Events. In: Dascalu, M. , Marti, P. , Pozzi, F. (eds) Polyphonic Construction of Smart Learning Ecosystems. SLERD 2022. Smart Innovation, Systems and Technologies, vol 908. Singapore: Springer. https://doi.org/10.1007/978-981-19-5240-1_1
Olari V. , & Romeike, R. (2021). “Addressing AI and Data Literacy in Teacher Education: A Review of Existing Educational Frameworks”. WiPSCE ‘21: The 16th Workshop in Primary and Secondary Computing Education (pp. 1–2). Retrieved October 3, 2023 from https://doi.org/10.1145/3481312.3481351.
Dykes, B. (2020). Data Storytelling: How to Drive Change with Data, Narrative and Visuals. Wiley.
Baena, F. , Guarin, A. , Mora, J. , Sauza, J. , & Retat, S. (2017). “Learning Factory: The Path to Industry 4.0”. Procedia Manufacturing, 9: 73–80.
Breeze Creative. (n.d.). Retrieved October 3, 2023 from https://www.breezecreative.com/
Studio azzurro. Opere. (n.d.). Retrieved October 3, 2023 from https://www.studioazzurro.com/category/opere/
Doma, O. O. , & Sener, S. M. “Dreamscape Bricks VR: An Experimental Virtual Reality Tool for Architectural Design”. Interaction Design and architecture(s) Journal—IxD&A, 52: 234–258. https://doi.org/10.55612/s-5002-052-013

Zhou, Y. , Hou, J. , Liu, Q. , Chao, X. , Wang, N. , Chen, Y. , Guan, J. , Zhang, Q. , & Diwu, Y. (2021). “VR/AR Technology in Human Anatomy Teaching and Operation Training”. Journal of Healthcare Engineering, 2021: 9998427.

Sullivan, E. , Nieves, A. D. , & Snyder, L. M. (2017). “Making the Model: Scholarship and Rhetoric in 3-D Historical Reconstructions”. In: Sayers, J. (ed), Making Things and Drawing Boundaries: Experiments in the Digital Humanities (pp. 301–316). University of Minnesota Press, Minneapolis.

Greenfield, A. (2006). Everyware: The Dawning Age of Ubiquitous Computing. New Riders.

Nieuwdorp, E. (2007). “The Pervasive Discourse”. Computers in Entertainment, 5(2): 13.

Li, S. , Xu, L. D. , & Zhao, S. (2015). “The Internet of Things: A Survey”. Information Systems Frontiers, 17: 243–259.

Giovannella, C. (2008). “L’uomo, La Macchina E La Comunicazione Mediata: Evoluzioni Di Paradigmi E Design Per Le Esperienze Nell’era Organica Dell’interazione”. Machinae: Tecniche Arti E Saperi Del Novecento (pp. 471–490). Ed. Graphics, B. A. Bari .

The Body in Healing Technology

Abtahi, P. , Hough, S. Q. , Landay, J. A. , & Follmer, S. (2022). Beyond Being Real: A Sensorimotor Control Perspective on Interactions in Virtual Reality. In CHI Conference on Human Factors in Computing Systems (CHI ’22), April 29-May 5, 2022, New Orleans, LA, USA. ACM, New York, NY, USA, 17 pages. https://doi.org/10.1145/3491102.3517706

Artificial Nature. Retrieved from https://artificialnature.net/

Bahouth, Mona N. , Zink, Elizabeth K. , Ahmad, Omar Roy , Promit, Zeiler , Steven R. , Urrutia, Victor C. , & Krakauer, John W. (2023). Bringing High-Dose Neurorestorative Behavioral Training into the Acute Stroke Unit. American Journal of Physical Medicine & Rehabilitation, 102(2S): S33–S37. https://doi.org/10.1097/PHM.0000000000002146

Bargeri, S. , Scalea, S. , Agosta, F. , Banfi, G. , Corbetta, D. , Filippi, M. , Sarasso, E. , Turolla, A. , Castellini, G. , & Gioanola, S. (2023). Effectiveness and Safety of Virtual Reality Rehabilitation after Stroke: An Overview of Systematic Reviews. eClinicalMedicine, The Lancet Discovery Science, 64: 102220. https://doi.org/10.1016/j.eclinm.2023.102220

BeAnotherLab. (n.d.) . The Machine to Be Another. BeAnotherLab. https://beanotherlab.org/home/work/tmtba/.

Behnke, E. (2011). Husserl and Phenomenology. Internet Encyclopedia of Philosophy. Retrieved from https://iep.utm.edu/husspemb/.

Cai, S. , Li, G. , Zhang, X. , Huang, S. , Zheng, H. , Longhan, X. (2019). Detecting Compensatory Movements of Stroke Survivors using Pressure Distribution Data and Machine Learning Algorithms. Journal of NeuroEngineering and Rehabilitation, 16: 131. https://doi.org/10.1186/s12984-019-0609-6

Cardenas-Robledo, L. A. , Hernández-Uribe, Ó. , Reta, C. , & Cantoral-Ceballos, J. A. (2022). Extended Reality Applications in Industry 4.0.-A Systematic Literature Review. Telematics and Informatics, 73, 101863

Cirstea, M. C. , & Levin, M. F. (2000). Compensatory Strategies for Reaching in Stroke. Brain, 123(5): 940–953. https://doi.org/10.1093/brain/123.5.940.

Douglass-Kirk, P. , Grierson, M. , Ward, N. S. , Brander, F. , Kelly, K. , Chegwidden, W. , Shivji, D. , & Stewart, L. (2022). Real-time auditory feedback may reduce abnormal movements in patients with chronic stroke. Disability and Rehabilitation, 45(4), 613–619. https://doi.org/10.1080/09638288.2022.2037751

Feigin , et al. (2022). WSO Global Stroke Fact Sheet. International Journal of Stroke, 17: 18–29.

Gonzalez-Franco M. , & Peck T. C. (2018). Avatar Embodiment. Towards a Standardized Questionnaire. Frontiers in Robotics and AI, 5: 74. https://doi.org/10.3389/frobt.2018.00074

Goudman, L. , Jansen, J. , Billot, M. , Vets, N. , De Smedt, A. , Roulaud, M. , Rigoard, P. , & Moens, M. (2022). Virtual Reality Applications in Chronic Pain Management: Systematic Review and Meta-analysis. JMIR Serious Games, 10(2): e34402. https://doi.org/10.2196/34402

Hadjipanayi, C. , Banakou, D. , & Michael-Grigoriou, D. (2023). Art as Therapy in Virtual Reality: A Scoping Review. Frontiers in Virtual Reality, 4: 1065863. https://doi.org/10.3389/frvir.2023.1065863

Hao, J. , Xie, H. , Harp, K. , Chen, Z. , & Siu, K. C. (2022). Effects of Virtual Reality Intervention on Neural Plasticity in Stroke Rehabilitation: A Systematic Review. Archives of Physical Medicine and Rehabilitation, 103(3): 523–541. https://doi.org/10.1016/j.apmr.2021.06.024

Kirkevold, M. , Kildal Bragstad, L. , Bronken, B. A. , Kvigne, K. , Martinsen, R. , Gabrielsen Hjelle, E. , Kitzmüller, G. , Mangset, M. , Angel, S. , Aadal, L. , Eriksen, S. , Wyller, T. B. , & Sveen, U. (2018). Promoting Psychosocial Well-Being Following Stroke: Study Protocol for a Randomized, Controlled Trial. BMC Psychology, 6(1): 12. https://doi.org/10.1186/s40359-018-0223-6

Krakauer, J. W. , Kitago, T. , Goldsmith, J. , Ahmad, O. , Roy, P. , Stein, J. , Bishop, L. , Casey, K. , Valladares, B. , Harran, M. , Camilo Cortés, J. , Forrence, A. , Xu, J. , DeLuzio, S. , Held, J. , Schwarz, A. , Steiner, L. , Widmer, M. , Jordan, K. , Ludwig, D. , Moore, M. , Barbera, M. , Vora, I. , Stockley, R. , Celnik, P. , Zeiler, S. , Branscheidt, M. , Kwakkel, G. , Luft, A. (2021). Comparing a Novel Neuroanimation Experience to Conventional Therapy for High-Dose Intensive Upper-Limb Training in Subacute Stroke: The SMARTS2 Randomized Trial. Neurorehabilitation and Neural Repair, 35(5): 393–405. https://doi.org/10.1177/15459683211000730

Livingston-Thomas, J. , Nelson, P. , Karthikeyan, S. , Antonescu, S. , Jeffers, M. S. , Marzolini, S. , & Corbett, D. (2016). Exercise and Environmental Enrichment as Enablers of Task-Specific Neuroplasticity and Stroke Recovery. Neurotherapeutics, 13: 395–402. https://link.springer.com/content/pdf/10.1007/s13311-016-0423-9.pdf?pdf=button sticky

Marín-Morales, J. , Higuera-Trujillo, J. L. , Guixeres, J. , Llinares, C. , Alcañiz, M. , & Valenza, G. (2021). Heart Rate Variability Analysis for the Assessment of Immersive Emotional Arousal using Virtual Reality: Comparing Real and Virtual Scenarios. PloS one, 16(7): e0254098. https://doi.org/10.1371/journal.pone.0254098.

McDonald, M. W. , Hayward, K. S. , Rosbergen, I. C. M. , Jeffers, M. S. , & Corbett, D. (2018). Is Environmental Enrichment Ready for Clinical Application in Human Post-stroke Rehabilitation? Frontiers in Behavioral Neuroscience, 12. https://doi.org/10.3389/fnbeh.2018.00135

Praetorius, A. S. , & Görlich, D. (2021). The Proteus Effect: How Avatars Influence Their Users' Self-perception and Behavior. In: Tom Dieck, M. C. , Jung, T. H. , Loureiro, S. M. C. (eds), Augmented Reality and Virtual Reality. Progress in IS. Springer, Cham. https://doi.org/10.1007/978-3-030-68086-2_9.

Slater, M. , Pérez Marcos, D. , Ehrsson, H. , & Sanchez-Vives, M. V. (2009). Inducing Illusory Ownership of a Virtual Body. Frontiers in Neuroscience, 3(2): 214–220. https://doi.org/10.3389/neuro.01.029.2009

Stroke Association. (n.d.). What is Stroke? Retrieved from https://www.stroke.org.uk/what-is-stroke

Ramachandran, V. S. , & Hirstein, W. (1998). The Perception of Phantom Limbs. The D. O. Hebb Lecture. Brain: A Journal of Neurology, 121(Pt 9): 1603–1630. https://doi.org/10.1093/brain/121.9.1603

Rojo, A. , Santos-Paz, J. Á. , Sánchez-Picot, Á. , Raya, R. , & García-Carmona, R. (2022). FarmDay: A Gamified Virtual Reality Neurorehabilitation Application for Upper Limb Based on Activities of Daily Living. Applied Sciences, 12(14): 7068. MDPI AG. Retrieved from http://dx.doi.org/10.3390/app12147068

Ward, N. S. , Brander, F. , & Kelly, K. (2019). Intensive upper limb neurorehabilitation in chronic stroke: outcomes from the Queen Square programme. Journal of Neurology, Neurosurgery, and Psychiatry, 90(5), 498–506. https://doi.org/10.1136/jnnp-2018-319954

Watanabe, R. , & Higuchi T. (2016). Behavioral Advantages of the First-Person Perspective Model for Imitation. Frontiers in Psychology, 7, 701. https://doi.org/10.3389/fpsyg.2016.00701

Yee, N. , Bailenson, J. N. , & Ducheneaut, N. (2009). The Proteus Effect: Implications of Transformed Digital Self-Representation on Online and Offline Behavior. Communication Research, 36(2): 285–312. https://doi.org/10.1177/0093650208330254

Smart Design for Human Responsiveness and Movement

Albright, T. , S. Gepshtein , and E. Macagno . (2020). "Visual neuroscience for architecture." Architectural Design 90, no. 6: 110–117.

Alais, D. , and D. Burr . (2004). "The ventriloquist effect results from near-optimal bimodal integration." Current Biology 14, no. 3: 257–262.

Alais, D. , F. Newell , and P. Mamassian . (2010). "Multisensory processing in review: From physiology to behaviour." Seeing and Perceiving 23, no. 1: 3–38.

Belting, H. (2011). Florence and Baghdad, Renaissance Art and Arab Science. Cambridge: Harvard University Press.

Benedikt, M. , and S. Mcelhinney . (2019). "Isovists and the metrics of architectural space." In Paper Presented at the 107th ACSA Annual Meeting. Articulating Architecture's core in the Post Digital Era, Pittsburg, March 1–10.

Cimoli, A. , and F. Irace . (2007). La Divina Proporzione. Triennale 1951. Milan: Mondadori Electa.

Cimoli, A. , and F. Irace . (2013). "Triennial 1951: Post-War reconstruction and divine proportion." Nexus Network Journal 15, no. 1: 3–14.

Clark, J. J. , and A. L. Yuille , 1990. Data Fusion for Sensory Information Processing Systems. New York: Springer Science & Business Media.

Delbeke, M. , and M. Cohen . (2018). Proportional Systems in the History of Architecture: A Critical Reconsideration. Leiden: Leiden University Press.

Eberhard, J. P. (2009). Brain Landscape: The Coexistence of Neuroscience and Architecture. Oxford: Oxford University Press.
Epstein, W. , and J. N. Park . (1963). “Shape constancy: Functional relationships and theoretical formulations.” Psychological Bulletin 60, no. 3: 265.
Ernst, M. O. , and H. H. Bülthoff . (2004). “Merging the senses into a robust percept.” Trends in Cognitive Sciences 8, no. 4: 162–169.
Gepshtein, S. (2010). “Two psychologies of perception and the prospect of their synthesis.” Philosophical Psychology 23, no. 2: 217–281.
Gepshtein, S. (2020). “Species of space.” Architectural Design 90, no. 6: 36–41.
Gepshtein, S. , and M. S. Banks . (2003). “Viewing geometry determines how vision and haptics combine in size perception.” Current Biology 13, no. 6: 483–488.
Gepshtein, S. , J. Burge , M. O. Ernst , and M. S. Banks . (2005). “The combination of vision and touch depends on spatial proximity.” Journal of Vision 5, no. 11–7: 1013–1023.
Gepshtein, S. , J. H. Elder , and L. T. Maloney . (2008). “Perceptual organization and neural computation.” Journal of Vision 8, no. 7: 1–4.
Gepshtein, S. , and J. Snider . (2019). “Neuroscience for architecture: The evolving science of perceptual meaning.” Proceedings of the National Academy of Sciences USA 116, no. 29: 14404–14406.
Gescheider, G. A. (2013). Psychophysics: The Fundamentals. London: Psychology Press.
Hillis, J. M. , S. J. Watt , M. S. Landy , and M. Banks . (2004). “Slant from texture and disparity cues: Optimal cue combination.” Journal of Vision 4, no. 12: 1–1.
Howard, I. P. (2012). Perceiving in Depth, Volume 1: Basic Mechanisms. Oxford: Oxford University Press.
Kanizsa, G. (1979). Organization in Vision: Essays on Gestalt Perception. Westport, CT: Praeger Publishers.
Kanizsa, G. , and W. Gerbino . (1976). Convexity and symmetry in figure-ground organization. In Art and Artefacts. Edited by Henle M. , 25–32. New York: Springer.
King, D. L. (1988). “Assimilation is due to one perceived whole and contrast is due to two perceived wholes.” New Ideas in Psychology 6, no. 3: 277–288.
Kingdom, F. A. A. , and N. Prins . (2016). Psychophysics. A Practical Introduction. London: Elsevier.
Koffka, K. (1935). Principles of Gestalt Psychology. New York: Harcourt, Brace, & World.
Kubovy, M. (1986). The Psychology of Perspective and Renaissance art. Cambridge: Cambridge University Press.
Kubovy, M. (1994). “The perceptual organization of dot lattices.” Psychonomic Bulletin & Review 1, no. 2: 182–190.
Kubovy, M. , and S. Gepshtein . (2003). Perceptual grouping in space and in space-time: An exercise in phenomenological psychophysics. In Perceptual Organization in Vision: Behavioral and Neural Perspectives, Edited by Kimchi, Ruth , Marlene Behrmann , and Carl R. Olson , 45–85. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
Kubovy, M. , and J. R. Pomerantz , eds. (1981). Perceptual Organization. Hillsdale, NJ: Erlbaum.
Kubovy, M. , and M. Van Den Berg . (2008). “The whole is equal to the sum of its parts: A probabilistic model of grouping by proximity and similarity in regular patterns.” Psychological Review 115, no. 1: 131–154.
Landy, M. S. , L. T. Maloney , E. B. Johnston , and M. Young . (1995). “Measurement and modeling of depth cue combination: In defense of weak fusion.” Vision Research 35, no. 3: 389–412.
Mallgrave, H. F. (2010). The Architect’s Brain: Neuroscience, Creativity, and Architecture. New York: John Wiley & Sons.
Maloney, L. T. , and M. S. Landy . (1989). A statistical framework for robust fusion of depth information. In Visual Communications and Image Processing IV. Vol. 1199, 1154–1163. Philadelphia: Society of Photo-Optical Instrumentation Engineers (SPIE).
Padovan, R. (1999). Proportion. Science, Philosophy, Architecture. London and New York: Taylor & Francis Routledge.
Panofsky, E. (1991). Perspective as Symbolic Form (1927). New York: Zone Books.
Perdreau, F. , and P. Cavanagh . (2013). “Is artists’ perception more veridical?.” Frontiers in Neuroscience 7: 6.
Pirenne, M. H. (1970). Optics, Painting & Photography. Cambridge: Cambridge University Press.
Proietti, T. (2015). Ordine e Proporzione. Dom Hans van der Laan e L’espressività Dello Spazio Architettonico. Macerata: Quodlibet.
Proietti, T. (2021). “Revisiting the plastic number theory from the perspective of perceptual psychology.” Architectural Science Review 64, no. 4: 346–358.
Proietti, T. , and S. Gepshtein . (2022a). “Architectural proportion from an empirical standpoint.” Journal of Interior Design 47, no. 1: 11–29.
Proietti, T. , and S. Gepshtein . (2022b). Locating architectural atmosphere. In Generators of Architectural Atmospheres, Edited by Canepa Elisabetta , 95–110. Kansas State University Library: New Prairie Press.

Robinson, S. , and J. Pallasmaa , eds. (2015). Mind in Architecture: Neuroscience, Embodiment, and the Future of Design. Cambridge: MIT Press.
Rock, I. (1983). The Logic of Perception. Cambridge, MA: The MIT Press.
Rock, I. , and J. Victor . (1964). “Vision and touch: An experimentally created conflict between the two senses.” Science 143, no. 3606: 594–596.
Van der Laan, H. (1977). The Architectonic Space. Fifteenth Lessons on the Human Habitat. Leiden: Brill.
Wagemans, J. , J. H. Elder , M. Kubovy , S. E. Palmer , Maary A. Peterson , M. Singh , and R. von der Heydt . (2012a). “A century of Gestalt psychology in visual perception: I. Perceptual grouping and figure–ground organization.” Psychological bulletin 138, no. 6: 1172.
Wagemans, J. , J. H. Elder , M. Kubovy , S. E. Palmer , M. A. Peterson , M. Singh , and R. von der Heydt . (2012b). “A century of Gestalt psychology in visual perception: II. Conceptual and theoretical foundations.” Psychological Bulletin 138, no. 6: 1218.
Wittkower, R. (1953). “Brunelleschi and proportion in perspective.” Journal of the Warburg and Courtauld Institutes 16, no. 3–4: 275–291.
Wittkower, R. (1960). “The changing concept of proportion.” Daedalus 89, no. 1: 119–215.
Zevi, B. (1957). “I sistemi proporzionali sconfitti a Londra.” L’architettura. Cronache e Storia 26: 508–509.
Babcock KR , Page JS , Fallon JR , Webb AE . (2021). Adult hippocampal neurogenesis in aging and Alzheimer’’s disease. Stem Cell Reports, 16(4): 681–693. doi: 10.1016/j.stem- cr.2021.01.019. Epub 2021 Feb 25. PMID: 33636114; PMCID: PMC8072031.
Burzynska A. , Malinin L. (2017). Enriched environments for healthy aging: qualities of seniors housing. Designs Promoting Brain and Cognitive Health. Senior Housing & Care Journal, 25(1): 16–27.
Cassarino M , Setti A. (2015). Environment as ‘‘Brain Training’’: A review of geographical and physical environmental influences on cognitive ageing. Ageing Research Reviews, 23(Pt B): 167–182. doi: 10.1016/j.arr.2015.06.003. Epub 2015 Jul 2. PMID: 26144974.
Elnimr, H. (2021). Interactive architecture as a therapeutic environment for people with Alzheimer’s disease, a scoping review. FormAkademisk, 14(1): 19–23.
García-Betances RI , Waldmeyer MTA , Fico G , Cabrera-Umpiérrez MF . (2015). A succinct overview of virtual reality technology use in Alzheimer’’s disease. Frontiers in Aging Neuroscience, 7: 80.
García-Constantino M , Orr C , Synnott J , Shewell C , Ennis A , Cleland I , Nugent C , Rafferty J , Morrison G , Larkham L , McIlroy S , Selby A. (2021). Design and implementation of a smart home in a box to monitor the wellbeing of residents with dementia in care homes. Frontiers in Digital Health, 3: 798889. doi: 10.3389/fdgth.2021.798889.
Gillani N , Arslan T. (2021). Intelligent sensing technologies for the diagnosis, monitoring and therapy of Alzheimer’s disease: A systematic review. Sensors (Basel), 21(12): 4249. doi: 10.3390/s21124249.
Goodall G , Ciobanu I , Taraldsen K , Sørgaard J , Marin A , Draghici R , Zamfir MV , Berteanu M , Maetzler W , Serrano JA . (2019). The use of virtual and immersive technology in creating personalized multisensory spaces for people living with dementia (SENSE-GARDEN): Protocol for a multisite before-after trial. JMIR Research Protocols, 8(9): e14096. doi: 10.2196/14096. PMID: 31538942;
Kenning G. and Treadaway C. (Jan. 2018). Designing for dementia: Iterative grief and transitional objects. Design Issues, 34(1): 42–53. doi: 10.1162/DESI_a_00475.
Liappas N , Teriús-Padrón JG , García-Betances RI , Cabrera-Umpiérrez MF . (2021). Advancing smart home awareness-a conceptual computational modelling framework for the execution of daily activities of people with Alzheimer’’s disease. Sensors (Basel), 22(1): 166. doi: 10.3390/s22010166. PMID: 35009709; PMCID: PMC8747630.
Lu X , Liu C , Shao F. (2023). Phototherapy improves cognitive function in dementia: A systematic review and meta-analysis. Brain and Behavior, 13: e2952.
Ly NT , Tscharn R , Preßler J , Huber S , Aknine S , Serna A , Hurtienne J. (2016). Smart lighting in dementia care facility. In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct (UbiComp ‘16). Association for Computing Machinery, New York, 1636–1639.
Lyons BE , Eaustin D , Eseelye A , Epetersen J , Yeargers J , Eriley T , Esharma N , Mattek NC , Ewild K , Edodge H , et al. (2015). Pervasive computing technologies to continuously assess Alzheimer’s disease progression and intervention efficacy. Frontiers in Aging Neuroscience, 7: 102. doi: 10.3389/fnagi.2015.00102
Neal D , van den Berg F, Planting C , Ettema T , Dijkstra K , Finnema E , Dröes R-M , (2021). Can use of digital technologies by people with dementia improve self-management and social participation? A systematic review of effect studies. Journal of Clinical Medicine, 10: 604.
Pappadà A , Chattat R , Chirico I , Valente M , Ottoboni G. (2021). Assistive technologies in dementia care: An updated analysis of the literature. Frontiers in Psychology, 12: 644587. doi: 10.3389/fpsyg.2021.644587. PMID: 33841281; PMCID: PMC8024695.

