International Conference for
Sustainable Design of the
Built Environment
SDBE 2017

Abstracts
Foreword

The International Conference for Sustainable Design of the Built Environment SDBE 2017 forms one of the key deliverables of the British Council Newton Institutional Links Fund project: Building Capacity for Sustainable Development of the Built Environment (BC-SDBE) launched in April 2016. The aim of the BC-SDBE institutional link project is to bridge the gap between the rapidly developing advancements in research and training in sustainable development of the built environment globally, the demanding professional development required in Egypt’s construction labour market, and the national plans for the country’s economic development. The main objective of BC-SDBE project is to build capacity in education, research, innovation, and exploitation of state-of-the art sustainable development strategies to help promote and sustain socio-economic growth in Egypt.

SDBE 2017 conference offered a unique opportunity for academics, researchers, architects, urban designers, engineers, and professionals to meet and share the latest knowledge, research and innovations on low carbon building design, building performance, simulation tools and energy efficient building-related technologies. The conference focuses on sustainable design, building energy performance, sustainable planning of neighbourhoods and cities, emphasising a balanced approach to environmental, socio-economic and technical aspects of sustainability. The topics extend to include innovative approaches for education and training on sustainability of the built environment. The conference also raises awareness to state-of-the-art strategies and best practice across the world with regards to integrating sustainable development approaches in the built environment.

The book of abstracts includes all 106 papers accepted for the conference under 12 themes clustered into 6 thematic groupings. The full conference proceedings are available to download at http://newton-sdbe.uk/conferences/sdbe-conference-2017/

On behalf of the SDBE 2017 Organising Committee, I hope the research papers hereby presented help stimulate further ideas for research in the near future.

We would also like to take this opportunity to invite you to submit abstracts to the second SDBE 2018.

Yours sincerely,

Heba Elsharkawy, BC-SDBE Principal Investigator
Scientific Committee:

Prof. Hassan Abdalla, University of East London
Dr. Wael Abdelhameed, University of Bahrain
Prof. Ahmed Abdin, Cairo University
Prof. Khalifa Al-Jabri, Sultan Qaboos University
Dr. Chaham Alalouch, Sultan Qaboos University
Prof. Ayman Ashour, Ain Shams University
Prof. Suzette Aziz, Arab Academy for Science, Technology & Maritime Transport
Dr. Isnin Can, İzmir Institute of Technology
Mr. Alan Chandler, University of East London
Dr. Stuart Connop, University of East London
Dr. Mihaela Anca Ciupala, University of East London
Mr. Jack Clough, University of East London
Dr. Ranjith Dayaratne, University of Bahrain
Prof. Khaled Dewidar, British University in Egypt
Dr. Bahar Durmaz Drinkwater, İzmir University of Economics
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Prof. Omar El-Husseiny, Ain Shams University
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Dr. David Grierson, University of Strathclyde

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Dr. Anastasia Karandinou, University of East London
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Prof. Ahmed Rashed, British University in Egypt
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Prof. Ashraf Salama, University of Strathclyde
Ms. Maria Segantini, University of East London
Prof. Zeinab Shafik, Cairo University
Prof. Steve Sharples, University of Liverpool
Prof. Lobna Sherif, Arab Academy for Science, Technology & Maritime Transport
Prof. Nagwa Sherif, American University in Cairo
Dr. Sahar Zahiri, University of East London
Keynote speakers:

Prof. Brian Ford, Emeritus Professor, University of Nottingham
Prof. Rajat Gupta, School of Architecture, Oxford Brookes University
Mr. Mark Jenkinson, City of London Director, Siemens
Prof. Philip Jones, Welsh School of Architecture, Cardiff University
Mr. Bruno Moser, Head of Urban Design, Foster and Partners
Prof. Fergus Nicol, London Metropolitan University
Prof. Steve Sharplees, School of Architecture, University of Liverpool
Mr. Charles Walker, Director Zaha Hadid Architects

Editors:

Dr. Heba Elsharkawy
Dr. Sahar Zahiri
Mr. Jack Clough
## International Conference for Sustainable Design of the Built Environment 2017 - The Crystal, London

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- Sustainable Construction and Technology
- Bioclimatic and Passive Design
- Energy Efficiency in Buildings
- Renewable Energy Technologies
- Building Simulation and Building Information Modelling (BIM)
- Building Performance Evaluation (BPE)
- Innovative Didactics for Sustainable Development