Tsekleves E , Keady J. (2021). Design for people living with dementia: Interactions and innovations. 10.4324/9780429442407.
White PJ , Moussavi Z. (2016). Neurocognitive treatment for a patient with Alzheimer's disease using a virtual reality navigational environment. Journal of Experimental Neuroscience, 10: 129–135. doi: 10.4137/JEN.S40827. PMID: 27840579; PMCID: PMC5102253.
Abbas, H. , Garberson, F. , Liu-Mayo, S. , Glover, E. , & Wall, D. (2020). Multi-modular AI approach to streamline autism diagnosis in young children. Scientific Reports, 10(1), 5014.
Abdeen, F. , & Albiladi, W. (202). Factors influencing the adoption of virtual reality (VR) technology among parents of individuals with ASD. Interactive Learning Environments, 32(4), 1330–1347.
Artiran, S. , Ravisankar, R. , Luo, S. , Chukoskie, L. , & Cosman, P. (2022). Measuring social modulation of gaze in autism spectrum condition with virtual reality interviews. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 30, 2373–2384.
Bailey, B. , Bryant, L. , & Hemsley, B. (2022). Virtual reality and augmented reality for children, adolescents, and adults with communication disability and neurodevelopmental disorders: A systematic review. Review Journal of Autism and Developmental Disorders, 9(2), 160–183.
Baus, O. , & Bouchard , S (2014) Moving from virtual reality exposure-based therapy to augmented reality exposure-based therapy: A review. Frontiers in Human Neuroscience, 8,112. doi: 10.3389/fnhum.2014.00112.
Cheung, S. , Kwok, L. , Shang, J. , Wang, A. , & Kwan, R. (2016). Virtual reality enabled training for social adaptation in inclusive education settings for school-aged children with autism spectrum disorder (ASD). In Blended Learning: Aligning Theory with Practices (Vol. 9757, Lecture Notes in Computer Science, pp. 94–102). Switzerland: Springer International Publishing AG.
Data & Statistic on Autism Spectrum Disorder. (2023). Centers for Disease Control and Prevention https://www.cdc.gov/autism/data-research/index.html.
DeLeyer-Tiarks, J. , Li, M. , Levine-Schmitt, M. , Andrade, B. , Bray, M. , & Peters, E. (2023). Advancing autism technology. Psychology in the Schools, 60(2), 495–506.
Erden, Y. , Hummerstone, H. , & Rainey, S. (2021). Automating autism assessment: What AI can bring to the diagnostic process. Journal of Evaluation in Clinical Practice, 27(3), 485–490.
Gaines, K. , Bourne, A. , Pearson, M. , & Kleibrink, M. (2016). Designing for Autism Spectrum Disorders. Routledge.
Genova, H. , Lancaster, K. , Morecraft, J. , Haas, M. , Edwards, A. , DiBenedetto, M. , & Smith, M. (2021). A pilot RCT of virtual reality job interview training in transition-age youth on the autism spectrum. Research in Autism Spectrum Disorders, 89, 101878.
Ide-Okochi, A. , Matsunaga, N. , & Sato, H. (2022). A preliminary study of assessing gaze, interoception and school performance among children with neurodevelopmental disorders: The feasibility of VR Classroom. Children (Basel), 9(2), 250.
Javed, H. , & Park, C. (2022). Promoting social engagement with a multi-role dancing robot for in-home autism care. Frontiers in Robotics and AI, 9, 880691
Kandalaft, M. R. , Didehbani, N. , Krawczyk, D. C. , Allen, T. T. , & Chapman, S. B. (2013). Virtual reality social cognition training for young adults with high-functioning autism. Journal of Autism and Developmental Disorders, 43(1), 34–44.
McCleery, J. , Zitter, A. , Solórzano, R. , Turnacioglu, S. , Miller, J. , Ravindran, V. , & Parish-Morris, J. (2020). Safety and feasibility of an immersive virtual reality intervention program for teaching police interaction skills to adolescents and adults with autism. Autism Research, 13(8), 1418–1424.
Nakai, N. , Sato, M. , Yamashita, O. , Sekine, Y. , Fu, X. , Nakai, J. , Zalesky, A. , & Takumi, T. (2023). Virtual reality-based real-time imaging reveals abnormal cortical dynamics during behavioral transitions in a mouse model of autism. Cell Reports, 42(4). https://doi.org/10.1016/j.celrep.2023.112258.
Neo, H. , Teo, C. , & Yeo, Q. (2021). Augmented reality emotion recognition for autism spectrum disorder children [version 1; peer review: 1 not approved]. F1000 Research, 10, 1217.
Odom, S. , Thompson, J. , Hedges, S. , Boyd, B. , Dykstra, J. , Duda, M. , & Bord, A. (2015). Technology-Aided interventions and instruction for adolescents with autism spectrum disorder. Journal of Autism and Developmental Disorders, 45(12), 3805–3819.
Panerai, S. , Catania, V. , Rundo, F. , & Ferri, R. (2018). Remote home-based virtual training of functional living skills for adolescents and young adults with intellectual disability: Feasibility and preliminary results. Frontiers in Psychology, 9, 1730.
Parsons, T. D. & Carlew, A. R. (2016). Bimodal Virtual Reality Stroop for Assessing Distractor Inhibition in Autism Spectrum Disorders. Journal of Autism and Developmental Disorders, 46, 1255–1267.
Savickaite, S. , Husselman, T. , Taylor, R. , Millington, E. , Hayashibara, E. , & Arthur, T. (2022). Applications of virtual reality (VR) in autism research: Current trends and taxonomy of definitions. Journal of Enabling Technologies, 16(2), 147–154.
Schuman, A. (2021). AI, telehealth & sensor-based technologies facilitate autism diagnosis. Contemporary Pediatrics (Montvale, N.J.), 38(10), 16–20.

Smith, M. , Ginger, E. , Wright, K. , Wright, M. , Taylor, J. , Humm, L. , Olsen, D. , Bell, M. , & Fleming, M. (2014). Virtual Reality job interview training in adults with autism spectrum disorder. Journal of Autism and Developmental Disorders, 44(10), 2450–2463
Wang, M. , & Jeon, M. (2024). Assistive technology for adults on the autism spectrum: A systematic survey. International Journal of Human–Computer Interaction, 40(10), 2433–2452.
Wang, M. , Zhang, D. , Huang, J. , Yap, P. , Shen, D. , & Liu, M. (2020). Identifying autism spectrum disorder with multi-site fmri via low-rank domain adaptation. IEEE Transactions on Medical Imaging, 39(3), 644–655.

Proportioned and Smart Architecture

Albright, T. , S. Gepshtein , and E. Macagno . (2020). “Visual neuroscience for architecture.” Architectural Design 90, no. 6: 110–117.
Alais, D. , and D. Burr . (2004). “The ventriloquist effect results from near-optimal bimodal integration.” Current Biology 14, no. 3: 257–262.
Alais, D. , F. Newell , and P. Mamassian . (2010). “Multisensory processing in review: From physiology to behaviour.” Seeing and Perceiving 23, no. 1: 3–38.
Belting, H. (2011). Florence and Baghdad, Renaissance Art and Arab Science. Cambridge: Harvard University Press.
Benedikt, M. , and S. Mcelhinney . (2019). “Isovists and the metrics of architectural space.” In Paper Presented at the 107th ACSA Annual Meeting. Articulating Architecture’s core in the Post Digital Era, Pittsburg, March 1–10.
Cimoli, A. , and F. Irace . (2007). La Divina Proporzione. Triennale 1951. Milan: Mondadori Electa.
Cimoli, A. , and F. Irace . (2013). “Triennial 1951: Post-War reconstruction and divine proportion.” Nexus Network Journal 15, no. 1: 3–14.
Clark, J. J. , and A. L. Yuille , 1990. Data Fusion for Sensory Information Processing Systems. New York: Springer Science & Business Media.
Delbeke, M. , and M. Cohen . (2018). Proportional Systems in the History of Architecture: A Critical Reconsideration. Leiden: Leiden University Press.
Eberhard, J. P. (2009). Brain Landscape: The Coexistence of Neuroscience and Architecture. Oxford: Oxford University Press.
Epstein, W. , and J. N. Park . (1963). “Shape constancy: Functional relationships and theoretical formulations.” Psychological Bulletin 60, no. 3: 265.
Ernst, M. O. , and H. H. Bülthoff . (2004). “Merging the senses into a robust percept.” Trends in Cognitive Sciences 8, no. 4: 162–169.
Gepshtein, S. (2010). “Two psychologies of perception and the prospect of their synthesis.” Philosophical Psychology 23, no. 2: 217–281.
Gepshtein, S. (2020). “Species of space.” Architectural Design 90, no. 6: 36–41.
Gepshtein, S. , and M. S. Banks . (2003). “Viewing geometry determines how vision and haptics combine in size perception.” Current Biology 13, no. 6: 483–488.
Gepshtein, S. , J. Burge , M. O. Ernst , and M. S. Banks . (2005). “The combination of vision and touch depends on spatial proximity.” Journal of Vision 5, no. 11–7: 1013–1023.
Gepshtein, S. , J. H. Elder , and L. T. Maloney . (2008). “Perceptual organization and neural computation.” Journal of Vision 8, no. 7: 1–4.
Gepshtein, S. , and J. Snider . (2019). “Neuroscience for architecture: The evolving science of perceptual meaning.” Proceedings of the National Academy of Sciences USA 116, no. 29: 14404–14406.
Gescheider, G. A. (2013). Psychophysics: The Fundamentals. London: Psychology Press.
Hillis, J. M. , S. J. Watt , M. S. Landy , and M. Banks . (2004). “Slant from texture and disparity cues: Optimal cue combination.” Journal of Vision 4, no. 12: 1–1.
Howard, I. P. (2012). Perceiving in Depth, Volume 1: Basic Mechanisms. Oxford: Oxford University Press.
Kanizsa, G. (1979). Organization in Vision: Essays on Gestalt Perception. Westport, CT: Praeger Publishers.
Kanizsa, G. , and W. Gerbino . (1976). Convexity and symmetry in figure-ground organization. In Art and Artefacts. Edited by Henle M. , 25–32. New York: Springer.
King, D. L. (1988). “Assimilation is due to one perceived whole and contrast is due to two perceived wholes.” New Ideas in Psychology 6, no. 3: 277–288.
Kingdom, F. A. A. , and N. Prins . (2016). Psychophysics. A Practical Introduction. London: Elsevier.
Koffka, K. (1935). Principles of Gestalt Psychology. New York: Harcourt, Brace, & World.
Kubovy, M. (1986). The Psychology of Perspective and Renaissance art. Cambridge: Cambridge University Press.

Kubovy, M. (1994). “The perceptual organization of dot lattices.” Psychonomic Bulletin & Review 1, no. 2: 182–190.
Kubovy, M. , and S. Gepshtein . (2003). Perceptual grouping in space and in space-time: An exercise in phenomenological psychophysics. In Perceptual Organization in Vision: Behavioral and Neural Perspectives, Edited by Kimchi, Ruth , Marlene Behrmann , and Carl R. Olson , 45–85. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
Kubovy, M. , and J. R. Pomerantz , eds. (1981). Perceptual Organization. Hillsdale, NJ: Erlbaum.
Kubovy, M. , and M. Van Den Berg . (2008). “The whole is equal to the sum of its parts: A probabilistic model of grouping by proximity and similarity in regular patterns.” Psychological Review 115, no. 1: 131–154.
Landy, M. S. , L. T. Maloney , E. B. Johnston , and M. Young . (1995). “Measurement and modeling of depth cue combination: In defense of weak fusion.” Vision Research 35, no. 3: 389–412.
Mallgrave, H. F. (2010). The Architect’s Brain: Neuroscience, Creativity, and Architecture. New York: John Wiley & Sons.
Maloney, L. T. , and M. S. Landy . (1989). A statistical framework for robust fusion of depth information. In Visual Communications and Image Processing IV. Vol. 1199, 1154–1163. Philadelphia: Society of Photo-Optical Instrumentation Engineers (SPIE).
Padovan, R. (1999). Proportion. Science, Philosophy, Architecture. London and New York: Taylor & Francis Routledge.
Panofsky, E. (1991). Perspective as Symbolic Form (1927). New York: Zone Books.
Perdreau, F. , and P. Cavanagh . (2013). “Is artists’ perception more veridical?.” Frontiers in Neuroscience 7: 6.
Pirenne, M. H. (1970). Optics, Painting & Photography. Cambridge: Cambridge University Press.
Proietti, T. (2015). Ordine e Proporzione. Dom Hans van der Laan e L’espressività Dello Spazio Architettonico. Macerata: Quodlibet.
Proietti, T. (2021). “Revisiting the plastic number theory from the perspective of perceptual psychology.” Architectural Science Review 64, no. 4: 346–358.
Proietti, T. , and S. Gepshtein . (2022a). “Architectural proportion from an empirical standpoint.” Journal of Interior Design 47, no. 1: 11–29.
Proietti, T. , and S. Gepshtein . (2022b). Locating architectural atmosphere. In Generators of Architectural Atmospheres, Edited by Canepa Elisabetta , 95–110. Kansas State University Library: New Prairie Press.
Robinson, S. , and J. Pallasmaa , eds. (2015). Mind in Architecture: Neuroscience, Embodiment, and the Future of Design. Cambridge: MIT Press.
Rock, I. (1983). The Logic of Perception. Cambridge, MA: The MIT Press.
Rock, I. , and J. Victor . (1964). “Vision and touch: An experimentally created conflict between the two senses.” Science 143, no. 3606: 594–596.
Van der Laan, H. (1977). The Architectonic Space. Fifteenth Lessons on the Human Habitat. Leiden: Brill.
Wagemans, J. , J. H. Elder , M. Kubovy , S. E. Palmer , Maary A. Peterson , M. Singh , and R. von der Heydt . (2012a). “A century of Gestalt psychology in visual perception: I. Perceptual grouping and figure–ground organization.” Psychological bulletin 138, no. 6: 1172.
Wagemans, J. , J. H. Elder , M. Kubovy , S. E. Palmer , M. A. Peterson , M. Singh , and R. von der Heydt . (2012b). “A century of Gestalt psychology in visual perception: II. Conceptual and theoretical foundations.” Psychological Bulletin 138, no. 6: 1218.
Wittkower, R. (1953). “Brunelleschi and proportion in perspective.” Journal of the Warburg and Courtauld Institutes 16, no. 3–4: 275–291.
Wittkower, R. (1960). “The changing concept of proportion.” Daedalus 89, no. 1: 119–215.
Zevi, B. (1957). “I sistemi proporzionali sconfitti a Londra.” L’architettura. Cronache e Storia 26: 508–509.

Smart Home Design for People with Dementia

Babcock KR , Page JS , Fallon JR , Webb AE . (2021). Adult hippocampal neurogenesis in aging and Alzheimer’’s disease. Stem Cell Reports, 16(4): 681–693. doi: 10.1016/j.stem- cr.2021.01.019. Epub 2021 Feb 25. PMID: 33636114; PMCID: PMC8072031.
Burzynska A. , Malinin L. (2017). Enriched environments for healthy aging: qualities of seniors housing. Designs Promoting Brain and Cognitive Health. Senior Housing & Care Journal, 25(1): 16–27.
Cassarino M , Setti A. (2015). Environment as ‘‘Brain Training’’: A review of geographical and physical environmental influences on cognitive ageing. Ageing Research Reviews, 23(Pt B): 167–182. doi: 10.1016/j.arr.2015.06.003. Epub 2015 Jul 2. PMID: 26144974.

Elnimr, H. (2021). Interactive architecture as a therapeutic environment for people with Alzheimer’s disease, a scoping review. FormAkademisk, 14(1): 19–23.
García-Betances RI , Waldmeyer MTA , Fico G , Cabrera-Umpiérrez MF . (2015). A succinct overview of virtual reality technology use in Alzheimer’’s disease. Frontiers in Aging Neuroscience, 7: 80.
García-Constantino M , Orr C , Synnott J , Shewell C , Ennis A , Cleland I , Nugent C , Rafferty J , Morrison G , Larkham L , McIlroy S , Selby A. (2021). Design and implementation of a smart home in a box to monitor the wellbeing of residents with dementia in care homes. Frontiers in Digital Health, 3: 798889. doi: 10.3389/fdgth.2021.798889.
Gillani N , Arslan T. (2021). Intelligent sensing technologies for the diagnosis, monitoring and therapy of Alzheimer’s disease: A systematic review. Sensors (Basel), 21(12): 4249. doi: 10.3390/s21124249.
Goodall G , Ciobanu I , Taraldsen K , Sørgaard J , Marin A , Draghici R , Zamfir MV , Berteanu M , Maetzler W , Serrano JA . (2019). The use of virtual and immersive technology in creating personalized multisensory spaces for people living with dementia (SENSE-GARDEN): Protocol for a multisite before-after trial. JMIR Research Protocols, 8(9): e14096. doi: 10.2196/14096. PMID: 31538942;
Kenning G. and Treadaway C. (Jan. 2018). Designing for dementia: Iterative grief and transitional objects. Design Issues, 34(1): 42–53. doi: 10.1162/DESI_a_00475.
Liappas N , Teriús-Padrón JG , García-Betances RI , Cabrera-Umpiérrez MF . (2021). Advancing smart home awareness-a conceptual computational modelling framework for the execution of daily activities of people with Alzheimer’’s disease. Sensors (Basel), 22(1): 166. doi: 10.3390/s22010166. PMID: 35009709; PMCID: PMC8747630.
Lu X , Liu C , Shao F. (2023). Phototherapy improves cognitive function in dementia: A systematic review and meta-analysis. Brain and Behavior, 13: e2952.
Ly NT , Tscharn R , Preßler J , Huber S , Aknine S , Serna A , Hurtienne J. (2016). Smart lighting in dementia care facility. In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct (UbiComp ‘16). Association for Computing Machinery, New York, 1636–1639.
Lyons BE , Eaustin D , Eseelye A , Epetersen J , Yeargers J , Eriley T , Esharma N , Mattek NC , Ewild K , Edodge H , et al. (2015). Pervasive computing technologies to continuously assess Alzheimer’s disease progression and intervention efficacy. Frontiers in Aging Neuroscience, 7: 102. doi: 10.3389/fnagi.2015.00102
Neal D , van den Berg F, Planting C , Ettema T , Dijkstra K , Finnema E , Dröes R-M , (2021). Can use of digital technologies by people with dementia improve self-management and social participation? A systematic review of effect studies. Journal of Clinical Medicine, 10: 604.
Pappadà A , Chattat R , Chirico I , Valente M , Ottoboni G. (2021). Assistive technologies in dementia care: An updated analysis of the literature. Frontiers in Psychology, 12: 644587. doi: 10.3389/fpsyg.2021.644587. PMID: 33841281; PMCID: PMC8024695.
Tsekleves E , Keady J. (2021). Design for people living with dementia: Interactions and innovations. 10.4324/9780429442407.
White PJ , Moussavi Z. (2016). Neurocognitive treatment for a patient with Alzheimer’s disease using a virtual reality navigational environment. Journal of Experimental Neuroscience, 10: 129–135. doi: 10.4137/JEN.S40827. PMID: 27840579; PMCID: PMC5102253.

Smart Design and AI for Developmental Disabilities

Abbas, H. , Garberson, F. , Liu-Mayo, S. , Glover, E. , & Wall, D. (2020). Multi-modular AI approach to streamline autism diagnosis in young children. Scientific Reports, 10(1), 5014.
Abdeen, F. , & Albiladi, W. (202). Factors influencing the adoption of virtual reality (VR) technology among parents of individuals with ASD. Interactive Learning Environments, 32(4), 1330–1347.
Artiran, S. , Ravisankar, R. , Luo, S. , Chukoskie, L. , & Cosman, P. (2022). Measuring social modulation of gaze in autism spectrum condition with virtual reality interviews. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 30, 2373–2384.
Bailey, B. , Bryant, L. , & Hemsley, B. (2022). Virtual reality and augmented reality for children, adolescents, and adults with communication disability and neurodevelopmental disorders: A systematic review. Review Journal of Autism and Developmental Disorders, 9(2), 160–183.
Baus, O. , & Bouchard , S (2014) Moving from virtual reality exposure-based therapy to augmented reality exposure-based therapy: A review. Frontiers in Human Neuroscience, 8,112. doi: 10.3389/fnhum.2014.00112.
Cheung, S. , Kwok, L. , Shang, J. , Wang, A. , & Kwan, R. (2016). Virtual reality enabled training for social adaptation in inclusive education settings for school-aged children with autism spectrum disorder (ASD). In

Blended Learning: Aligning Theory with Practices (Vol. 9757, Lecture Notes in Computer Science, pp. 94–102). Switzerland: Springer International Publishing AG.
Data & Statistic on Autism Spectrum Disorder. (2023). Centers for Disease Control and Prevention https://www.cdc.gov/autism/data-research/index.html.
DeLeyer-Tiarks, J. , Li, M. , Levine-Schmitt, M. , Andrade, B. , Bray, M. , & Peters, E. (2023). Advancing autism technology. Psychology in the Schools, 60(2), 495–506.
Erden, Y. , Hummerstone, H. , & Rainey, S. (2021). Automating autism assessment: What AI can bring to the diagnostic process. Journal of Evaluation in Clinical Practice, 27(3), 485–490.
Gaines, K. , Bourne, A. , Pearson, M. , & Kleibrink, M. (2016). Designing for Autism Spectrum Disorders. Routledge.
Genova, H. , Lancaster, K. , Morecraft, J. , Haas, M. , Edwards, A. , DiBenedetto, M. , & Smith, M. (2021). A pilot RCT of virtual reality job interview training in transition-age youth on the autism spectrum. Research in Autism Spectrum Disorders, 89, 101878.
Ide-Okochi, A. , Matsunaga, N. , & Sato, H. (2022). A preliminary study of assessing gaze, interoception and school performance among children with neurodevelopmental disorders: The feasibility of VR Classroom. Children (Basel), 9(2), 250.
Javed, H. , & Park, C. (2022). Promoting social engagement with a multi-role dancing robot for in-home autism care. Frontiers in Robotics and AI, 9, 880691
Kandalaft, M. R. , Didehbani, N. , Krawczyk, D. C. , Allen, T. T. , & Chapman, S. B. (2013). Virtual reality social cognition training for young adults with high-functioning autism. Journal of Autism and Developmental Disorders, 43(1), 34–44.
McCleery, J. , Zitter, A. , Solórzano, R. , Turnacioglu, S. , Miller, J. , Ravindran, V. , & Parish-Morris, J. (2020). Safety and feasibility of an immersive virtual reality intervention program for teaching police interaction skills to adolescents and adults with autism. Autism Research, 13(8), 1418–1424.
Nakai, N. , Sato, M. , Yamashita, O. , Sekine, Y. , Fu, X. , Nakai, J. , Zalesky, A. , & Takumi, T. (2023). Virtual reality-based real-time imaging reveals abnormal cortical dynamics during behavioral transitions in a mouse model of autism. Cell Reports, 42(4). https://doi.org/10.1016/j.celrep.2023.112258.
Neo, H. , Teo, C. , & Yeo, Q. (2021). Augmented reality emotion recognition for autism spectrum disorder children [version 1; peer review: 1 not approved]. F1000 Research, 10, 1217.
Odom, S. , Thompson, J. , Hedges, S. , Boyd, B. , Dykstra, J. , Duda, M. , & Bord, A. (2015). Technology-Aided interventions and instruction for adolescents with autism spectrum disorder. Journal of Autism and Developmental Disorders, 45(12), 3805–3819.
Panerai, S. , Catania, V. , Rundo, F. , & Ferri, R. (2018). Remote home-based virtual training of functional living skills for adolescents and young adults with intellectual disability: Feasibility and preliminary results. Frontiers in Psychology, 9, 1730.
Parsons, T. D. & Carlew, A. R. (2016). Bimodal Virtual Reality Stroop for Assessing Distractor Inhibition in Autism Spectrum Disorders. Journal of Autism and Developmental Disorders, 46, 1255–1267.
Savickaite, S. , Husselman, T. , Taylor, R. , Millington, E. , Hayashibara, E. , & Arthur, T. (2022). Applications of virtual reality (VR) in autism research: Current trends and taxonomy of definitions. Journal of Enabling Technologies, 16(2), 147–154.
Schuman, A. (2021). AI, telehealth & sensor-based technologies facilitate autism diagnosis. Contemporary Pediatrics (Montvale, N.J.), 38(10), 16–20.
Smith, M. , Ginger, E. , Wright, K. , Wright, M. , Taylor, J. , Humm, L. , Olsen, D. , Bell, M. , & Fleming, M. (2014). Virtual Reality job interview training in adults with autism spectrum disorder. Journal of Autism and Developmental Disorders, 44(10), 2450–2463
Wang, M. , & Jeon, M. (2024). Assistive technology for adults on the autism spectrum: A systematic survey. International Journal of Human–Computer Interaction, 40(10), 2433–2452.
Wang, M. , Zhang, D. , Huang, J. , Yap, P. , Shen, D. , & Liu, M. (2020). Identifying autism spectrum disorder with multi-site fmri via low-rank domain adaptation. IEEE Transactions on Medical Imaging, 39(3), 644–655.

On Science of the Materials for the Built Environments – The Role of Biomimetics/Biomimicry and Development of Strength and Promoting Natural Forms and Functionality Inspired by Nature

Barnsley, M. (2014). Fractals Everywhere, Academic Press.
Blanciak, F. (2008). Siteless, 1001 Building Forms, MIT Press
Burry, J. (2020). Fabricate, Riverside Architectural Press.

Deleuze, G. (2003). The Fold. Leibniz and the Baroque, Continuum London.
Foster, H. (2002). The Anti-Aesthetic: Essays on Postmodern Culture, The New Press.
Frampton, K. (2011). Rappel à Ordre: The case for the Tectonic, Chronicle Books.
Gissen, D. (2009). Subnature: Architecture's other Environments, Princeton Architectural Press.
Gramazio, F. (2008). Digital Materiality in Architecture, Lars Müller Publishers Zürich.
Grant, P. (2017). Ecology and Evolution, Princeton University Press.
Hegger, M. (2012). Heat | Cool: Energy Concepts, Birkhäuser.
Jacobs, J. (2005). Dark Age Ahead, Vintage.
Leach, N. (2014). Swarm Tectonics, Digital Tectonics, Wiley.
Manzini, E. (1989). The Material of Invention, MIT Press.
Nesbit, K. (1996). Theorizing a New Agenda for Architecture, Chronicle Books.
Orr, D. (2002). The Nature of Design: Ecology, Culture and Human Intention, Oxford University Press.
Pallasmaa, J. (2007). The Eyes of the Skin: Architecture and the Senses, Wiley.
Pawley, M. (1990). Theory and Design in the Second Machine Age, Blackwell.
Pawlyn, M. (2016). Biomimicry in Architecture, RIBA Publishing.
Schwartz, C. (2017). Introducing Architectural Tectonics, Exploring the Intersection of Design and Construction, Routledge.
Semper, G. (1851–1989). The Four Elements of Architecture and other Writings, New York, Cambridge.
Sennet, R. (2018). Building and Dwelling: Ethics for the City, Farrar, Straus and Giroux.
Sequin, P. (2007). Jean Prouvé, Sonnabend & Sequin NY.
Silk, G. (1984). Automobile and Culture, Harry N. Abrams, NY.
Spiller, N. (2018). Celebrating the Marvellous: Surrealism in Architecture, Wiley.
Sulzer, P. (1991). Jean Prouvé, Meister der Metallumformung: Das Neue Blech, Rudolf Mueller.
Thomsen, M. (2024). Design for Rethinking Resources, Sustainable Development Goal Series, Springer.
Von Meiss, P. (2004). Elements of Architecture: From Form to Place, Routledge.
Von Vegesack, A. (2004). The Poetics of the Technical Object, Vitra Design Museum.
Waldrop, M. (1992). Complexity: The Emerging Science at the Edge of Order and Chaos, Simon and Schuster.
Zumthor, P. (2010). Thinking Architecture (3rd ed.), Birkhaeuser.

Smart Ways to Enclose Buildings

Abo-El-Enein, S. A. , Ali, A. H. , Talkhan, F. N. , & Abdel-Gawwad, H. A. (2013). Application of microbial biocementation to improve the physico-mechanical properties of cement mortar. HBRC Journal, 9(1), 36–40.
Achal, V. , Mukherjee, A. , & Zhang, Q. (2016). Unearthing ecological wisdom from natural habitats and its ramifications on development of biocement and sustainable cities. Landscape and Urban Planning, 155, 61–68.
De Belie, N. , & De Muynck W. (2008, November). Crack repair in concrete using biodeposition. In Proceedings of the international conference on concrete repair, rehabilitation and retrofitting (ICCRRR), Cape Town, South Africa (pp. 291–292).
Dezeen . (July 16, 2021). Drive to reduce embodied carbon in buildings makes biomaterials market a "really exciting space". Interview with Jan Wurm, Arup research and innovation. https://www.dezeen.com/2021/07/16/carbon-drive-reduce-embodied-carbon-buildings-biomaterials-jan-wurms/
Farahbakhsh, M. , Rybkowski, Z. K. , Zakira, U. , Kalantar, N. , & Onifade, I. (2022). Impact of robotic 3D printing process parameters on interlayer bond strength. Automation in Construction, 142, 104478.
Farahbakhsh, M. , Kalantar, N. , & Rybkowski, Z. (2021). Impact of Robotic 3D Printing Process Parameters on Bond Strength: A Systematic Analysis Using Clay-Based Materials. In Proceedings of the ACADIA 2020 Conference (pp. 594–603).
Lehne, J. , & Preston, F. (2018, June 13). Making concrete change: Innovation in low-carbon cement and concrete | chatham house - international affairs think tank. Chatham House. https://www.chathamhouse.org/2018/06/making-concrete-change-innovation-low-carbon-cement-and-concrete
Moulton, D. , Goriely, A. & Chirat, R. (2018). Spirals, Spines, and Ridges: The Mathematical Story of Seashells. Scientific American, April 2018.
Rong, H. , & Qian, C. X. (2012). Development of microbe cementitious material in China. Journal of Shanghai Jiaotong University (Science), 17, 350–355.

Su, Y. , Liu, C. , Fang, H. , & Zhang, D. (2020). Bacillus subtitles: a universal cell factory for industry agriculture biomaterials and medicine. Microbial Cell Factories, 19, 173.
Westers, L. , Westers, H. , & Quax, W. J. (2004). Bacillus subtilis as cell factory for pharmaceutical proteins: a biotechnological approach to optimize the host organism. Biochim Biophys Acta, 1694, 299–310.
Wiktor, V. , Thijssen, A. , & Jonkers, H. M. (2012). Development of a liquid bio-based repair system for aged concrete structures. In Concrete Repair, Rehabilitation and Retrofitting III. Alexander et al. (eds), pp. 345–346.
Zweers, J. C. , Barak, I. , Becher, D. , Driessen, A. J. , Hecker, M. , Kontinen, V. P. , Saller, M. J. , Vavrova, L. , van Dijl, J. M. (2008). Towards the development of Bacillus subtilis as a cell factory for membrane proteins and protein complexes. Microbial Cell Fact, 7, 10.

Smart Materials as Architectured Porous and Hybrid Systems to Produce Performative Building Components

Ahlquist, S. , & Menges, A. (2013). Frameworks for Computational Design of Textile Micro-Architectures and Material Behavior in Forming Complex Force-Active Structures. https://doi.org/10.52842/conf.acadia.2013.281.
Ashby, M. , & Bréchet, Y. (2003). Designing hybrid materials. Acta Materialia, 51(19), 5801–5821.
Azulay, R. , Combescure, C. , & Dirrenberger, J. (2023). Instability-induced pattern generation in architectured materials—A review of methods. International Journal of Solids and Structures, 274, 112240.
Bao, D. W. , & Yan, X. (2024). Data-driven performance-based generative design and digital fabrication for Industry 4.0: Precedent work, current progress, and future prospects. In: Barberio, M. , Colella, M. , Figliola, A. , Battisti, A. (eds), Architecture and Design for Industry 4.0. Lecture Notes in Mechanical Engineering. Cham: Springer. https://doi.org/10.1007/978-3-031-36922-3_46
Bao, D.W. , Yan, X. , Snooks, R. , & Xie , Y.M. (2020). Bioinspired generative architectural design form-finding and advanced robotic fabrication based on structural performance. In: Yuan, P. , Xie, Y.M. , Leach, N. , Yao, J. , & Wang, X. (eds.), Architectural Intelligence. Singapore: Springer.
Bao, D. W. , Yan, X. , & Xie, Y. M. (2022). Encoding topological optimisation logical structure rules into multi-agent system for architectural design and robotic fabrication. International Journal of Architectural Computing, 20(1), 7–17.
Barthelat, F. (2015). Architectured materials in engineering and biology: Fabrication, structure, mechanics and performance. International Materials Reviews, 60(8), 413–430.
Bilotti, J. , Norman, B. , Liu, J. , Rosenwasser, D. , & Sabin, J. (2018). Robosense 2.0 Robotic Sensing and Architectural Ceramic Fabrication. In Proceedings of the 38th Annual Conference of the Association for Computer Aided Design in Architecture (ACADIA), Mexico City, Mexico, pp. 18-20. 2018. https://doi.org/10.52842/conf.acadia.2018.276
Bouaziz, O. , Bréchet, Y. , & Embury, J. (2008). Heterogeneous and architectured materials: A possible strategy for design of structural materials. Advanced Engineering Materials, 10(1–2), 24–36.
Burry, J. , Felicetti, P. , Tang, J. , Burry, M. , Xie, Y. M. (2005). Dynamical structural modeling: A collaborative design exploration. International Journal of Architectural Computing, 3(1), 27–42. https://doi.org/10.1260/1478077053739595.
Estrin, Y. , Bréchet, Y. , Dunlop, J. , & Fratzl, P. (2019). Architectured Materials in Nature and Engineering. Cham, Switzerland: Springer Nature Switzerland AG.
Feng, Z. , Gu, P. , Zheng, M. , Yan, X. , & Bao, D. W. (2022). Environmental data-driven performance-based topological optimisation for morphology evolution of artificial Taihu stone. In: Yuan, P.F. , Chai, H. , Yan, C. , & Leach, N. (eds.), Proceedings of the 2021 Digital Futures. CDRF 2021. Singapore: Springer. https://doi.org/10.1007/978-981-16-5983-6_11.
Huang, X. , & Xie, Y. M. (2010). Evolutionary Topology Optimization of Continuum Structures: Methods and Applications. Chichester: Wiley. https://doi.org/10.1002/9780470689486
Jonkers, H. , Thijssen, A. , Muyzer, G. , Copuroglu, O. , & Schlangen, E. (2010). Application of bacteria as self-healing agent for the development of sustainable concrete. Ecological Engineering, 36, 230–235. https://doi.org/10.1016/j.ecoleng.2008.12.036.
Lewis, W.J. (2003). Tension Structures: Form and Behavior. London: Thomas Telford Publishing.
Li, C. , Bao, D. W. , Yan, X. , Wu, R. , & He, C. (2023). RE-WEATHERING: A nature-inspired experimental method for re-generating porous architectural systems based on environmentally data-driven performance. In: Immanuel Koh , Dagmar Reinhardt , Mohammed Makki , Mona Khakhar , Nic Bao (eds.), HUMAN-CENTRIC - Proceedings of the 28th CAADRIA Conference, Ahmedabad, 18-24 March 2023, pp. 271–280. https://doi.org/10.52842/conf.caadria.2023.1.271

Lu, H. , Lee, T. , Ma, J. , Chen, D. , & Xie, Y. (2023). Designing 2D stochastic porous structures using topology optimisation. Composite Structures, 321, 117305. https://doi.org/10.1016/j.compstruct.2023.117305.

Mehan, A. , & Mostafavi, S. (2022). Building resilient communities over time. In Building Resilient Communities Over Time (pp. 1–4). Springer International Publishing. https://doi.org/10.1007/978-3-030-51812-7_322-1

Mohamed, H. , Bao, D. W. , & Snooks, R. (2021). Super Composite: Carbon Fibre Infused 3D Printed Tectonics. pp. 297–308. In: Yuan, P.F. , Yao, J. , Yan, C. , Wang, X. , Leach, N. (eds), Proceedings of the 2020 DigitalFUTURES. CDRF 2020. Singapore: Springer. https://doi.org/10.1007/978-981-33-4400-6_28

Morales-Beltran, M. , & Mostafavi, S. (2022). Topology optimization in architectural design a technique for obtaining discrete structures from continuum typologies. In Pak, B. , Wurzer, G. , & Stouffs, R. (eds.), eCAADe 2022- Co-creating the Future: Inclusion in and Through Design (pp. 589–598). (Proceedings of the International Conference on Education and Research in Computer Aided Architectural Design in Europe).

Mostafavi, S. (2021). Hybrid intelligence in architectural robotic materialization (HI-ARM): Computational, fabrication and material intelligence for multi-mode robotic production of multi-scale and multi-material systems. A+BE | Architecture and the Built Environment, 11(12), 1–266. https://doi.org/10.7480/abe.2021.12.5799

Mostafavi, S. , & Anton, A. (2018). Materially informed robotic fabrication: Architectural robotics and multi-scalar material architecture. In Daas, M. , & Wit, A. J. (eds.), Towards a Robotic Architecture (pp. 88–99). ORO Editions.

Mostafavi, S. , & Bier, H. (2016). Materially informed design to robotic production: A robotic 3D printing system for informed material deposition. In: Reinhardt, D. , Saunders, R. , & Burry, J. (eds.), Robotic Fabrication in Architecture, Art and Design 2016. Cham: Springer. https://doi-org.lib-e2.lib.ttu.edu/10.1007/978-3-319-26378-6_27.

Mostafavi, S. , Bier, H. , Bodea, S. , & Antón, A.M. (2015). Informed design to robotic production systems - developing robotic 3d printing system for informed material deposition. In Martens, B , Wurzer, G. , Grasl, T. , Lorenz, W.E. & Schaffranek, R. (eds.), Real Time - Proceedings of the 33rd International Conference on Education and Research in Computer Aided Architectural Design in Europe (eCAADe) [Volume 2]. Vienna University of Technology, Vienna, Austria, https://doi.org/10.52842/conf.ecaade.2015.2.287

Mostafavi, S. , Kemper, B. , & Du, C. (2019). Materializing hybridity in architecture: Design to robotic production of multi-materiality in multiple scales. Architectural Science Review, 62(5), 424–437.

Rosenwasser, D. , Mantell, S. , & Sabin, J. (2017). Clay Non-Wovens: Robotic Fabrication and Digital Ceramics. ACADIA 2017: DISCIPLINES & DISRUPTION [Proceedings of the 37th Annual Conference of the Association for Computer Aided Design in Architecture (ACADIA). ISBN 978-0-692-96506-1] Cambridge, MA 2-4 November 2017, pp. 502–511. https://doi.org/10.52842/conf.acadia.2017.502

Schröpfer, T. , & Carpenter, J. (2011). Material Design: Informing Architecture by Materiality. Berlin, Boston: Birkhäuser, 2011. https://doi.org/10.1515/9783034611664

Snooks, R. (2021). Behavioral formation: Volatile design processes and the emergence of a strange specificity. New York: Actar Publishers. https://trove.nla.gov.au/work/227465948?keyword=9781940291925

Snooks, R. (2022). Behavioral tectonics: agentBody prototypes and the compression of tectonics. Architectural Intelligence. https://doi.org/10.1007/s44223-022-00007-8

Xie, Y. M. (2022). Generalized topology optimization for architectural design. ARIN 1, 2. https://doi.org/10.1007/s44223-022-00003-y.

Xie, Y. M. , & Steven, G. P. (1997). Evolutionary Structural Optimization. London: Springer. https://doi.org/10.1007/978-1-4471-0985-3.

Yan, X. , Bao, D. W. , Cai, K. , Fang, Y. , & Xie, Y. M. (2019). A new form-finding method for shell structures based on BESO algorithm. In: Proceedings of International Association for Shell and Spatial Structures (IASS) Annual Symposia, IASS 2019 Barcelona Symposium: Form-finding and Optimization, pp. 1–8. https://www.ingentaconnect.com/content/iass/piass/2019/00002019/00000017/art00012

Yan, X. , Bao, D. W. , Xiong, Y. , Snooks, R. , & Xie, Y. M. (2023). Structural topology optimisation based on a multi-agent model. Engineering Structures, 296, 116978.

Yeo, S. , Oh, M. , & Yoo, P. (2019). Structurally controlled cellular architectures for high performance ultra-lightweight materials. Advanced Materials (Weinheim), 31(34), E1803670-N/a.

Al-Ketan, O. , Rezgui, R. , Rowshan, R. , Du, H. , Fang, N. X. , & Al-Rub ., R. K. (2018). Microarchitected stretching-dominated mechanical metamaterials with minimal surface topologies. Advanced Engineering Materials, 20(9), 1800029.
Alkus . (2014). Housing Complex in Helsinki: Light and Airy Precast Façade for Finnish Residential Complex. Retrieved from Alkus Innovative Systems: https://www.alkus.com/en/references/housing-complex-in-helsinki on 30th November 2023.
Ambu, R. , & Morabito, A. E. (2018). Porous scaffold design based on minimal surfaces: Development and assessment of variable architectures. Symmetry, 10(9), 361.
Barnsley, M. F. (2014). Fractals Everywhere. Cambridge: Academic Presss.
Breseghello, L. , & Naboni, R. (2022). Toolpath-based design for 3D concrete printing of carbon-efficient architectural structures. Additive Manufacturing, 56, 102872.
Cannon, J. , Floyd, W. , & Parry, W. (2001). Finite subdivision rules. Conformal Geometry and Dynamics of the American Mathematical Society, 5(8), 153–196.
Chatterjee, T. , Chakraborty, S. , Goswami, S. , Adhikari, S. , & Friswell, M. I. (2021). Robust topological designs for extreme metamaterial micro-structures. Scientific Reports, 11(1), 15221.
Deng, J. , Yan, J. , & Cheng, G. (2017). Multi-objective concurrent topology optimization of thermoelastic structures composed of homogeneous porous material. Structural and Multidisciplinary Optimization, 47, 583–597.
Feng, J. , Fu, J. , Lin, Z. , Shang, C. , & Li, B. (2018). A review of the design methods of complex topology structures for 3D printing. Isual Computing for Industry, Biomedicine, and Art, 1(1), 1–16.
Hansmeyer, M. (2017). Digital Grotesque II. Retrieved from Michael Hansmeyer, Computational Architecture. https://www.michael-hansmeyer.com/digital-grotesque-II
Hansmeyer, M. , & Dillenburger, B. (2013). Digital grotesque: Towards a micro-tectonic architecture. SAJ-Serbian Architectural Journal, 5(2), 194–201.
Helou, M. , & Kara, S. (2018). Design, analysis and manufacturing of lattice structures: An overview. International Journal of Computer Integrated Manufacturing, 31(3), 243–261.
Hutchinson, J. E. (1981). Fractals and self-similarity. Indiana University Mathematics Journal, 30(5), 713–747.
Jipa, A. , Barentin, C. C. , Lydon, G. , Rippmann, M. , Chousou, G. , Lomaglio, M. , … Dillenburger, B. (2019). 3D-printed formwork for integrated funicular concrete slabs. Proceedings of IASS Annual Symposia, 2019(6), 1–8. International Association for Shell and Spatial Structures (IASS).
Kearsley, E. P. , & Wainwright, P. J. (2002). The effect of porosity on the strength of foamed concrete. Cement and Concrete Research, 32(2), 233–239.
Kim, J.-E. , & Park, K. (2021). Multiscale topology optimization combining density-based optimization and lattice enhancement for additive manufacturing. International Journal of Precision Engineering and Manufacturing-Green Technology, 8, 1197–1208.
Kudless, A. (2012). Matsys. Retrieved from https://www.matsys.design/scin-cube on 30th November 2023.
Lo, T. Y. , & Cui, H. Z. (2004). Effect of porous lightweight aggregate on strength of concrete. Materials Letters, 58(6), 916–919.
Lu, L. , Sharf, A. , Zhao, H. , Wei, Y. , Fan, Q. , Chen, X. , … Chen, B. (2014). Build-to-last: Strength to weight 3D printed objects. ACM Transactions on Graphics (ToG), 33(4), 1–10.
Mahmoud, D. , & Elbestawi, M. A. (2017). Lattice structures and functionally graded materials applications in additive manufacturing of orthopedic implants: A review. Journal of Manufacturing and Materials Processing, 1(2), 13.
Mandelbrot, B. B. (1982). The Fractal Geometry of Nature (Vol. 1 ed.). New York: WH Freeman.
Maskery, I. , Aboulkhair, N. T. , Aremu, A. O. , Tuck, C. J. , & Ashcroft, I. A. (2017). Compressive failure modes and energy absorption in additively manufactured double gyroid lattices. Additive Manufacturing, 16, 24–29.
McDowell, D. L. , Panchal, J. , Choi, H.-J. , Seepersad, C. , Allen, J. , & Mistree, F. (2009). Integrated Design of Multiscale, Multifunctional Materials and Products. Butterworth-Heinemann, Oxford.
Meza, L. R. , Das, S. , & Greer, J. R. (2014). Strong, lightweight, and recoverable three-dimensional ceramic nanolattices. Science, 345(6202), 1322–1326.
Montazerian, H. , Davoodi, E. , Asadi-Eydivand, M. , Kadkhodapour, J. , & Solati-Hashjin, M. (2017). Porous scaffold internal architecture design based on minimal surfaces: A compromise between permeability and elastic properties. Materials & Design, 126, 98–114.
Murr, L. E. (2018). A metallographic review of 3D printing/additive manufacturing of metal and alloy products and components. Metallography, Microstructure, and Analysis, 7, 103–132.
Naboni, R. , Breseghello, L. , & Sanin, S. (2022). Environment-aware 3D concrete printing through robot-vision. In 40th Conference on Education and Research in Computer Aided Architectural Design in Europe, eCAADe 2022, (pp. 409–418). Ghent, Belgium.

Noack, K. , Eichenauer, F. M. , & Lordick, D. (2019). Optimization of voids in concrete ceilings: A geometrical approach. FME Transactions, 47(2), 245–252.
Petroff, M. , Appel, J. , Rostem, K. , Bennett, C. L. , Eimer, J. , Marriage, T. , Ramirez, J. , & Wollack, E. J. (2019). A 3D-printed broadband millimeter wave absorber. Review of Scientific Instruments, 90(2), 1–6.
Prusinkiewicz, P. , & Lindenmayer, A. (2012). The Algorithmic Beauty of Plants. New York: Springer Science & Business Media.
Rayneau-Kirkhope, D. , Mao, Y. , & Farr, R. (2012). Ultralight fractal structures from hollow tubes. Physical Review Letters, 109(20), 204301.
Rian, I. M. (2019). IFS-based computational morphogenesis of a hierarchical trussed beam. CAAD Futures 2019: "Hello, Culture" (pp. 1010–1022). Daejon, South Korea: KAIST.
Rian, I. M. , & Ibrahim, A. (2022). Fractal-based perforation morphology and structural optimization of perforated steel beams. In IASS 2022 Symposium affiliated with APCS 2022 conference Innovation·Sustainability·Legacy. Beijing, China. pp. 2374–2381.
Rodrigues, H. , Guedes, J. M. , & Bendsoe, M. P. (2002). Hierarchical optimization of material and structure. Structural and Multidisciplinary Optimization, 24, 1–10.
Sapoval, B. , & Filoche, M. (2009, 03 25). The Fractal® acoustic barrier (Research Article). Retrieved from Institute for Pure & Applied Mathematics (IPAM) https://www.ipam.ucla.edu/research-articles/fractal-acoustic-barrier/ on 30th November 2023.
Sapoval, B. , Haeberlé, O. , & Russ, S. (1997). Acoustical properties of irregular and fractal cavities. The Journal of the Acoustical Society of America, 102(4), 2014–2019.
Sivapuram, R. , Dunning, P. , & Kim, H. A. (2016). Multiscale topology optimization for structures with tailored porous structured materials. In 57th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, San Diego, California, pp. 0938–2016.
Skinner, M. & Hecker, D. (2007). Superabsorber. Retrieved from https://marthaskinner.com/project/superabsorber/ on 30th November 2023.
Soo, S. C. , & Yu, K. M. (2002). Tool-path generation for fractal curve making. The International Journal of Advanced Manufacturing Technology, 19, 32–48.
Ullah, A. S. , D'Addona, D. M. , Seto, Y. , Yonehara, S. , & Kubo, A. (2021). Utilizing fractals for modeling and 3D printing of porous structures. Fractal and Fractional, 5(2), 40.
Ünal, O. , Uygunoğlu, T. , & Yildiz, A. (2007). Investigation of properties of low-strength lightweight concrete for thermal insulation. Building and Environment 42(2), 584–590.
Vicente, M. A. , González, D. C. , Mínguez, J. , Tarifa, M. A. , Ruiz, G. , & Hindi, R. (2018). Influence of the pore morphology of high strength concrete on its fatigue life. International Journal of Fatigue 112, 106–116.
Wang, X. , Xu, S. , Zhou, S. , Xu, W. , Leary, M. , Choong, P. , … Xie, Y. M. (2016). Topological design and additive manufacturing of porous metals for bone scaffolds and orthopaedic implants: A review. Biomaterials, 83, 127–141.
Xia, L. , & Breitkopf, P. (2017). Recent advances on topology optimization of multiscale nonlinear structures. Archives of Computational Methods in Engineering, 24, 227–249.
Zhao, J. , Yoon, H. , & Youn, B. D. (2018). An efficient decoupled sensitivity analysis method for multiscale concurrent topology optimization problems. Structural and Multidisciplinary Optimization, 58, 445–457.

Advancing Tunable Acoustics through Smart Materials and Reconfigurable Kerf Structures

Borhani, A. , Kalantar, N. , Muliana, A. , Shahid, Z. , Rezaei, E. , and Green, E. (October 26–29, 2022). "The sound of kerfing: A new approach to integrating geometry, materials, and acoustics to build invisibles." In Proceedings ACADIA 2022 Hybrids and Haecceities, University of Pennsylvania, Philadelphia, PA.
Chen, R. Turman, C. , Jiang, M. , Kalantar, N. , Moreno, M. , and Muliana, A. (2020). "Mechanics of kerf patterns for creating freeform structures." Acta Mech, 231 (9): 3499–3524. https://doi.org/10.1007/s00707-020-02713-8.
Kalantar, N. , and Borhani, A. (2018). "Informing deformable formworks—parameterizing deformation behavior of a non-stretchable membrane via Kerfing." In Learning, Adapting and Prototyping - Proceedings of the 23rd CAADRIA Conference, CAADRIA (pp. 339–348). Tsinghua University, Beijing, China.
Mansoori, M. , Kalantar, N. , and Creasy, T. (July 2018). "The design and fabrication of transformable, doubly-curved surfaces using shape memory composites." In Proceedings of IASS Annual Symposia (Vol. 2018, No. 14, pp. 1–4). International Association for Shell and Spatial Structures (IASS), MIT, Boston, USA.
Mansoori, M. , Rybkowski, Z. , and Kalantar, N. (2022). Material driven adaptive design model for environmentally-responsive envelopes. In Advanced Materials in Smart Building Skins for Sustainability: From Nano to Macroscale (pp. 207–220). Springer International Publishing, Cham.

Shahid, Z. , Bond, C. , Johnson, M. , Hubbard Jr J. , Kalantar, N. , and Muliana, A. , (2022b). “Dynamic Response of Flexible Viscoelastic Kerf Structures of Freeform Shapes.” International Journal of Solids and Structures, 254–255: 111895.
Shahid, Z. , Hubbard Jr, J. , Kalantar, N. , and Muliana, A. (2022a). “An Investigation of Dynamics Responses of Architectural Kerf Structures.” Acta Mechanica, 233: 157–181.
Varjo, J. , Hongisto, V. , Haapakangas, A. , Maula, H. , Koskela, H. , and Hyönä, J. (2015). “Simultaneous effects of irrelevant speech, temperature and ventilation rate on performance and satisfaction in open-plan offices.” Journal of Environmental Psychology, 44: 16–33. https://doi.org/10.1016/j.jenvp.2015.08.001.
Zarrinmehr, S. , Akleman, E. , Ettehad, M. , Kalantar, N. , and Borhani, A. (2017a). “Kerfing with Generalized 2D meander-patterns: Conversion of planar rigid panels into locally-flexible panels with stiffness control.” In Future Trajectories of Computation in Design [17th International Conference, CAAD Futures 2017, Proceedings, CAAD Futures] (pp. 276–293). Istanbul, Turkey.
Zarrinmehr, S. , Akleman, E. , Ettehad, M. , Kalantar, N. , Haghighi, A.B. , and Sueda, S. (2017b). “An algorithmic approach to obtain generalized 2D meander-patterns.” In Bridges 2017 Conference Proceedings. The 20th Annual Bridges Conference, BRIDGES (pp. 87–94). Waterloo, Ontario, Canada.
Zarrinmehr, S. , Ettehad, M. , Kalantar, N. , Borhani, A. , Sueda, S. , and Akleman, E. (2017c). “Interlocked archimedean spirals for conversion of planar rigid panels into locally flexible panels with stiffness control.” Computers & Graphics, 66: 93–102. https://doi.org/10.1016/j.cag.2017.05.010.

Smart Tectonics for the Design of Building Structural Systems

Beim, A. , & Jensen, J. Z. (2022). Teknik og Arkitektur Mod en Bedre Byggeskik. Copenhagen: CINARK, Institut for Bygningskunst og Teknologi, Det Kongelige Akademi. Hamburg: HafenCity University Hamburg.
Beim, A. , Vibæk, K. S. , & Jørgensen, T. R. (2007). Arkitektonisk Kvalitet og Industrielle Byggesystemer. Copenhagen: Kunstakademiets Arkitektskole, CINARK.
Brancart, S. , Larsen, O. P. , De Temmerman, N. , & De Laet, L. (2017). Bending-active reciprocal structures based on equilateral polyhedral geometries. IASS Symposium. Hamburg: HafenCity University Hamburg.
Castriotto, C. , Tavares, F. , Celini, G. , Larsen, O. P. , & Browne, X. (November 2021). Clamp links: A novel type of reciprocal frame connection. International Journal of Architectural Computing. doi:https://doi.org/10.1177/14780771211054169
Horswill, D. , & Nielsen, T. (2016). Can CLT construction help copenhagen become world’s first carbon neutral city? Structures and Architecture, 1, 153–160.
IPCC Secretariat . (2023). Synthesis Report of the Ipcc Sixth Assessment Report (AR6). Geneva: IPCC Secretariat.
Larsen, O. P. (2008). Reciprocal Frame Architecture. London: Architectural Press.
Larsen, O. P. (2019). Physical Modelling for Architecture and Building Design: A Design Practice Tool. London: Institution of Civil Engineers.
Larsen, O. P. , & Browne, X. (2023). Loadbearing structures from reclaimed wood – strategies, design parameters and reflections. Proceedings of 6th International Scientific Conference,Wood Technology & Product Design. Skopje: Cyril and Methodius University Skopje.
Larsen, O. P. , De Laet, L. , De Temmerman, N. , & Brancart, S. (July 2018). Bending-active reciprocal structures: Geometric parameters and their stiffening effect. Creativity in Structural Design: IASS Symposium 2018, Boston: IASS, 566.
Montjoy, V. (23. November 2023). What Materials Can Promote Health in Interior Architecture? Hentet fra ArchDaily: https://www.archdaily.com/989880/what-materials-can-promote-health-in-interior-architecture
Munk, C. A. (12. December 2022). Studerende tager 200 år gamle træidéer ind i fremtiden. Hentet fra HedeDanmark: https://www.hededanmark.dk/nyheder/studerende-tager-200-aar-gamle-traeideer-ind-i-fremtiden
Ramage, M. H. , Burridge, H. , Busse-Wicher, M. , Fereday, G. , Reynolds, T. , Shah, D. U. , … Scherman, O. (2017). The wood from the trees: The use of timber in construction. Renewable and Sustainable Energy Reviews, 68(1), 333–359. doi:http://dx.doi.org/10.1016/j.rser.2016.09.107
Richardson, K. , Steffen, W. , Lucht, W. , Bendtsen, J. , Cornell, S. E. , Donges, J. F. , … Rockström, J. (13. September 2023). Earth beyond six of nine planetary boundaries. Science Advances, 9(37). doi: 10.1126/sciadv.adh2458
Ritchie, H. , & Roser, M. (2018). Urbanization. Hentet fra Out World in Data: https://ourworldindata.org/urbanization
UNEP. (2022). 2022 Global Status Report for Buildings and Construction: Towards a Zeroemission, Efficient and Resilient Buildings and Construction Sector. Nairobi: United Nations Environment Programme.

Smart Building Sensibilities

AITJ Staff Writer . (22 February 2023). The Impact of AI and Machine Learning on Commercial Real Estate. AI Time Journal. Retrieved from https://www.aitimejournal.com/the-impact-of-ai-and-machine-learning-on-commercial-real-estate/42619.

Alonso, S. (29 October 2023). Smarter Building Management. AECOM. Retrieved from https://www.aecom.com/ca/smarter-building-management.

Cross, P. (18 February 2022). Smart Building Challenges and Opportunities. MBS: Modern Building Services. Retrieved from https://modbs.co.uk/news/fullstory.php/aid/19792/Smart_Building_Challenges_and_Opportunities_.html#:~:text=Cybersecurity%20has%20typically%20been%20the,of%20data%20are%20top%20concerns.

Dhingra, Suruchi . (4 October 2022). The Use of Smart Buildings Solutions Can Reduce Total Global Energy Consumption by 3–5%. Transforma Insights. Retrieved from https://transformainsights.com/blog/smart-buildings-reduce-global-energy#:~:text=Building%20Automation%20Systems%20integrated%20with,by%2010%25%20on%20an%20average.

Doolittle, Tom & Fliegelman, Arthur. (24 August 2023). Work-from-Home and the Future Consolidation of the U.S. Commercial Real Estate Office Sector: The Decline of Regional Malls May Provide Insight. Office of Financial Research. p.2.

D'Silva, Milton . (5 June 2023). Energy Saving In Smart Buildings. Smart Building EMEA. Retrieved from https://smartbuildingmag.com/market-overview/68658-energy-saving-in-smart-buildings#:~:text=A%20study%20done%20by%20the,40%25%20of%20final%20energy%20consumption.

Dutton, Holly . (7 July, 2023). The Risks and Rewards of Facial Recognition Tech in Office Buildings. Propmodo. Retrieved from: https://propmodo.com/the-risks-and-rewards-of-facial-recognition-tech-in-office-buildings/#:~:text=This%20kind%20of%20technology%20has,SCAN%2C%20a%20division%20of%20RealNetworks.

Ernst & Young Global Ltd. (October 2017). Smart Buildings: How to Drive Operational Efficiencies. Retrieved from https://www.ey.com/en_gl/real-estate-hospitality-construction/smart-buildings--how-to-drive-operational-efficiencies.

Euklidiadas, M. (16 June 2023). Wi-Fi 7: What Is It And Why Is It So Important For Cities? Tomorrow City. Retrieved from https://tomorrow.city/a/what-is-wifi-7.

EY. (2021). Executive Playbook: 2021 and Beyond. Microsoft.

JPMorgan Chase & Co. (14 April 2022). JPMorgan Chase Unveils Plans for New Global Headquarters Building in New York City. Retrieved from https://www.jpmorganchase.com/news-stories/jpmorgan-chase-unveils-plans-for-new-global-headquarters-building-in-new-york-city.

Merholz, Norman . (2008). UX Week|Don Norman | Peter Merholz Speaks with Don Norman. (2008). Retrieved from: https://vimeo.com/2963837

PR Newswire. (15 September 2022). Smart Building Market to Hit $570.02 Billion by 2030: Grand View Research, Inc. Bloomberg. Retrieved from https://www.bloomberg.com/press-releases/2022-09-15/smart-building-market-to-hit-570-02-billion-by-2030-grand-view-research-inc.

University of Michigan: Center for Sustainable Systems . (12 November 2023) Commercial Buildings Factsheet. Retrieved from https://css.umich.edu/publications/factsheets/built-environment/commercial-buildings-factsheet#:~:text=Commercial%20buildings%20consumed%2018%25%20of,in%20the%20U.S.%20in%202022.&text=In%202022%2C%20the%20commercial%20sector,a%2072%25%20increase%20from%201980.&text=Operational%20energy%20represents%2080%2D90,building’s%20life%20cycle%20energy%20consumption.

Vierra, S. (2021). Whole Building Design Guide’s Sustainable Building Technical Manual.

Jonze, S. (Director). (2014). Her [Film]. Annapurna Pictures; Warner Home Video.

Kubrick, S. (Director). (1968). 2001: A Space Odyssey [Film]. Metro-Goldwyn-Mayer; Warner Bros.

Panarchistic Architecture

Gabanyi, I. , et al. (2022). Bacterial Sensing via Neuronal Nod2 Regulates Appetite and Body Temperature. Science. 376(6590). https://pubmed.ncbi.nlm.nih.gov/35420957/

Gunderson, L. H. , Allen, C. R. , and Holling, C. S. (2010). Foundations of Ecological Resilience. Island Press. Washington.

Gunderson, L. H. , and Holling, C. S. (2002). Panarchy: Understanding Transformations in Human and Natural Systems. Island Press. Washington.

Gunderson, L. H. , Holling, C. S. , and Light, S. S. (1995). Barriers and Bridges to the Renewal of Ecosystems and Institutions. Columbia University Press. New York.
Hesiod, Homeric Hymns, Epic Cycle, Homerica. (1914). Translated by Evelyn-White, H. G. Loeb Classical Library Volume 57. William Heinemann. London.
Holling, C. S. (1973). Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics. 4. https://www.annualreviews.org/content/journals/10.1146/annurev.es.04.110173.000245
Holling, C. S. (1986). The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change. In: Clark, W. C. , and Munn, R. E. (eds), Sustainable Development of the Biosphere. Cambridge University Press. Cambridge, 292–317.
Holling, C. S. (1992). Cross-scale Morphology, Geometry, and Dynamics of Ecosystems. Ecological Monographs. 62: 447–502.
Holling, C. S. (1996). Engineering Resilience versus Ecological Resilience. In: Schulze, E. (ed.), Engineering Within Ecological Constraints. National Academy of Engineering. Washington, DC.
Holling, C , S., and Meffe, G. K. (1996). Command and Control and the Pathology of Natural Resource Management. Conservation Biology. 10.
Lui, P. , et al. (2019). Crosstalk between the Gut Microbiota and the Brain: An Update on Neuroimaging Findings. Frontiers in Neurology. 10, 8883.
Martin, C. R. , et al. (2018). The Brain-Gut-Microbiome Axis. Cellular and Molecular Gastrentrerology and Hepatology. 6(2)
Nijhuis, M. (2012). Forest Fires: Burn Out. Nature. 489(7416): 352–354.
Pausas, J. G. (2015). Bark thickness and Fire Regime. Functional Ecology. 29. https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2435.12372
Pawlyn, P (2011). Biomimicry in Architecture. RIBA Publishing. London.
Pyne, S. J. (2015). The Fire Age. Aeon. https://aeon.co/essays/how-humans-made-fire-and-fire-made-us-human
Rowe, J. S. (1983). Concept of Fire Effects on Plant Individuals and Species. In: Wein, R. W. , and MacLean, D. A. (eds), The Role of Fire in Northern Circumpolar Ecosystems: Scientific Committee on Problems of the Environment. John Wiley & Sons Ltd. Chichester.
Sterry, M. L. (2018). Panarchistic Architecture: Building Wildland-Urban Interface Resilience to Wildfire through Design Thinking, Practice and Building Codes Modelled on Ecological Systems Theory. PhD Thesis, University of Greenwich, London.
von Humboldt, A. (1849). Views of Nature with Scientific Annotations. Corrected and Expanded Third Edition. J. G. Cotta Publishing. Stuttgart and Tubingen.
Wallace, L , L, and Christensen, N. L. (2004). Epilogue: After The Fires. What Have We Learned? In After the Fires: The Ecology of Change in Yellowstone National Park. Yale University Press. New York, 362–372.
Watson (2019). Lo—TEK: Design by Radical Indigenism. Taschen. Cologne, Germany.

Connecting Architecture and Agriculture for a Climate-Smart Future

Agritecture . (2018). Smart cities are forgetting about something: Food, from: https://www.agritecture.com/blog/2018/8/17/smart-cities-are-forgetting-about-something-food
Anggraeni, E.W. , Handayati, Y. , Novani, S. (2022). Improving Local food systems through the coordination of agriculture supply chain actors. Sustainability, 14(6): 3281.
Beacham, A.M. , Vickers, L.H. , Monaghan, J.M. (2019). Vertical farming: A summary of approaches to growing skywards. The Journal of Horticultural Science and Biotechnology, 94(3): 277–283
City of Dallas. (2022). Comprehensive urban agriculture plan: Draft plan & upcoming community meetings, November 4, 2022, from: https://dallascityhall.com/government/citymanager/Documents/FY%2022-23%20Memos/Comprehensive%20Urban%20Agriculture%20Plan.pdf
Dzvene, A.R. , Tesfuhuney, W.A. , Walker, S. , Ceronio, G. (2023). Management of cover crop intercropping for live mulch on plant productivity and growth resources: A review. Air, Soil and Water Research, 16: 1–6.
Ellen Macarthur Foundation . (2022). Transforming our food system can tackle climate change, and cities play a leading role, from: https://www.ellenmacarthurfoundation.org/cities-and-a-circular-economy-for-food/climate-article
Engler, Nicholas , Krarti, Moncef . (2021). Review of energy efficiency in controlled environment agriculture. Renewable and Sustainable Energy Reviews, 141: 110786
Filintas, A. , Gougoulias, N. , Hatzichristou, E. (2023). Modeling soil erodibility by water (Rainfall/irrigation) on tillage and no-tillage plots of a helianthus field utilizing soil analysis, precision agriculture, gis, and kriging geostatistics. Environmental Sciences Proceedings, 25(1): 54.

Mes´ıas-Ruiz, G.A., Pe´ rez-Ortiz, M., Dorado, J. , de Castro, A.I. , Peña, J.M. (2023). Boosting precision crop protection towards agriculture 5.0 via machine learning and emerging technologies: A contextual review. Frontiers in Plant Science, 14: 1143326

Perkins . (2022). Farming in 2050: The farmers of tomorrow 2022, from: https://www.perkins.com/en_GB/campaigns/powernews/features/future-farmers.html

Ridge, Rosamarie (2003). The History of Community Gardens in New York City: The Role of Urban Agriculture and Green Roofs in Addressing Environmental Racism. Student Theses 2001–2013. 76.

Scherr, S.J. , Shames, S. Friedman, R. (2012). From climate-smart agriculture to climate-smart landscapes. Agriculture & Food Security, 1: 12.

The Standard . (2023). What is Neom? The $500 billion Saudi Arabian ‘smart city’ is 33 times the size of New York, 17 October 2023, from: https://www.standard.co.uk/news/world/neom-saudi-arabia-smart-city-mohammed-bin-salman-b1114036.html#:~:text=Neom%20is%20a%20city%20of,has%20been%20reserved%20for%20nature.

Viparis, Nature Urbaine , (2022). from: https://www.viparis.com/en/news-events/news/nature-urbaine-2

Wang, Chao , Chen, Yu, Sun , Mingxing, Wu, Jiayu , (2023). Potential of technological innovation to reduce the carbon footprint of urban facility agriculture: A food–energy–water–waste nexus perspective. Journal of Environmental Management, 339: 117806.

Anti-desertification Architecture

Bishop, E. , and Wilson, J. (2011). “21 concept to realisation: GRC and complex facades.” GRC 2011Congress, Istanbul: 1–15. https://www.grca.online/about-grca/previous-grca-congress/grca-2011-congress-istanbul

Cooper, D. (2023). “Dry matters: Speculations for an arid future.” Journal of Architectural Education, 77(2): 410–426.

Eades, L. (2018). “Air pollution at the U.S.–Meχico Border: Strengthening the framework for bilateral cooperation.” Journal of Public and International Affairs: 64–79. https://jpia.princeton.edu/sites/g/files/toruqf1661/files/resource-links/jpia_2018.pdf

Grassi, G. , Lupica Spagnolo, S. , and Paoletti, I. (2019). “Fabrication and durability testing of a 3D printed façade for desert climates.” Additive Manufacturing, 28: 439–444.

Henni, S. , (ed.) (2022). Deserts Are Not Empty. Columbia University Press.

Heyman, J. (2007). “Environmental issues at the U.S.–Mexico Border and the unequal territorialization of value.” In A. Hornberg , J. McNeill , and J. Martinez-Alier (eds.), Rethinking Environmental History: World-Systems History and Global Environmental Change. New York: Altamira Press: 327–341.

IPCC. (2023). Climate Change 2023: Synthesis Report. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 184 pp., doi: 10.59327/IPCC/AR6-9789291691647.

Jiang, H. (2016). Taking down the “Great Green Wall”: The science and policy discourse of desertification and its control in China. The End of Desertification? Disputing Environmental Change in the Drylands. Berlin: Springer-Verlag: 513–536.

KLAQ (2023). “El Paso has the world’s largest one of these.” https://klaq.com/worlds-largest-el-paso-desalination-plant

Kripa, E. , Marullo F. , and Mueller, S. , (eds.) (2023). Journal of Architectural Education, 77(2): Deserts.

Lambert, L. (ed.) (2022). Funambulist Magazine. Vol. 44: The Desert.

Mueller, S. (2020). “Airborne agents.” In Tatiana Bilbao , Ayesha Ghosh , and Nile Greenberg , (eds), Two Sides of the Border: Reimagining the Region. Zurich: Lars Muller Publishers: 290–304.

Mueller, S. , and Kripa, E. (2022). “Drawn across borders.” In Emanuele Giorgi , Tiziano Cattaneo , Alfredo Mauricio Flores Herrera , Virginia del Socorro Aceves Tarango , (eds), Design for Vulnerable Communities. Cham: Springer Nature, 395–422.

Spiegelenberg, F. (2022). “Spatial justice and large-scale land transformation: A study of spatial justice for transhumant pastoralists in the case of the Great Green Wall.” Linköping: Linköpings Universitet: 1–91.

Turner, M. D. , Carney, T. , Lawler, L. , Reynolds, J. , Kelly, L. , Teague, M. S. , and Brottem, L. (2021). “Environmental rehabilitation and the vulnerability of the poor: The case of the Great Green Wall.” Land Use Policy, 111: 105750.

Turner, M. D. , Davis, D. K. , Yeh, E. T. , Hiernaux, P. , Loizeaux, E. R. , Fornof, E. M. , … Suiter, A. K. (2023). “Great green walls: Hype, myth, and science.” Annual Review of Environment and Resources, 48: 263–287.

Veste, M. , Gao, J. , Sun, B. , and Breckle, S. W. (2006). “The green great wall-combatting desertification in China.” Geographische Rundschau International Edition, 2(3): 14–20.

WeForest. (2023). https://www.weforest.org/programme/great-green-wall/
World Bank. (2013). Transforming the Sahel: Supporting the Great Green Wall Initiative. https://www.worldbank.org/en/region/afr/brief/world-bank-support-for-great-green-wall-initiative

The Stacked City as a Model for High-Density Low-Carbon Urbanization

Cody, B. (2017). Form Follows Energy: Using Natural Forces to Maximize Performance. Berlin, Boston: Birkhaeuser.
Cody, B. (2022). Visionary Engineered Biotopes in Bringing Nature to High Levels from: The Routledge Companion to Ecological Design Thinking, Healthful Ecotopian Visions for Architecture and Urbanism. Routledge.
Evans, J. (2016). The glorious failure of the experimental city: Cautionary tales from Arcosanti and Masdar City. In The Experimental City, 218–235. Routledge.
Food and Agriculture Organization (FAO) of the United Nations. (n.d.) . SDG indicators data portal. Retrieved November 3, 2023. https://www.fao.org/sustainable-development-goals-data-portal/data/indicators
Fuller, Brandon and Romer, Paul (May 1, 2014). Urbanization as Opportunity. World Bank Policy Research Working Paper No. 6874.
Goetzberger, A. , Zastrow, A. (1982). On the coexistence of solar-energy conversion and plant cultivation. International Journal of Solar Energy, 1(1), 55–69.
Griffiths, S. , Sovacool, B. (2020). Rethinking the future low-carbon city: Carbon neutrality, green design, and sustainability tensions in the making of Masdar City. Energy Research & Social Science, 62, 101368.
Habitat for Humanity . Retrieved November 3, 2023. https://www.habitat.org/sites/default/files/documents/Policy-brief_housing-in-the-time-of-COVID-19-and-beyond.pdf#:~:text=An%20estimated%201.6%20billion%20people,people%20live%20without%20improved%20sanitation.
IEA. (2022). An updated roadmap to net zero emissions by 2050. https://www.iea.org/reports/world-energy-outlook-2022/an-updated-roadmap-to-net-zero-emissions-by-2050
Jackson, Tim . (2016). Prosperity without Growth. 2nd ed. London: Routledge.
Jarzebski, M.P. , et al. (2021). Ageing and population shrinking: implications for sustainability in the urban century. npj Urban Sustain, 1, 17. https://doi.org/10.1038/s42949-021-00023-z.
Liu et al. (2014). How much of the world’s land has been urbanized, really? A hierarchical framework for avoiding confusion. Landscape Ecology, 29, 763–771.
Mellinger, M. et al. (2000). Climate, water navigability, and economic development. CID Working Paper No. 24. September 1999. Center for International Development at Harvard University
Moser, S. (2020). New cities: Engineering social exclusions. One Earth, 2(2), 125–127.
Neumann, B. et al. (2015). Future coastal population growth and exposure to sea-level rise and coastal flooding—a global assessment. PLOS ONE. Public Library of Science, 10(3), 1–34.
Nunez, C. (2019). Desertification, explained. Humans are driving the transformation of drylands into desert on an unprecedented scale around the world, with serious consequences. But there are solutions. National Geographic.
Office of the Director of National Intelligence, ODNI. (2021). Structural forces. Demographics, and Human Development. Retrieved November 3, 2023 . https://www.dni.gov/index.php/gt2040-home/gt2040-structural-forces/demographics-and-human-development
Paszkowska-Kaczmarek, Natalia E. (2021). The line – the Saudi-Arabian linear city concept as the protype of future cities. Architecturae et Artibus, 13–2(48). Sciendo.
Peek, K. (December 7, 2022). Global Population Growth Is Slowing Down. Here’s One Reason Why. Scientific American.
Tiseo, Ian . (2023). Statista. Retrieved November 3, 2023. https://www.statista.com/statistics/276629/global-co2-emissions/#:~:text=Since%201990%2C%20global%20CO%E2%82%82%20emissions,5.01%20GtCO%E2%82%82%20in%202021%2C%20respectively.
United Nations . Global issues, population, our growing population. Retrieved November 3, 2023. https://www.un.org/en/global-issues/population
UN Habitat . SDG 11: Sustainable cities and Make cities and human settlements inclusive, safe, resilient and sustainable communities. https://unhabitat.org/sites/default/files/2023/07/2023_hlpf_factsheet_sdg_11_2.pdf
Walton, Molly . (2019). Desalinated water affects the energy equation in the Middle East. https://www.iea.org/commentaries/desalinated-water-affects-the-energy-equation-in-the-middle-east.
Wang, X. et al. 2019. Evaluating the challenges of eco-city development in China: A comparison of Tianjin and Dongtan eco-cities. IDPR, 41(2), 215–242.

WHO. (n.d.). Water supply, sanitation and hygiene monitoring. Retrieved November 3, 2023. https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/monitoring-and-evidence/wash-monitoring.
Wilkinson, Allie . (2014). Science. Expanding tropics will play greater global role, report predicts. Retrieved November 3, 2023. https://www.science.org/content/article/expanding-tropics-will-play-greater-global-role-report-predicts
World Bank. (2013). https://www.worldbank.org/en/news/feature/2013/08/19/coastal-cities-at-highest-risk-floods.

Sustainable Smart Cold Living Habitats – Lesson from Antarctica for Other Earth Locations in the Light of Climate Crisis

Abdel Mottal, D. (2021). “Antarctic Resources and the Protocol of Environmental Protection” in: Antarctic Resolution, ed. Giulia Foscari, Zurich , Lars Muller Publishers, pp. 136–137.
Baroni, C. , Fox, A. , Harris, U. , Pirlot, J.-Y. (2021). “Naming the Antarctic” in: Antarctic Resolution, ed. Giulia Foscari, Zurich , Lars Muller Publishers, p. 82.
Bergami, E. Corsi (2021). “The Emerging Issue of Plastic Pollution in Antarctica” in: Antarctic Resolution, ed. Giulia Foscari , Lars Muller Publishers, p. 159.
Foscari, G. (ed.) (2021). “Henryk Arctowski 1977/2020+” in: Archive of Antarctic Architecture, pp. 601–875, fragment: Antarctic Resolution, ed. G. Foscari , Lars Muller Publishers, pp. 848–851.
Liggett, D. (2021). “Antarctic Tourism” in: Antarctic Resolution, ed. Giulia Foscari, Zurich , Lars Muller Publishers, p. 165.
Schramm, T. (2021). “Design for Removal: The Life Cycle of Antarctic Stations” in: Antarctic Resolution, ed. G. Foscari , Lars Muller Publishers, p. 503.

Envisioning Ecological Planning Merged with Smart Technologies and Density

10 Principles for livable high-density cities: Lessons from Singapore. (2013). Centre for Liveable Cities and Urban Land Institute. https://www.clc.gov.sg/docs/default-source/books/10principlesforliveablehighdensitycitieslessonsfromsingapore.pdf
Architecture 2030 . (2020, September 20). RESET! URBANIZATION: Global Sprawl, Climate Change, and Equity // CarbonPositive RESET! [Video]. YouTube. https://www.youtube.com/watch?v=A7vCgPJVRi8
Aronson, M. , Goddard, M. , Lepcyk, C. , Lerman, S. , (2017). Biodiversity in the city: Key challenges for urban green space management. Frontiers in Ecology and the Environment, 15(Issue 4). https://doi.org/10.1002/fee.1480
Artmann, M. , Kohler, M. , Meinel, G. , Gan, J. , & Ioja, C. (2017). How smart growth and green infrastructure can mutually support each other—A conceptual framework for compact and green cities. Ecological Indicators, 96. https://doi.org/10.1016/j.ecolind.2017.07.001.
Baumgarten, S. , Stoneburner, L. , & Grossinger, R. (2022, June). Historical ecology deepens our understanding of place: the democratization of maps & California’s future. Artemisia, 49(1), 20–25
Calthorpe, P. (2011). Urbanism in the Age of Climate Change. Island Press
Fishman, R. (1977). Urban Utopias in the Twentieth Century: Ebenezer Howard, Frank Lloyd Wright, Le Corbusier. Basic Books, Inc. p. 3–20
Galle, N. , Nitoslawski, S. , & Pilla, F. (2019). The Internet of Nature: How taking nature online can shape urban ecosystems. The Anthropocene Review, 6. https://doi.org/10.1177/2053019619877103.
Guerry, A. , Smith, J. , Lonsford, E. , Daily, G. , Wang, X. , & Chun, Y. (2021). Urban Nature and Biodiversity for Cities. World Bank Publications Reports 36325, The World Bank Group
Hiramatsu, T. (2014). Expansive urban growth boundary. Modern Economy, 5, 806–820. https://doi.org/10.4236/me.2014.57074
Ives, C.D. , Lentini, P. E. , Threlfall, C. G. , Ikin, K. , Shanahan, D. F. , Garrard, G. E. , Bekessy, S. A. , Fuller, R. A. , Mumaw, L. , Rayner, L. , Rowe, R. , Valentine, L. E. , & Kendal, D. (2016), The importance of cities for threatened species. Global Ecology and Biogeography, 25, 117–126. https://doi.org/10.1111/geb.12404.
Kett, H. (2017, November 26). How to filter 2 million gallons of stormwater from the Aurora Bridge. Nature.org. https://www.nature.org/en-us/about-us/where-we-work/united-states/washington/stories-in-washington/filtering-stormwater/.

Le Corbusier . (1987). The City of To-Morrow and its Planning (F. Etchells , Trans). Dover Publications, Inc. (Original work published 1929) pp. 15–20, 163–245.
Margolis, L. , & Robinson, A. (2007). Living Systems: Innovative Materials and Technologies for Landscape Architecture. Birkhäuser.
Meck, S. (Ed). (2002). Growing Smart Legislative Guidebook—Model Statutes for Planning and the Management of Change. HUD USER, Economic Development, Economic Development Publications.
On the roof with Dr. Nadina Galle on the Internet of Nature. (2021, Fall). https://livingarchitecturemonitor.com/articles/dr-nadina-galle-on-the-internet-of-nature-f21
Orf, D. (2023, September 12). Saudia Arabia is building an entire city in a straight line. It makes zero sense. Popular Mechanics. https://www.popularmechanics.com/science/green-tech/a44966174/saudi-arabia-line-city/.
Parris, K. , Amati, M. , Bekessy, S. , Dagenais, D. , Fryd, O. , & Hahs , A., Hes, D. , Imberger, M. , Livesley, S. , Marshall, A. , Rhodes, J. , Threlfall, C. , Tingley, R. , van der Ree, R. , Walsh, C. J. , Doshi, M. , & Williams, N. (2018). The seven lamps of planning for biodiversity in the city. Cities, 83. https://doi.org/10.1016/j.cities.2018.06.007.
Perkl, R. (2022, June). Introduction: The democratization of maps & California’s future. Artemisia, 49(1), 2–6.
Pourtaherian, P. , & Jaeger, J. (2022). How effective are greenbelts at mitigating urban sprawl? A comparative study of 60 European cities. Landscape and Urban Planning, 227, https://doi.org/10.1016/j.landurbplan.2022.104532.
Richardson, O. (2023, April 26). Aurora Bridges Bioswales—ULI Americas Awards for Excellence Winner. ULI.org. https://americas.uli.org/aurora-bridge-bioswales-uli-americas-awards-for-excellence-winner/.
Rzevski, G. , Kozhevnikov, S. , & Svitek, M. (2020). Smart city as an urban ecosystem. 2020 Smart City Symposium Prague (SCSP), Prague, Czech Republic, 2020, p. 1–7, https://doi.org/10.1109/SCSP49987.2020.9133849.
Salmon-Safe Inc . (2023). Salmon-Safe Urban Standards version 3.1. Herrera Environmental Consultants, Inc.
Smith, A. , & Gill, G. (2018). Residency: A Carbon Analysis of Residential Typologies. ASGG. p. 7
Thoreau, H. D. , & Emerson R. W. (1991). Walking. In Nature and Walking. Beacon Press. p. 100
Wright, F. L. (1945). When Democracy Builds. University of Chicago Press.

The Intelligence of Buildings

Banham, Reyner . 1984. The Architecture of the Well-Tempered Environment. The University of Chicago Press: Chicago.
Butler, S. 1872. Erewhon, or Over the Range. Trubner & Co: London.
Darwin, Charles . 1859. The Origin of Species by Means of Natural Selection, or, The Preservation of Favored Races in the Struggle for Life, John Wanamaker: Philadelphia.
Deleuze, G. and F. Guattari . 1983. Anti-Oedipus: Capitalism and Schizophrenia. University of Minnesota Press: Minneapolis.
Hirata, Hironori and Robert Ulanowicz . 1984. ‘Information theoretical analysis of ecological networks.’ International Journal of Systems Science, 15, 3: 261–270.
Jorgensen, S. E. 1992. Integration of Ecosystem Theories: Apattern, 3rd edition, Kluwer Academic Publishers: Dordrecht; Boston, c2002.
Kurzweil, Ray . 2005. The singularity is Near: When Humans Transcend Biology. Viking: New York.
Leontief, Wassily . 1986. Input-Output Economics. Oxford University Press.
Marcus, George H. 2013. The Houses of Louis Kahn. Yale University Press: New Haven.
Odum, Howard T. 1994. Ecological and General Systems: An Introduction to Systems Ecology. University of Colorado Press: Niwot.
Odum, Howard T. 1996. Environmental Accounting: EMERGY and environmental Decision Making. Wiley: New York.
Passe, U. and F. Battaglia . 2015. Designing Spaces for Natural Ventilation: An Architect’s Guide. Routledge: New York.
Shannon, C. E. 1948. “A mathematical theory of communication.” Bell System Technical Journal, 27 (July, October): 379–423, 623–656.
Simon, Maron J. 1947. Your Solar House; A Book of Practical Homes for all Parts of the Country. Simon and Schuster: New York.
Szyrmer, J. and R. E. Ulanowicz . 1987. “Total flows in ecosystems.” Ecological Modelling, 35(1): 123–136.

Ulanowicz, Robert E. 1997. Ecology: The Ascendent Perspective. Columbia University Press: New York.
Vinge, Vernor . 1993. “Technological singularity.” Whole Earth Review, 81: 88.
Yi, Hwang . 2016. Information in Environmental Architecture: Ecological Network Analysis and New indices of Building Performance, PhD dissertation, University of Pennsylvania, Philadelphia, PA.
Yi, Hwang , William W. Braham , David R. Tilley , and Ravi Srinivasan . 2017a. “A metabolic network approach to building performance: Information building modeling and simulation of biological indicators”. Journal of Cleaner Production, 165: 1133–1162.
Yi, Hwang , William W. Braham , David R. Tilley , and Ravi Srinivasan . 2017b. “Measuring ecological characteristics of environmental building performance: Suggestion of an information-network model and indices to quantify complexity, power, and sustainability of energetic organization.” Ecological Indicators, 83: 201–217.

Smart Energy Harvesting from Natural and Artificial Aquatic Systems

Alberti, M. , Booth, D. , Hill, K. , Coburn, B. , Avolio, C. , Coe, S. , & Spirandelli, D. (2007). The impact of urban patterns on aquatic ecosystems: An empirical analysis in Puget lowland sub-basins. Landscape and Urban Planning, 80(4), 345–361.
Aqel, M. O. , Issa, A. , Qasem, E. & El-Khatib, W. (2018, October). Hydroelectric generation from water pipelines of buildings. In 2018 International Conference on Promising Electronic Technologies (ICPET) (pp. 63–68). IEEE.
Araújo, R. , Vázquez Calderón, F. , Sánchez López, J. , Azevedo, I. C. , Bruhn, A. , Fluch, S. , … & Ullmann, J. (2021). Current status of the algae production industry in Europe: an emerging sector of the blue bioeconomy. Frontiers in Marine Science, 7, 626389.
Baecher, G. B. , Paté, M. E. , & De Neufville, R. (1980). Risk of dam failure in benefit-cost analysis. Water Resources Research, 16(3), 449–456.
Baxter, R. M. , (1977). Environmental effects of dams and impoundments. Annual Review of Ecology and Systematics, 8(1), 255–283.
Bernitsas, M. M. , Raghavan, K. , Ben-Simon, Y. , & Garcia, E. M. H. (2008). VIVACE (Vortex Induced Vibration Aquatic Clean Energy): A new concept in generation of clean and renewable energy from fluid flow. Journal of Offshore Mechanics and Arctic Engeneering, 130(4), 041101.
Booth, D. B. , & Jackson, C. R. (1997). Urbanization of aquatic systems: degradation thresholds, stormwater detection, and the limits of mitigation 1. JAWRA Journal of the American Water Resources Association, 33(5), 1077–1090.
Dixon, J. A. , Talbot, L. M. , & Le Moigne, G. J. M. (1989). Dams and the Environment. World Bank Technical Paper, 110.
Ferreira, G. F. , Pinto, L. R. , Maciel Filho, R. , & Fregolente, L. V. (2019). A review on lipid production from microalgae: Association between cultivation using waste streams and fatty acid profiles. Renewable and Sustainable Energy Reviews, 109, 448–466.
Foyer, C. H. , Ruban, A. V. , & Nixon, P. J. (2017). Photosynthesis solutions to enhance productivity. Philosophical Transactions of the Royal Society B: Biological Sciences, 372(1730), 20160374.
Gönülol, A. , & Obali, O. (1998). A study on the phytoplankton of hasan UĞURLU Dam Lake (Samsun-Turkey). Turkish Journal of Biology, 22(4), 447–462.
Hariri-Ardebili, M. A. (2018). Risk, Reliability, Resilience (R3) and beyond in dam engineering: A state-of-the-art review. International Journal of Disaster Risk Reduction, 31, 806–831.
Kienert, W. (1978). Ökologische Untersuchungen am Phytoplankton der Edertalsperre. PhD Thesis, Gesamthochschule Kassel, Germany.
Kong, H. , Roussinova, V. , & Stoilov, V. (2019). Renewable energy harvesting from water flow. International Journal of Environmental Studies, 76(1), 84–101.
Kryvenda, A. , Tischner, R. , Steudel, B. , Griehl, C. , Armon, R. , & Friedl, T. (2023). Testing for terrestrial and freshwater microalgae productivity under elevated CO2 conditions and nutrient limitation. BMC Plant Biology, 23(1), 1–17.
Kumar, D. , Korstad, J. , & Singh, B. (2015). Life cycle assessment of algal biofuels. In Algae and Environmental Sustainability, Ed. Bhaskar Singh , Kuldeep Bauddh , & Faizal Bux , Springer, 165–181.
Ma, T. , Yang, H. , Guo, X. , Lou, C. , Shen, Z. , Chen, J. , & Du, J. (2018). Development of inline hydroelectric generation system from municipal water pipelines. Energy, 144, 535–548.
Mohammed, A. A. , Ahmed, A. M. , & El-Otify, A. M. (1989). Field and laboratory studies on Nile phytoplankton in Egypt IV. Phytoplankton of Aswan High Dam Lake (Lake Nasser). Internationale Revue der gesamten Hydrobiologie und Hydrographie, 74(5), 549–578.

Ritchie, H. , Roser, M. , & Rosado, P. (2020).“Energy”. Published online at OurWorldInData.org. Retrieved from “hattp://ourworldindata.org/energy”
Röhling, H. G. , Teicke, J. , & Wellmer, F. W. (2010). The upper harz water regale. Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften, 66, 119–121.
Seo, S. N. , & Seo, S. N., (2021). Energy revolutions: A story of the Three Gorges Dam in China. Climate Change and Economics: Engaging with Future Generations with Action Plans, Palgrave Macmillan, Cham, 113–129.
Stančius, A. , & Grecevičius, P. (2021). Influence of Ancient Mesopotamian Aesthetics of Gardens/Parks and Water Installations on the Development of Landscape Architecture. Athens Journal of Architecture 8(1), 9–34.
Vijayaraghavan, K. , & Hemanathan, K. (2009). Biodiesel production from freshwater algae. Energy & Fuels, 23(11), 5448–5453.
Wang, Z. J. , & Wang, Z. W. (2019, March). A review on tidal power utilization and operation optimization. In IOP Conference Series: Earth and Environmental Science (Vol. 240, No. 5, p. 052015). IOP Publishing.
Xiaoxiang, S. (1994). The city should be rich in the pleasures of wild nature—A traditional aesthetic concept of China for urban planning. Ekistics, 61(364/365), 22–28.
Yaakob, M. A. , Mohamed, R. M. S. R. , Al-Gheethi, A. , Aswathnarayana Gokare, R. , & Ambati, R. R. (2021). Influence of nitrogen and phosphorus on microalgal growth, biomass, lipid, and fatty acid production: an overview. Cells, 10(2), 393.
Ynalvez, R.A. , Dinamarca, J. and Moroney, J.V. , 2018. Algal photosynthesis. eLS, 1–9.
Zamora-Juárez, M. Á. , Ortiz, C. R. F. , Guerra-Cobián, V. H. , López-Rebollar, B. M. , Alarcón, I. G. & García-Pulido, D. (2023). Parametric assessment of a Pelton turbine within a rainwater harvesting system for micro hydro-power generation in urban zones. Energy for Sustainable Development, 73, 101–115.
Zarfl, C. , Lumsdon, A. E. , Berlekamp, J. , Tydecks, L. , Tockner, K. (2015). A global boom in hydropower dam construction. Aquatic Sciences, 77, 161–170.

Amphibious Structures for Smart Flood Risk Reduction and Climate Change Adaptation

Aga Khan Award for Architecture. (2019). Arcadia Education Project. Retrieved January 2, 2024 from https://the.akdn/en/how-we-work/our-agencies/aga-khan-trust-culture/akaa/arcadia-education-project
Barker, R. , Coutts, R. (2015). Aquatecture: Buildings and Cities Designed to Live and Work with Water. London: Royal Institute of British Architects, p. 21 24.
Barsley, E. (2020). Retrofitting for Flood Resilience: A Guide to Building & Community Design. London: Royal Institute of British Architects, p. 197.
Boiten, Factor Architecten . (2011). Project Review: Floating Homes ‘De Gouden Kust’. Maasbommel, the Netherlands, 1998–2005. Retrieved January 2, 2024, from http://climate-adapt.eea.europa.eu/en/metadata/case-studies/amphibious-housing-in-maasbommel-the-netherlands/11310092.pdf.
English, E. (2009). “Amphibious foundations and the buoyant foundation project: innovative strategies for flood-resilient housing”. In: Presented at the International Conference on Urban Flood Management “Road Map Towards a Flood Resilient Urban Environment”, November 25–27, 2009, Paris, France. Retrieved January 2, 2024, from www.buoyantfoundation.org/research.
English, E. , Chan, L. , Doberstein, B. , Tran, T. (2020). Development of Amphibious Homes for Marginalized and Vulnerable Populations in Vietnam. Ww216. Final Report – Executive Summary. Waterloo: University of Waterloo. Retrieved January 2, 2024, from www.buoyantfoundation.org/research.
English, E. , Chen, M. , Zarins. R. , Patange, P. Humenyuk, I. (2018). “An Innovative Strategy to Increase the Resilience of Flood-Vulnerable Communities while Reducing Risk of Population Displacement and Psychological Trauma”. In Presented at 8th International Conference on Building Resilience—ICBR Lisbon 2018, 14–16 November 2018—Lisbon, Portugal. Retrieved January 2, 2024, from www.buoyantfoundation.org/research.
English, E. , Chen, M. , Zarins. R. , Patange, P. , Wiser, J. (2021). “Building Resilience through Flood Risk Reduction: The Benefits of Amphibious Foundation Retrofits to Heritage Structures”. International Journal of Architectural Heritage 15(7): 976–984, DOI: 10.1080/15583058.2019.1695154.
English, E. , Klink, N. , Turner, S. (2016). “Thriving with Water: Developments in Amphibious Architecture in North America”. E3S Web of Conferences, 7, 13009. DOI: https://doi.org/10.1051/e3sconf/20160713009.
Mollard, M. (2023). “Arcadia Education Project (2016–2020): Demolition Postcard”. The Architectural Review [online]. Retrieved January 2, 2024, from www.architectural-review.com/essays/arcadia-education-project-2016-2020-demolition-postcard.

Morphosis Architects . (n.d.). FLOAT House. Retrieved January 2, 2024, from www.morphosis.com/architecture/126/
Piątek, Ł. (2016). “Displacing Architecture? From Floating Houses to Ocean Habitats: Expanding the Building Typology”. In: Bezerra, L. , Słyk, J. , (Eds.) Architecture for the Society of Knowledge; Education for Research, Research for Creativity. Warsaw: Warsaw University of Technology, Volume 1, pp. 273–280.
Piątek, Ł. , Wojnowska-Heciak, M. (2020). “Multicase Study Comparison of Different Types of Flood-Resilient Buildings (Elevated, Amphibious, and Floating) at the Vistula River in Warsaw, Poland”. Sustainability 12(22): 9725, https://doi.org/10.3390/su12229725.
Pötz, H. , Anholts, T. , de Koning, M. , (2014). Multi-Level Safety. Water-Resilient Urban and Building Design. Amersfoort: STOWA, Retrieved from https://www.stowa.nl/publicaties/meerlaagsveiligheid-waterrobuust-bouwen-stedelijk-gebied-nl-en-english-version
Watson, D. , Adams, M. (2010). Design for Flooding. Hoboken, NJ: Wiley, p. 244.

Smart Ocean Living

Andersen, T. L. , Kvitrud, A. , Jensen, J. E. , and ASME (2014). “The floatel superior loose-anchor incident and its significance for design and operation of semi-submersibles,” UNSP V04BT02A012.
AT Design Office (2015). Floating City, https://www.atdesignoffice.com/floating-city/. Accessed 3 January 2024 .
Baumeister, J. (2022). “The evolution of aquatecture: SeaManta, a Floating Coral Reef,” in WCFS2020, Ł. Piątek , S. H. Lim , C. M. Wang and R. de Graaf-van Dinther (eds.), Singapore: Springer Singapore, pp. 131–142.
Callebaut, V. (2014). “Lilypad: Floating ecopolis for climatical refugees,” in Large Floating Structures: Technological Advances, C. M. Wang and B. T. Wang (eds.), Singapore: Springer Verlag, Singapore, pp. 303–327.
Craven, J. P. , and Hanson, J. A. (1972). Hawaii’s Floating City Development Program First Annual Report - Fiscal Year 1972. Honolulu: University of Hawaii and the Oceanic Institute. https://repository.library.noaa.gov/view/noaa/42324
Czapiewski, K. M. , Roeffen, B. , Dal Bo Zanon, B. , and Graaf, R. de (2013). Seasteading Implementation Plan, Delft: DeltaSync.
Dunne, A. , and Raby, F. (2013). Speculative Everything: Design, Fiction, and Social Dreaming, Cambridge, MA; London: The MIT Press.
Energy Observer (2022). Energy Observer 2, a Demonstrator Vessel that Runs on Liquid Hydrogen, https://www.energy-observer.org/resources/energy-observer-2-liquid-hydrogen. Accessed 12 January 2024 .
Fuller, B. (2004). A Study of a Prototype Floating Community, Honolulu: University Press of the Pacific.
Gabor, M. (1979). Houseboats: Living on the Water Around the World, New York: Ballantine Books.
Giovannini, J. (2002). “The vertical campus—with Deft Strokes, Kohn-Pedersen-Fox builds a collegiate village in an urban tower (New Academic Complex, Baruch-College the City-University- of-New-York),” Architecture. Vol. 91, No. 10: pp. 62–67.
Hayward, P. (2014). “Islands and micronationality,” Shima: The International Journal of Research into Island Cultures. Vol. 8, No. 1, pp. 1–8.
Jencks, C. (1973). Modern Movements in Architecture, Garden City: Anchor Press/Doubleday.
Lin, F.-Y. , Spijkers, O. , and van der Plank, P. (2022). “Legal framework for sustainable floating city development: A case study of the Netherlands,” in WCFS2020, Ł. Piątek , S. H. Lim , C. M. Wang and R. de Graaf-van Dinther (eds.), Singapore: Springer Singapore, pp. 433–460.
Newsubstance. (2024). Sea Monster, https://seemonster.co.uk/. Accessed 12 January 2024 .
NOAA. (2024). How deep is the Ocean?: Ocean Exploration Facts. NOAA Office of Ocean Exploration and Research, https://oceanexplorer.noaa.gov/facts/ocean-depth.html. Accessed 11 January 2024 .
Oceanix Ltd . (2023). Oceanix. Leading the Next Frontier for Human Habitation. Accessed 3 January 2023 .
Olthuis, K. , and Keuning, D. (2011). Float!: Building on Water to Combat Urban Congestion and Climate Change, Amsterdam: Frame.
Piątek, Ł. (2023). “Amphibious buoyant architecture—designs for living with water: Floating futures,” in The Routledge Companion to Ecological Design Thinking: Healthful Ecotopian Visions for Architecture and Urbanism, M. Kanaani (ed.), New York, London: Routledge, Taylor et Francis Group, pp. 413–423.
Piątek, Ł. , and Słyk, J. (2017). “Jednostki—okrętowy rodowód modernistycznych koncepcji mieszkaniowych [Unités - marine origins of modernist housing concepts],” in Architektura XX Wieku i jej Waloryzacja w Gdyni i w Europie, Gdynia: Urząd Miasta Gdyni, pp. 245–250.
Quirk, J. , and Friedman, P. (2017). Seasteading: How Ocean Cities Will Restore the Environment, Enrich the Poor, Cure the Sick, and Liberate Humanity from Politicians, New York: Simon & Schuster.

Shimizu Corporation (2014). The Environmental Island, Green Float, https://www.shimz.co.jp/en/topics/dream/content03/. Accessed 12 October 2021 .
Upholt, B. (2021). The quest for a floating Utopia. Hakai Magazine, https://www.hakaimagazine.com/features/the-quest-for-a-floating-utopia/. Accessed 10 October 2021 .

Aquatic Structures

Baumeister, J. (2021). The evolution of Aquatecture: SeaManta, a floating coral reef. Lecture Notes in Civil Engineering, 131–142. https://doi.org/10.1007/978-981-16-2256-4_8
Baumeister, J. (2023). Developing aquatic urbanism: A taxonomy describing 7 strategies and 35 tactics. In: Baumeister, J. , Giurgiu, I. C. , Linaraki, D. , Ottmann, D. A. (eds.), SeaCities. Cities Research Series. Springer, Singapore.
Baumeister, J. , & Giurgiu, I. C. (2022). SeaOasis: Floating Aquaculture for Smallholders' Global Food Security. Springer Nature.
Baumeister, J. , & Morrison, A. (2023). SeaSurveyor: An innovative floating solution for establishing marine protection areas in shallow international waters. Proceedings of the Third World Conference on Floating Solutions—WCFS2023 Tokyo, Japan.
Bayazit, N. (2004). Investigating design: A review of forty years of design research. Design Issues, 20(1), 16–29. https://web-s-ebscohost-com.libraryproxy.griffith.edu.au/ehost/pdfviewer/pdfviewer?vid=0&sid=5f278d7f-1468-495f-8b36-0679bf5ae53e%40redis (accessed 3. November 2023).
BIG's Oceanix Busan . (2022). https://big.dk/#projects-ocxb (accessed 6. November 2023)
NASA's Mars Exploration Program. https://mars.nasa.gov/MPF/martianchronicle/martianchron6/mars300k.html (accessed 6. November 2023)
Setiadi, R. , Baumeister, J. , & Lo, A. (2023). Floating Jakarta: A human dimension. In: Baumeister, J. , Giurgiu, I.C. , Linaraki, D. , Ottmann, D.A. (eds.), SeaCities. Cities Research Series. Springer, Singapore. https://doi.org/10.1007/978-981-99-2481-3_6.
The Britannica Dictionary's definition of 'aquatic' . https://www.britannica.com/dictionary/aquatic (accessed 6. November 2023)
The Britannica Dictionary's definition of 'structure'. https://www.britannica.com/dictionary/structure (accessed 6. November 2023)
United Nations. (2023). Climate change-induced sea-level rise direct threat to millions around World. https://press.un.org/en/2023/sc15199.doc.htm#:~:text=Rather%2C%20they%20are%20rising%2C%20and,new%20homes%20in%20new%20locations (accessed 6. November 2023)
Waterstudio . (2022). Maldives Floating City, a benchmark for vibrant communities. https://www.waterstudio.nl/projects/maldives-floating-city-a-benchmark-for-vibrant-communities-beyond-the-waterfront/ (accessed 6. November 2023)
Zubrin, R. , & McKay, C. (1993). Technological requirements for terraforming Mars. In 29th Joint Propulsion Conference and Exhibit. https://doi.org/10.2514/6.1993-2005

Expansion in the Water

Baumeister, J. , & Linaraki, D. (2023). Cities+1m, Urban Development Solutions for Sea Level Rise. Singapore: Springer.
Berman, O. , Weizman, M. , Oren, A. , Neri, R. , Parnas, H. , Shashar, N. , & Tarazi, E. (2023). Design and application of a novel 3D printing method for bio-inspired artificial reefs. Ecological Engineering, 188, 106892. doi:https://doi.org/10.1016/j.ecoleng.2023.106892
Biribo, N. , & Woodroffe, C. D. (2013). Historical area and shoreline change of reef islands around Tarawa Atoll, Kiribati. Sustainability Science, 8(3), 345–362. doi:10.1007/s11625-013-0210-z
Birkeland, C. (2015). Coral Reefs in the Anthropocene (1st ed.). Dordrecht: Springer Netherlands.
Done, T. (2011). Corals: Environmental Controls on Growth (pp. 281–293). In: Hopley, D. (ed) Encyclopedia of Modern Coral Reefs. Encyclopedia of Earth Sciences Series. Dordrecht: Springer. https://doi.org/10.1007/978-90-481-2639-2_10
Ferrario, F. , Beck, M. W. , Storlazzi, C. D. , Micheli, F. , Shepard, C. C. , & Airoldi, L. (2014). The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. Nature Communications, 5(1), 3794. doi:10.1038/ncomms4794.

Girling, M. (2019). The Netherlands is tackling climate change by making floating solar farms. Retrieved from https://www.weforum.org/agenda/2019/12/the-netherlands-is-building-solar-islands-to-fight-rising-sea-levels.
Gupta, P. (2015). Futures, fakes and discourses of the gigantic and miniature in 'the world' Islands, Dubai. Island Studies Journal, 10(2), 181–196.
Hubbard, D. K. (2015). Reef biology and geology - not just a matter of scale. In: Birkeland, C. (ed) Coral Reefs in the Anthropocene. Dordrecht: Springer. https://doi.org/10.1007/978-94-017-7249-5_3
Kapmeier, F. , & Gonçalves, P. (2018). Wasted paradise? Policies for Small Island States to manage tourism-driven growth while controlling waste generation: the case of the Maldives. System Dynamics Review, 34(1–2), 172–221. doi:10.1002/sdr.1607
Kench, P. , Perry, C. , & Spencer, T. (2009). Coral Reefs (pp. 180–213). Cambridge University Press.
Lange, C. , Ratoi, L. , & Co, D. L. (2020). Reformative coral habitats. Rethinking Artificial Reef structures through a robotic 3D clay printing method. In Paper Presented at the 25th International Conference of the Association for Computer-Aided Architectural Design Research in Asia. Hong Kong.
Linaraki, D. (2021). A comparison between alternative relocation options for the Pacific Islands based on a human-centred approach (pp.253–269). In J. Baumeister , E. Bertone , & P. Burton (Eds.), SeaCities. Singapore: Springer.
Linaraki, D. , Baumeister, J. , Stevens, T. , & Burton, P. (2023). An overview of artificial islands growth processes and their adaptation to sea-level rise (pp. 65–120). In J. Baumeister , I.C. Giurgiu , D. Linaraki , D.A. Ottmann (Eds.), SeaCities. Singapore: Springer.
Lister, N. , & Muk-Pavic, E. (2015). Sustainable artificial island concept for the Republic of Kiribati. Ocean Engineering, 98, 78–87. doi:10.1016/j.oceaneng.2015.01.013
Martín-Antón, M. , Negro, V. , José María Del, C. , López-Gutiérrez, J. S. , & Esteban, M. D. (2016). Review of coastal land reclamation situation in the world. Journal of Coastal Research, 1(75), 667–671. doi:10.2112/SI75–133.1
Masselink, G. , McCall, R. , Beetham, E. , Kench, P. , & Storlazzi, C. (2021). Role of future reef growth on morphological response of Coral Reef Islands to sea-level rise. Journal of Geophysical Research. Earth Surface, 126(2), n/a-n/a. doi:10.1029/2020JF005749
Moussavi, Z. , & Aghaei, A. (2013). The environment, geopolitics and artificial islands of Dubai in the Persian Gulf. Procedia - Social and Behavioral Sciences, 81, 311–313. doi:10.1016/j.sbspro.2013.06.434
Naylor, A. K. (2015). Island morphology, reef resources, and development paths in the Maldives. Progress in Physical Geography, 39(6), 728–749. doi:10.1177/0309133315598269
Oppenheimer, M. , Glavovic, B.C. , Hinkel, J. , van de Wal, R. , Magnan, A.K. , Abd-Elgawad, A. , Cai, R. , Cifuentes-Jara, M. , DeConto, R.M. , Ghosh, T. , Hay, J. , Isla, F. , Marzeion, B. , Meyssignac, B. , & Sebesvari, Z. (2019). Sea level rise and implications for low-lying islands, coasts and communities. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. Monaco
Prathep, A. , Prathep, A. , Kaewsrikhaw, R. , Kaewsrikhaw, R. , Mayakun, J. , Mayakun, J. , , . Darakrai, A. (2018). The effects of light intensity and temperature on the calcification rate of Halimeda macroloba. Journal of Applied Phycology, 30(6), 3405–3412. doi:10.1007/s10811-018-1534-y
Ramalho, R. S. , Quartau, R. , Trenhaile, A. S. , Mitchell, N. C. , Woodroffe, C. D. , & Ávila, S. P. (2013). Coastal evolution on volcanic oceanic islands: A complex interplay between volcanism, erosion, sedimentation, sea-level change and biogenic production. Earth-Science Reviews, 127, 140–170. doi:10.1016/j.earscirev.2013.10.007
Sengupta, D. , Chen, R. , & Meadows, M. E. (2018). Building beyond land: An overview of coastal land reclamation in 16 global megacities. Applied Geography, 90, 229–238. doi:10.1016/j.apgeog.2017.12.015
Self-Assembly Lab (2019). Growing Islands. MIT. Retrieved https://selfassemblylab.mit.edu/growingislands
Veron, J. E. N. , & Stafford-Smith, M. (2000). Corals of the World. Townsville, QLD: Australian Institute of Marine Science.
Wyett, K. (2014). Escaping a rising tide: Sea level rise and migration in Kiribati. Asia and the Pacific Policy Studies, 1(1), 171–185. doi:10.1002/app5.7

Smart Mobility and the Future of Cities

American Lung Association. (2023). State of the Air: 2023 Report. Retrieved from https://www.lung.org/research/sota.
Brinley, S. (January 9, 2023). EV Chargers: How many do we need? S&P Global Mobility. Retrieved from https://www.spglobal.com/mobility/en/research-analysis/ev-chargers-how-many-do-we-need.html.
Davidson, J. (November 15, 2019). In 2029, a Hyperloop could turn Columbus, Ohio, into a Suburb of Chicago. New York Magazine. Retrieved October 22, 2023, from https://nymag.com/intelligencer/2019/11/by-2029-a-hyperloop-could-make-columbus-a-chicago-suburb.html.

Duany, A. , & Steuteville, R. (February 8, 2021). Defining the 15-minute city. CNU. Retrieved from https://www.cnu.org/publicsquare/2021/02/08/defining-15-minute-city.
Ehrlich, B , Clout, H. , & Hebbert, M. (2023). London. Encyclopedia Britannica. Retrieved November 5, 2023, from https://www.britannica.com/place/London.
Feller, G. (August 5, 2021). Microgrids + mass transit = resilient mobility in a future clouded by climate change. Canary Media. Retrieved from https://www.canarymedia.com/articles/mobility/microgrids-plus-mass-transit-equals-resilient-mobility-in-a-future-clouded-by-climate-change.
Foot, J. , Ring, R. , & Ehrlich, B. (2023). Rome. Encyclopedia Britannica. Retrieved November 5, 2023, from https://www.britannica.com/place/Rome.
Frank, L. , Andresen, M. , & Schmid, T. (August 27, 2004). Obesity relationships with community design, physical activity, and time spent in cars. American Journal of Preventative Medicine. Retrieved from https://pubmed.ncbi.nlm.nih.gov/15261894/.
Garcia, E. (May 24, 2018). Chicago to Pittsburgh in 45 minutes: A look at the high-speed hyperloop. WTTW. Retrieved from https://news.wttw.com/2018/05/24/chicago-pittsburgh-45-minutes-look-high-speed-hyperloop.
Gensler . (2022). Urban Mobility Report. Retrieved from https://www.gensler.com/gri/city-pulse-2022-urban-mobility-report.
Governors Highway Safety Association. (2023). Pedestrian Traffic Fatalities by State: 2022 Preliminary Data. Retrieved from https://www.ghsa.org/resources/Pedestrians23
Intelligent Transport . (February 17, 2023). London's congestion charge celebrates 20 years of success. Retrieved from https://www.intelligenttransport.com/transport-news/143883/londons-congestion-charge-celebrates-20-years-of-success/.
Jacobs, C. , & Kelly, W. (2008). Smogtown: The Lung-Burning History of Pollution in Los Angeles. Abrams Press.
Loukaitou-Sideris, A. , Handy, S. , Ong, P. , Barajas, J. , Wasserman, J. , Pech, C. , Garcia Sanchez, J. , Ramirez, A. , Jain, A. , Proussaloglou, E. , Nguyen, A. , Turner, K. , Fitzgibbon, A. , Kaeppelin, F. , Ramirez, F. , & Arenas, M. (2023). The implications of freeway siting in California: Four case studies on the effects of freeways on neighborhoods of color. UCLA: Institute of Transportation Studies. Retrieved from https://escholarship.org/uc/item/7mj2b24q.
McKay, J. (November 13, 2019). Transport or mobility: What's the difference and why does it matter? Retrieved from https://www.forumforthefuture.org/blog/transport-or-mobility#:~:text=Transportation%20(%E2%80%9Cacross%2Dcarry%E2%80%9D,mobility%20is%20something%20you%20have.
National Geographic Society. (2022). The History of Cities. Retrieved from https://education.nationalgeographic.org/resource/history-cities/.
Saha, L. , Kumar, A. , Kumar, S. , Korstad, J. , Srivastava, S. , & Bauddh, K. (2022). The impact of the COVID-19 lockdown on global air quality: A review. Environmental Sustainability (Singapore). Retrieved from https://doi.org/10.1007/s42398-021-00213-6
Schneider, B. (September 6, 2018). CityLab University: Induced demand. Bloomberg. Retrieved from https://www.bloomberg.com/news/articles/2018-09-06/traffic-jam-blame-induced-demand.
Walker, J. (January 26, 2011). Transit's product: Mobility or access? Human Transit. Retrieved from https://humantransit.org/2011/01/transits-product-mobility-or-access.html.
Wilson, K. (September 20, 2021). Biden's 'Heat Island' strategy ignores cars. Streetsblog USA. Retrieved from https://usa.streetsblog.org/2021/09/20/bidens-heat-island-strategy-ignores-cars.
Woodhouse, S. (May 9, 2023). Commuters ditched public transit for work from home. Now there's a crisis. Bloomberg. Retrieved from https://www.bloomberg.com/news/articles/2023-05-09/us-public-transit-is-in-crisis-from-washington-to-san-francisco.
United States Environmental Protection Agency . (n.d.). Transportation, Air Pollution, and Climate Change: Carbon Pollution from Transportation. Retrieved September 17, 2023, from https://www.epa.gov/transportation-air-pollution-and-climate-change/carbon-pollution-transportation.

The Future of Advanced Air Mobility and the Role of the Airports

McKinsey and Company, perspectives on advanced air mobility airmobilitypdf.pdf (mckinsey.com).
NASA is creating an advanced air mobility playbook NASA is creating an advanced air mobility playbook—NASA.
Groupe ADP , Volocopter and Groupe ADP at Forefront of Electric Urban Air Mobility (UAM): A World First in Summer 2024. Groupe ADP—Service Presse.
Business Air News, October 26, 2023, Wisk expands AAM influence in Los Angeles. Business Air News.

Los Angeles DOT, Urban air mobility aligns department vision & tactics to design our most preferred future aerial mobility report. LADOT (lacity.gov).

Space Station Architecture Precursor for a Comprehensive Smarter Architectural Design Study

Cohen, Marc M. (2012). The Continuum of Space Architecture from Earth to Orbit (AIAA 2012– 3575). 42nd International Conference on Environmental Systems (ICES). Reston, VI: American Institute of Aeronautics and Astronautics.

Fuller, R. Buckminster . (1963). Ideas and Integrities. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Fuller, R. Buckminster . (1975). Synergetics. New York: Macmillan Publishing Co.

MSFC. (1974, July). Skylab Lessons Learned (NASA TMX-64860). Huntsville, AL: NASA.

MSFC. (1974, Oct). Skylab Mission Report—Saturn Workshop, NASA TMX-64814). Huntsville, AL: NASA.

Schneider, William & Hanes, Thomas [Editors] (1975). The Skylab Results. Advances in the Astronautical Sciences, Vol 31, Parts 1 & 2. Tarzana, CA: American Astronautica Society.

Stokes, Jack W. (1981, May). Comparative Evaluation of Operability of Large Space Structure Connectors, 15th Aerospace Mechanisms Symposium (NASA CP-2181). Washington, DC: NASA.

Ter Haar, G. H. (1978, April). Hatch Latch Mechanism for Spacelab Scientific Airlock, 12th Aerospace Mechanisms Symposium (NASA CP-2080). Washington, DC: NASA.

Mobile Architecture for, with, and by the People

Barnhart, S. 2016. Environmentality. Discard Studies [Online]. Available: https://discardstudies.com/2016/07/27/environmentality/ [Accessed 17 Jan 2024].

CISCO. 2013. The Internet of Everything—Global Public Sector Economic Analysis [Online]. Available: https://www.cisco.com/c/dam/en_us/about/business-insights/docs/ioe-value-at-stake-public-sector-analysis-faq.pdf [Accessed 19 Jan 2024].

Colman, A. M. 2009. Environmentality. Oxford University Press.

Foucault, M. 1991a. Governmentality. In: Burchell, G. , Gordon, C. & Miller, P. (eds.), The Foucault Effect: Studies in Governmentality. Chicago: University of Chicago Press.

Foucault, M. 1991b. Politics and the study of discourse. In: Burchell, G. , Gordon, C. & Miller, P. (eds.), The Foucault Effect: Studies in Governmentality. Chicago: University of Chicago Press.

Friedman, Y. 1970. L' Architecture Mobile, Centre d'Etudes Architecturales.

Friedman, Y. 2020. L'Architecture Mobile (1958–2020): Vers une cité Conçue par ses Habitants Eux-Mêmes, Eclat (De l').

Gonzalez, C. G. 2020. Migration as reparation: Climate change and the disruption of borders. Loyota Law Review, 16, 401–444.

Harris, L. 2011. Neo(liberal) Citizens of Europe: Politics, scales, and visibilities of environmental citizenship in contemporary Turkey. Citizenship Studies, 15, 837–859.

Heathcote, E. 2022. Yona Friedman (1923–2020) [Online]. EMAP Publishing Limited (The Architectural Review). Available: https://www.architectural-review.com/essays/reputations/yona-friedman-1923-2020 [Accessed 14 Jan 2024].

Lawrence-Zuniga, D. 2017. Space and Place [Online]. Available: https://www.oxfordbibliographies.com/view/document/obo-9780199766567/obo-9780199766567-0170.xml [Accessed 15 Jan 2024].

Leonard, L. 2013. Ecomodern discourse and localized narratives: Waste policy, community mobilization and governmentality in Ireland. In: Campos, M. J. Z. & Hall, C. M. (eds.) Organising Waste in the City: International Perspectives on Narratives and Practices. Bristol: Policy Press.

Moore, S. A. 2012. Garbage matters: Concepts in new geographies of waste. Progress in Human Geography, 36, 780–799.

PCA. 2017. Exploiting the Revolutionary Potential of Technology? [Online]. PCA-Stream. Available: https://www.pca-stream.com/en/articles/yona-friedman-architecture-for-the-living-122 [Accessed 14 Jan 2024].

Piroozfar, P. & Farr, E. R. P. 2013. Evolution of nontraditional methods of construction: 21st century pragmatic viewpoint. Journal of Architectural Engineering, 19, 119–133.

Rudofsky, B. 1987. Architecture Without Architects: A Short Introduction to Non-pedigreed Architecture, University of New Mexico Press.
Sadler, S. 1998. The Situationist City, MIT Press.
Sassen, S. 2016. A massive loss of habitat: New drivers for migration. Sociology of Development, 2, 204–233.
Seonwook, K. & Pyo, M. Y. 2012. Mobile Architecture, Dom Publishers.
The Editors of Encyclopaedia Britannica . Invalid Date. Intension and Extension [Online]. Encyclopedia Britannica. Available: https://www.britannica.com/topic/intension [Accessed 14 Jan 2024].
Wachsmann, K. , Grüning, M. & Sumi, C. 1930. Building the Wooden House: Technique and Design. Birkhäuser.

Simulation-Driven Eco-Social Design

Block, P. (2016). “Parametricism’s structural congeniality”. Parametricism 2.0. Rethinking Architecture’s Agenda for the 21st Century. AD Vol. 86, 02/2016. pp. 68–75.
Bolojan, D. (2022). “Creative AI. Augmenting design potency”. Machine Hallucinations. Architecture and Artificial Intelligence. AD Vol. 92, 03/2022. pp. 22–27.
Coates, P. and Derix, C. (2014). “The deep structure of the picturesque”. Emphatic Spaces. The Computation of Human-Centric Architecture. AD Vol. 84, 05/2014. pp 32–37.
Del Campo , M. and Leach, N. (2022). “Can machines hallucinate architecture? AI as design method”. Machine Hallucinations. Architecture and Artificial Intelligence. AD Vol. 92, 03/2022. pp. 6–13.
Gramazio, F. , Kohler, M. and Willmann, J. (2014). “Authoring robotic processes”. Made by Robots. Challenging Architecture at a Larger Scale. AD Vol. 84, 03/2014. pp. 14–21.
Koh, I. (2022). “Architectural plasticity. The aesthetics of neural sampling”. Machine Hallucinations. Architecture and Artificial Intelligence. AD Vol. 92, 03/2022. pp. 86–93.
Mazé, R. and Redström, J. (2007). “Difficult forms. Critical practices of design and research”. Research Design Journal. Vol. 1/09, pp. 28–39.
Pelkonen, E. et al (2011). Kevin Roche: Architecture as environment. New Haven: Yale University Press with Yale School of Architecture.
Schumacher, P. (2012). The autopoiesis of architecture Vol. II. A New agenda for architecture. Chichester: Wiley & Sons Ltd.
Schumacher, P. (2014). “Tectonic articulation. Making engineering logics speak”. Future Details. AD Vol. 84, 04.2014, pp. 44–51.
Schumacher, P. (2023). Tectonism. Architecture for the twenty-first century. Melbourne: The Images Publishing Group Pty Ltd.
Simon, H. A. (1956). “Rational choice and the structure of the environment”. Psychological Review, Vol. 63(2), pp. 129–138.
Soules, M. (2021). Icebergs, zombies, and the ultra thin—architecture and capitalism in the twenty-first century. New York: Princeton Architectural Press.
Tafuri, M. (1974). “L’Architecture dans le Boudoir: The Language of Criticism and the Criticism of Language”. Oppositions, Vol. 3, pp. 291–316.
Thackara, J. (1988). “Beyond the object in design”. Design after modernism. New York: Thames and Hudson, pp. 11–34.
Willis, C. (1995). Form follows finance. Skyscrapers and skylines in New York and Chicago. New York: Princeton Architectural Press.
Woudhuysen, J. and Abley, I. (2004). Why is construction so backward? Chichester: John Wiley & Sons Ltd.
Zylinska, J. (2020). AI art. Machine visions and warped dreams. London: Open Humanities Press.

Smart Prototyping: From Data-Driven Mass-Customization to Community-Enabled Co-Production

Barberio, M. , Colella, M. , Figliola, A. , & Battisti, A. (Eds.). (2023). Architecture and Design for Industry 4.0: Theory and Practice. Springer Cham. https://doi.org/10.1007/978-3-031-36922-3
Beaudouin-Lafon, Michel , & Mackay , Wendy E. (2007). Prototyping tools and techniques. In The Human-Computer Interaction Handbook (pp. 1043–1066). CRC Press.

Chang, T.-W. , Hsiao, C.-F. , Chen, C.-Y. , & Huang , H.-Y. (2020, Jan 1). CoFabs: An interactive fabrication process framework. In P. F. Yuan , M. Xie , N. Leach , J. Yao , & X. Wang (Eds.), Architectural Intelligence,(pp. 271–292). Singapore: Springer Nature Singapore Pte Ltd https://doi.org/10.1007/978-981-15-6568-7_17

Eissen, K. (1990). Presenting Architectural Designs: Three-Dimensional Visualization Techniques. London: Architecture Design and Technology Press.

Frampton, K. , Kolbowski, S. , & Studies, I. F. (1981). Idea as Model. New York: Institute for Architecture and Urban Studies: Rizzoli International Publications.

Hoffman, D. L. , & Novak, T. P. (2018) Consumer and object experience in the internet of things: An assemblage theory approach. Journal of Consumer Research, 44(6), 1178–1204.

Jahn, G. , Newnham, C. , & van den Berg, N. (2022). Augmented reality for construction from steam-bent timber. In: CAADRIA Proceedings. CAADRIA 2022: Post-Carbon. CAADRIA. https://doi.org/10.52842/conf.caadria.2022.2.191.

Jahn, G. , Newnham, C. , van den Berg, N. , Iraheta, M. , & Wells, J. (2020). Holographic construction. In: C. Gengnagel , O. Baverel , J. Burry , M. Ramsgaard Thomsen & S. Weinzierl (Eds.), Impact: Design with All Senses. DMSB 2019. Cham: Springer. https://doi.org/10.1007/978-3-030-29829-6_25.

Kent, L. , Snider, C. , Gopsill, J. , & Hicks, B. (2021). Mixed reality in design prototyping: A systematic review. Design Studies, 77, 101046. https://doi.org/10.1016/j.destud.2021.101046

Khasraghi, S. S. , & Mehan, A. (2023). Glocalization challenges and the contemporary architecture: Systematic review of common global indicators in Aga Khan Award's winners. Journal of Architecture and Urbanism, 47(2), 135–145.

Kolarevic, B. (2003). Architecture in the Digital Age: Design and Manufacturing. New York: Spon Press.

Lauff, C. A. , Kotys-Schwartz, D. , & Rentschler, M. E. (2018). What is a prototype? What are the roles of prototypes in companies? Journal of Mechanical Design, 140(60). https://doi.org/10.1115/1.4039340

Li, B. , Hou, B. , Yu, W. , Lu, X. , & Yang, C. (2017). Applications of artificial intelligence in intelligent manufacturing: A review. Frontiers of Information Technology & Electronic Engineering, 18(1), 86–96. https://doi.org/10.1631/fitee.1601885

Mann, S. , Feiner, S. , Harner, S. , Ali, M. A. , Janzen, R. , Hansen, J. , & Baldassi, S. (2015, January). Wearable computing, 3D aug* reality, photographic/videographic gesture sensing, and veillance. In Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction. Association for Computing Machinery, New York, NY, USA (pp. 497–500). https://doi.org/10.1145/2677199.2683590

Mehan, A. , & Mostafavi, S. (2024). Spatial justice through immersive art: an interdisciplinary approach, in Gray, C. , Ciliotta Chehade, E. , Hekkert, P. , Forlano, L. , Ciuccarelli, P. , Lloyd, P. (eds.), DRS2024: Boston, 23–28 June, Boston, USA. https://doi.org/10.21606/drs.2024.302

Mehan, A. , Odour, N. , & Mostafavi, S. (2023). Socio-spatial micro-networks: Building community resilience in Kenya. In: Cheshmehzangi, A. , Sedrez, M. , Zhao, H. , Li, T. , Heath, T. , Dawodu, A. (eds) Resilience vs Pandemics. Urban Sustainability. Singapore: Springer. https://doi.org/10.1007/978-981-99-7996-7_9

Mehan, A. (2023). The role of digital technologies in building resilient communities. Bhumi, The Planning Research Journal, 10(1), 33–40. https://doi.org/10.4038/bhumi.v10i1.92

Mehan, A. , & Mostafavi, S. (2023a). Portcityscapes as liminal spaces: Building resilient communities through parasitic architecture in port cities. In ARCC 2023 Conference Proceeding (pp. 631–639). Architectural Research Centers Consortium, Inc.

Mehan, A. , & Mostafavi, S. (2023b). Navigating AI-enabled modalities of representation and materialization in architecture: Visual tropes, verbal biases, and geo-specificity. Plan Journal, 8(2), 1–16. https://www.doi.org/10.15274/tpj.2023.08.02.6

Mehan, A. , & Mostafavi, S. (2023c). Temporalities and the urban fabric. Co-producing liminal spaces in transitional epochs. UOU Scientific Journal. https://doi.org/10.14198/UOU.2023.6.12

Mehan, A. , & Mostafavi, S. S. (2022). Building resilient communities over time. In Building Resilient Communities Over Time (pp. 1–4). Springer International Publishing. https://doi.org/10.1007/978-3-030-51812-7_322-1

Mostafavi, S. (2021). Hybrid intelligence in architectural robotic materialization (HI-ARM): Computational, fabrication and material intelligence for multi-mode robotic production of multi-scale and multi-material systems. A+ BE| Architecture and the Built Environment, 12, 1–266. https://doi.org/10.7480/abe.2021.12.5799

Mostafavi, S. , Kemper, B. N. , Kretzer, M. , Etemadi, A. , Mahmoud, H. A. , Yaseen, A. , Nabizadeh, M. , Balazadeh, T. , & Chatterjee, S. (2023). Cobotic matters – collaborative robots and discrete assembly design: From stacking to self-interlocking of reciprocal components. In Proceedings of the 28th Conference on Computer Aided Architectural Design Research in Asia (CAADRIA) [Volume 2]. CAADRIA 2023: Human-Centric. CAADRIA. https://doi.org/10.52842/conf.caadria.2023.2.241

Mostafavi, S. , & Mehan, A. (2023). De-coding visual cliches and verbal biases: Hybrid intelligence and data justice. In Diffusions in Architecture: Artificial Intelligence and Image Generators (pp. 150–159). Wiley.

Mostafavi, S. , Mehan, A. , Howell, C. , Montejano, E. , & Stuckemeyer, J. (2024). FabriCity-XR: A phygital lattice structure mapping spatial justice–Integrated design to AR-enabled assembly workflow. In 112th ACSA Annual Meeting Proceedings, Disruptors on the Edge (pp. 180–187). Vancouver, Canada: ACSA Press. https://doi.org/10.35483/ACSA.AM.112.25

Ratti, C. (2012). Open-source architecture (OSArc). Domus Magazine, 961, 1–5.

Sanchez, J. (2021). Architecture for the Commons: Participatory Systems in the Age of Platforms. Routledge.

Sass, L. , & Oxman, R. (May 2006). Materializing design: The implications of rapid prototyping in digital design. Design Studies, 27(3), 325–355.

Sauer, J. , Seibel, K. , & Rüttinger, B. (2010). The influence of user expertise and prototype fidelity in usability tests. Applied Ergonomics, 41(1), 130–140. https://doi.org/10.1016/j.apergo.2009.06.003

Song, Y. , Koeck, R. , & Luo, S. (2021). Review and analysis of augmented reality (AR) literature for digital architectural fabrication. Automation in Construction, 128, 103762. https://doi.org/10.1016/j.autcon.2021.103762.

Taylor, A. G. (2016). Develop Microsoft HoloLens Apps Now (1st ed.). Berkeley, CA: Apress. https://doi.org/10.1007/978-1-4842-2202-7

Tedeschi, M. , & Rochielle Sievert, J. (2024). Spatial justice in design research: A transdisciplinary discourse, in Gray, C. , Ciliotta Chehade, E. , Hekkert, P. , Forlano, L. , Ciuccarelli, P. , Lloyd, P. (eds.), DRS2024: Boston, 23–28 June, Boston, USA. https://doi.org/10.21606/drs.2024.116

Varış Husar, S. C. , Mehan, A. , Erkan, R. , Gall, T. , Allkja, L. , Husar, M. , & Hendawy, M. (2023). What's next? Some priorities for young planning scholars to tackle tomorrow's complex challenges. European Planning Studies, 1–17. https://doi.org/10.1080/09654313.2023.2218417

Virzi, R. A. , Sokolov, J. L. , & Karis, D. (1996). Usability problem identification using both low- and high-fidelity prototypes. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Common Ground - CHI '96. https://doi.org/10.1145/238386.238516

Weichel, C. , Lau, M. , K. D., Villar , N., & Gellersen, H.-W. (2014). MixFab: A mixed-reality environment for personal fabrication. In CHI '14: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Association for Computing Machinery, 3855–3864. https://doi.org/10.1145/2556288.2557090

Wojtowicz, J. (Ed.) (1995). Virtual Design Studio. Hong Kong University Press.

Zhang, Y. , Zhang, G. , Wang, J. , Sun, S. , Si, S. , & Yang, T. (2014). Real-time information capturing and integration framework of the internet of manufacturing things. International Journal of Computer Integrated Manufacturing, 28(8), 811–822. https://doi.org/10.1080/0951192x.2014.900874

Zheng, P. , Wang, H. , Sang, Z. , Zhong, R. Y. , Liu, Y. , Liu, C. , Mubarok, K. , Yu, S. , & Xu, X. (2018). Smart manufacturing systems for industry 4.0: Conceptual framework, scenarios, and future perspectives. Frontiers of Mechanical Engineering, 13(2), 137–150. https://doi.org/10.1007/s11465-018-0499-5

Architecture, Engineering, and Construction (AEC) Industry 4.0 and Beyond

Big Think+ . 2018. Radical vs. disruptive innovation: What they mean for organizations [Online]. Big Think Available: https://bigthink.com/plus/radical-vs-disruptive-innovation-what-they-mean-for-organizations/ [Accessed 3 Nov 2023].

Bower, J. L. & Christensen, C. M. 1995. Disruptive technologies: Catching the wave. Harvard Business Review. Boston, MA: Harvard Business School.

Christensen, C. M. , Raynor, M. E. & Mcdonald, R. 2015. What is disruptive innovation? Harvard Business Review. Boston, MA: Harvard Business School.

Cooper, A. C. & Schendel, D. 1976. Strategic responses to technological threats. Business Horizons, 19, 61–69.

Cote, C. 2020. What is disruptive innovation? [Online]. Harvard Business School. Available: https://online.hbs.edu/blog/post/what-is-disruptive-innovation [Accessed 5 Nov 2023].

Cote, C. 2022. Sustaining vs. Disruptive innovation: What's the difference? [Online]. Harvard Business School. Available: https://online.hbs.edu/blog/post/sustaining-vs-disruptive-innovation [Accessed 4 Nov 2023].

European Commission . 2021. Industry 5.0 [Online]. European Commission Directorate-General for Research and Innovation, Publications Office. Available: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en [Accessed 1 Nov 2023].

Foster, R. N. 1986. Innovation: The attacker's advantage. Summit Books.

Geels, F. W. 2002. Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy, 31, 1257–1274.

Geels, F. W. 2005. The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). Technology Analysis & Strategic Management, 17, 445–476.
Geels, F. W. 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1, 24–40.
Hopp, C. , Antons, D. , Kaminski, J. & Salge, T. O. 2018. What 40 years of research reveals about the difference between disruptive and radical innovation. Harvard Business Review. Harvard Business School.
Khoshnevis, B. 2004. Automated construction by contour crafting—related robotics and information technologies. Automation in Construction, 13, 5–19.
Landry, L. 2020. 3 Types of innovation you should know [Online]. Harvard Business School. Available: https://online.hbs.edu/blog/post/3-types-of-innovation-you-should-know [Accessed 5 Nov 2023].
MathsWorks . 2021. Demystifying industry 4.0 [Online]. Available: https://www.mathworks.com/content/dam/mathworks/white-paper/demystifying-industry-4-0.pdf [Accessed 8 Nov 2023].
Mckinney, P. 2022. Disruptive innovation vs radical innovation: What's the difference? [Online]. Killer Innovation. [Accessed 1 Nov 2023].
Negroponte, N. 1970. The architecture machine, Cambridge, MA, M.I.T. Press.
Rip, A. & Kemp, R. 1998. Technological change. Human Choice and Climate Change, 2, 327–399.
Voltaire, P. V. F.-M. A. 1819. Ouvres Complètes de Voltaire (in French), Paris, P. Plancher.

Nesting Fabrication

Abdelmohsen, S. , & Hassab, A. (2020). A computational approach for the mass customization of materially informed double curved façade panels. In 25th International Conference on Computer-Aided Architectural Design Research in Asia, CAADRIA 2020. The Association for Computer-Aided Architectural Design Research in Asia (CAADRIA), Chulalongkorn University, Bangkok, Thailand, 163–172.
Agustí-Juan, I. , & Habert, G. (2017). Environmental design guidelines for digital fabrication. Journal of Cleaner Production, 142, 2780–2791.
Agustí-Juan, I. , Müller, F. , Hack, N. , Wangler, T. , & Habert, G. (2017). Potential benefits of digital fabrication for complex structures: Environmental assessment of a robotically fabricated concrete wall. Journal of Cleaner Production, 154, 330–340.
Arora, S. K. , Foley, R. W. , Youtie, J. , Shapira, P. , & Wiek, A. (2014). Drivers of technology adoption—The case of nanomaterials in building construction. Technological Forecasting and Social Change, 87, 232–244.
Bertollini, V. (2018) Here's what building the future looks like for a 10-billion-person planet. https://www.autodesk.com/design-make/infographics/building-the-future
Bock, T. (2015). The future of construction automation: Technological disruption and the upcoming ubiquity of robotics. Automation in Construction, 59, 113–121.
Borhani, A. & Kalantar, N. (2020). Interlocking Shell, Transforming a Block of Material into a Self-Standing Structure with No Waste. ACADIA, 226–231.
Borhani, A. & Kalantar, N. (2021). Nesting Fabrication, Using Minimum Material & Production Time to Deliver Nearly Zero-Waste Construction of Freeform Assemblies. ACADIA, 318–327.
Craveiro, F. , Duarte, J. P. , Bartolo, H. , & Bartolo, P. J. (2019). Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0. Automation in Construction, 103, 251–267.
de Soto, B. G. , Agustí-Juan, I. , Hunhevicz, J. , Joss, S. , Graser, K. , Habert, G. , & Adey, B. T. (2018). Productivity of digital fabrication in construction: Cost and time analysis of a robotically built wall. Automation in Construction, 92, 297–311.
Enrique, L. , Cepaitis, P. , Ordoñez, D. , & Piles, C. (2016). CASTonCAST: Architectural freeform shapes from precast stackable components. VLC Arquitectura. Research Journal, 3(1), 85–102.
European Commission (2019). Clean energy for all Europeans package. https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en#:~:text=The%20package%20includes%20a%20robust,NECPs)%20for%202021%2D30.
European Union (2012). Ecodesign your future - Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/4d42d597-4f92-4498-8e1d-857cc157e6db
Farahbakhsh, M. , Borhani, A. , Kalantar, N. , & Rybkowski, Z. (2021). PRINT in PRINT: A nested robotic fabrication strategy for 3D printing dissolvable formwork of a stackable column. In International Conference on Computer-Aided Architectural Design Futures (pp. 317–328). Singapore: Springer Singapore.
Ferriss, L. (2020). The New Net Zero. Boston Society for Architecture. https://www.architects.org/news/the-new-net-zero

Giesekam, J. , Barrett, J. R. , & Taylor, P. (2016). Construction sector views on low carbon building materials. Building Research & Information, 44(4), 423–444.
Hnin, T. (2022). The role of fabrication in construction industry and its significance. https://www.novatr.com/blog/fabrication-in-construction-industry
IEA and UNEP (2018). Global Status Report 2018: Towards a Zero-Emission, Efficient and Resilient Buildings and Construction Sector. http://www.ren21.net/status-of-renewables/global-status-report/.
Iwamoto, L. (2013). Digital Fabrications: Architectural and Material Techniques. Princeton Architectural Press.
Kolarevic, B. (2003). Architecture in the Digital Age: Design and Manufacturing, London: Taylor & Francis Group, 59.
Kongboon, R. , Gheewala, S. H. , & Sampattagul, S. (2022). Greenhouse gas emissions inventory data acquisition and analytics for low carbon cities. Journal of Cleaner Production, 343, 130711.
Kristen, F. & Taron, J. (2019). Waste Ornament: Augmenting the Visual Potency of Sustainable Facade Designs. ACADIA, 90–99.
Kudless, A. (2010). Zero/Fold Screen. https://www.matsys.design/zero-fold-screen/
Lavery, C. (2013). Spencer dock bridge. Concrete International, 35(6), 28–31.
Liebringshausen, A. , Eversmann, P. , & Göbert, A. (2023). Circular, zero waste formwork-Sustainable and reusable systems for complex concrete elements. Journal of Building Engineering, 80, 107696.
Meng, Q. , Hu, L. , Li, M. , & Qi, X. (2023). Assessing the environmental impact of building life cycle: A carbon reduction strategy through innovative design, intelligent construction, and secondary utilization. Developments in the Built Environment, 16, 100230.
Pinkse, J. & Dommisse, M. (2009). Overcoming barriers to sustainability: an explanation of residential 673 builders’ reluctance to adopt clean technologies. Business Strategy and the Environment, 18, 515–527.
Povilas, C. , Enrique, L. , Ordoñez, D. & Piles, C. (2011). Towards Waste-Free Concrete Fabrication Without Conventional Molds. Holcim Foundation. https://www.holcimfoundation.org/about/news/awards/towards-waste-free-concrete-fabrication-without-conventional-mol
Resch, E. , Lausselet, C. , Brattebø, H. , & Andresen, I. (2020). An analytical method for evaluating and visualizing embodied carbon emissions of buildings. Building and Environment, 168, 106476.
United Nations, Department of Economic and Social Affairs (2017). World Population Prospects 2050. https://www.un.org/en/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100.
Wikipedia (2024). Gaussian Curvature. Wikimedia Foundation, last modified 13 March, 2024 . https://en.wikipedia.org/wiki/Gaussian_curvature
Zuuk, R. (2016). Re-Settle Studio. https://www.renevanzuuk.nl/re-settlestudio

Human-Robot Reconfigurations

Amtsberg, F. , Yang, X. , Skoury, L. , Ron, G. , Kaiser, B. , Sousa Calepso , A., Sedlmair, M. , Verl, A. , Wortmann, T. , Menges, A. (2023) Multi-Akteur-Fabrikation im Bauwesen: Co-Design-Methoden für eine anpassungsfähigere Vorfabrikation. Bautechnik. https://doi.org/10.1002/bate.202300070
Amtsberg, F. , Yang, X. , Skoury, L. , Wagner, H. , Menges, A. (2021) iHRC: An AR-based interface for intuitive, interactive and coordinated task sharing between humans and robots in building construction. In Proceedings of the 38th International Association for Automation and Robotics in Construction Conference (ISARC), Dubai, UAE. 25–32 https://doi.org/10.22260/ISARC2021/0006
Åsberg, C. , Lykke, N. (2010) Feminist technoscience studies. European Journal of Women’s Studies, 17(4), 299–305.
Bardzell, S. (2010) Feminist HCI: Taking Stock and outlining an agenda for design. In CHI ‘10: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, April 2010. 1301–1310. https://doi.org/10.1145/1753326.1753521
Boeva, Y. , Wortmann, T. , Kropp, C. , Menges, A. (2022) Architectural computing and design optimization for healthful Ecotopian built environments? In Kanaani, M. (Ed.), The Routledge Companion on Intelligent Design Paradigms for a Smart Planet: Visions for the Future of Design Culture in Architecture & Urbanism. New York: Routledge. https://doi.org/10.4324/9781003183181-33
D'Ignazio, C. , Klein, L. F. (2020) Data Feminism. Boston: The MIT Press. ISBN: 9780262547185
Hermann, M. , Pentek, T. and Otto, B. (2016) Design Principles for Industrie 4.0 Scenarios. Proceedings of 49th Hawaii International Conference on System Sciences HICSS, Koloa, 5-8 January 2016, 3928–3937. https://doi.org/10.1109/HICSS.2016.488
Javaid, M. , Haleem, A. , Singh, R. P. , Suman, R. (2021) Substantial capabilities of robotics in enhancing industry 4.0 implementation. Cognitive Robotics, 1, 58–75. https://doi.org/10.1016/j.cogr.2021.06.001

Kaiser, B. , Reichle, A. , Verl, A. (2022) Model-based automatic generation of digital twin models for the simulation of reconfigurable manufacturing systems for timber construction. In Proceedings of the 55th CIRP Conference on Manufacturing Systems, pp. 387–392. https://doi.org/10.1016/j.procir.2022.04.063
Knippers, J. , Kropp, C. , Menges, A. , Sawodny, O. , Weiskopf, D. (2021) Integrative computational design and construction: Rethinking architecture digitally. Civil Engineering Design, 3, 123–135. https://doi.org/10.1002/cend.202100027
Kumar, S. , Savur, C. , Sahin, F. (2021) Survey of human–robot collaboration in industrial settings: Awareness, intelligence, and compliance. IEEE Transactions on Systems, Man, and Cybernetics: Systems, 51(1), 280–297. https://doi.org/10.1109/TSMC.2020.3041231
Kyjanek, O. , Al Bahar, B. , & Vasey, L. , Wannemacher, B. , Menges, A. (2019). “Implementation of an Augmented Reality AR Workflow for Human Robot Collaboration in Timber Prefabrication.” 2019 Proceedings of the 36th ISARC. Banff: The International Association for Automation and Robotics in Construction. 1223–1230. https://doi.org/10.22260/ISARC2019/0164
Latour, B. (2005) Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford and New York: Oxford University Press. ISBN: 9780199256051.
Lauer, A. P. R. , Benner, E. , Stark, T. , Klassen, S. , Abolhasani, S. , Schroth, L. , Gienger, A. , Wagner, H. J. , Schwieger, V. , Menges, A. , Sawodny, O. (2023) Automated on-site assembly of timber buildings on the example of a biomimetic shell. Automation in Construction, 156, 105118. ISSN 0926–5805, https://doi.org/10.1016/j.autcon.2023.105118.
Liao, Y. , Loures, E. R. , Deschamps, F. , Brezinski, G. , Venâncio, A. (2017) The impact of the fourth industrial revolution: A cross-country/region comparison. Production, 28, e20180061. https://doi.org/10.1590/0103-6513.20180061
Machado, C. F. , Davim, J. P. (2023) Industry 5.0: Creative and Innovative Organizations. Ed. Machado, C. F. , Davim, J. P. , Cham: Springer Nature. pp: v–vii. ISBN 3031262328
Müller, S. L. , Shehadeh, M. A. , Schröder, S. , Richert, A. , Jeschke, S. (2018) An overview of work analysis instruments for hybrid production workplaces. AI & Society, 33(3), 425–432.
Rosner, D. (2020) Critical Fabulations: Reworking the Methods and Margins of Design (1st ed.). Boston, MA: MIT Press. ISBN 9780262542685.
Skoury, L. , Amtsberg, F. , Yang, X. , Wagner, H.J. , Menges, A. , Wortmann, T. (2022) A framework for managing data in multi-actor fabrication processes. In: Gengnagel, C. , Baverel, O. , Betti, G. , Popescu, M. , Thomsen, M.R. , Wurm, J. (Eds.), Towards Radical Regeneration. DMS 2022. Cham: Springer. https://doi.org/10.1007/978-3-031-13249-0_47
Sousa Calepso, A. , Fleck, P. , Schmalstieg, D. , Sedlmair, M. (2023) Exploring Augmented Reality for Situated Analytics with Many Movable Physical Referents. In Proceedings of the 29th ACM Symposium on Virtual Reality Software and Technology. pp 1–12. https://dl.acm.org/doi/pdf/10.1145/3611659.3615700
Suchman, L. (2007) Human-Machine Reconfigurations: Plans and Situated Actions (2nd ed.) Cambridge: Cambridge University Press. https://doi.org/10.4018/978-1-61520-813-5
United Nations Environment Programme (2022) 2022 Global Status Report for Buildings and Construction: Towards a Zeroemission, Efficient and Resilient Buildings and Construction Sector. Nairobi. ISBN: 978–92–807–3984–8
Vasey, L. & Grossman, T. , Kerrick, H. , Nagy, D. (2016) The Hive: A Human and Robot Collaborative Building Process. ACM SIGGRAPH 2016 Talks (SIGGRAPH ‘16), 1–2. https://doi.org/10.1145/2897839.2927404
Wajcman, J. (2004) Technofeminism. Cambridge: Cambridge University Press. Doi: ISBN-13978–0745630441.
Weiss, A. , Wortmeier, A. K. , Kubicek, B. (2021) Cobots in industry 4.0: A roadmap for future practice studies on human–robot collaboration. IEEE Transactions on Human-Machine Systems, 51, 335–345. https://doi.org/10.1109/THMS.2021.3092684
Winkle, K. , McMillan, D. , Arnelid, M. , Harrison, K. , Balaam, M. , Johnson, I. (2023) Feminist human-robot interaction: Disentangling power, principles and practice for better, more ethical HRI. In Proceedings of the Conference on Human-Robot Interaction (HRI ’23), March 13–16, 2023, Stockholm, Sweden. New York: ACM, 11 pages. https://doi.org/10.1145/3568162.3576973
Yang, X. , Amstberg, F. , Skoury, L. , Wagner, H. J. , Menges, A. (2022) VIZOR: Facilitating cyber-physical workflows in prefabrication through augmented reality. In “POST-CARBO”: Proceedings of the 27th International Conference of the Association for Computer Aided Architectural Design Research in Asia (CAADRIA), Hong Kong, Vol. 2, 141–150. https://doi.org/10.52842/conf.caadria.2022.2.141
Yang, X. , Sousa Calepso, A. , Amtsberg, F. , Menges, A. , Sedlmair, M. (2023) Usability Evaluation of an Augmented Reality System for Collaborative Fabrication between Multiple Humans and Industrial Robots. In: Proceedings of the 2023 ACM Symposium on Spatial User Interaction (SUI ’23). pp. 1–10. https://doi.org/10.1145/3607822.3614528
Young, J (2020) Feminist design tool: Defensible decision making for interaction design and AI. https://ugc.futurelearn.com/uploads/files/16/b0/16b088ad-6145-45eb-b5d8-3753a41b4b88/2-

10_FeministDesignTool_2.0.pdf

Zimmerman, M. , Bagchi, S. , Marvel, J. , Nguyen, V. (2022) An analysis of metrics and methods in research from human-robot interaction conferences, 2015–2021. In Proceedings of the 2022 ACM/IEEE International Conference on Human-Robot Interaction (HRI ’22). Sapporo, Hokkaido, Japan: IEEE Press, 644–648.