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### Themes

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- Sustainable Construction Technology
- Zero and Low Carbon Design
- Building Simulation and Building Information Modelling (BIM)
- Building Performance Evaluation (BPE)
- Education for Sustainability
- Energy efficiency in Buildings
- Indoor Environmental Quality (IEQ), Health and Wellbeing
- Post Occupancy Evaluation (POE)
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## Chapter 1: Education for sustainability and Innovative didactics for sustainable development

### Education for Sustainability

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Education for sustainability
Innovative didactics for sustainable development
Striving for Sustainability; A staff and student approach

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Abstract: As educators, we are acutely aware of the need for the future generations to be interested in and design for sustainability. With changing climate and increased consumer awareness, the role of architectural design is becoming increasingly essential to reduce carbon and our footprint on the planet. We design into the Architectural Technology curriculum a variety of methods for learning about low energy design including activity led learning at year 1 and BREEAM accreditation at year 2, however how successful and inspirational has this been from the student perspective? This paper will look at and analyse the impact of both activity led learning and traditional lecture methods to investigate the impact on students thinking on their overall awareness and incorporation of sustainability into their design projects, together with learning points from both sides.

Keywords: Education, Sustainable design, Architectural Technology, Activity led learning
Establishing an Approach to Develop a Curriculum of Sustainability in Landscape Architecture in Saudi Arabia
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Abstract: Embedding concepts and practices of sustainability into curriculums of higher education programs is a topic gaining momentum. Throughout the different parts of the world attention with varying degree to the subject is increasing. While most of the attention and work has been directed towards the practices and operations of the institutions, a significant effort has been made to address issues relating to curricula, students and pedagogy. This paper aims to review some of the efforts concerning embedding sustainability concepts and practices in the curriculum of higher education programs in general and in the curriculum of professions dealing with the built environment in particular: namely, landscape architecture. A review the landscape architecture program at King Abdulaziz University in Jeddah Saudi Arabia against the findings will then take place to assess the program from the perspective of sustainability. Furthermore, an outline of an approach to review and assess curriculums of design and landscape architecture will be put forth. Finally, discussion and conclusions will be highlighted for the future development of curriculums in the fields of environmental design will be presented.

Keywords: Landscape Architecture, Sustainability, Curriculum, Saudi Arabia
Photography for nourishing visual skills in urban design programme: A Pedagogical module

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Abstract: Notwithstanding its regular presence in educational and professional documents, urban design is quite a vague term, practised differently by different groups in different circumstances. One of the most crucial matter is how a city looks and how its spaces are designed, this makes a body-base superimposed on what range of possible sensations can be thought about, evaluated and achieved. Regardless, the concept of urban design as nice images, the urban Architecture of cities comes in accumulative order and creates a visual excitement which gives meaning to the locations concerned. The extent to which students of urban design be schooled the context that can be seen outside the windows. This work focuses on the pedagogical method that documents the public realm by promoting students through learning the photography in urban design programmes to investigate everyday events that form public life. The picturing commuting could be guided by digital photography, archival research and critical thinking analysis. To contrive a kind of change, a module structure may come for the task of urban design as a field of professional practice to have a varied, integrated and transitioning role with different disciplines such as photography for raising the visual skills and boosting the way that students see their external environment. Moreover, the methods and techniques of urban design need to be extended to the unlimited borders of teaching various skills. The results stem from the reports of students’ feedback, as well as the course instructor’ comments and expert interviews. The conclusion is that urban design, as a visual-aesthetic management, can benefit from a method for module revisited that provides themes for photography to boost the skills that students should gain.

Keywords: Photography, urban design, critical thinking, visual thinking, pedagogy
Building Capacity for Sustainable Development of the Built Environment in Egypt: Challenges and Opportunities

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Abstract: The Sustainable Development Strategy (SDS) for Egypt has been recently introduced with three main goals to be achieved by 2030; economic development, competitiveness of markets and human capital. Hence, education for sustainable development in the Egyptian educational system is paramount. The building industry is considered one of the largest industries in Egypt, contributing with 34 per cent of the total National Gross Income, requires strategic planning to ensure principles of sustainability are learnt and applied in this key and dynamic sector. Building Capacity for Sustainable Development of the Built Environment (BC-SDBE) project proposes a viable framework for achieving sustainability in the built environment supported by proactive participation of stakeholders in built-environment-related disciplines. This is in the form of stakeholder workshops and a skills gap survey to outline the specific needs and demands in the construction labour market and the roadmap to achieve SDS objectives.

The paper presents the findings from the stakeholders’ skills-gap survey undertaken to identify the current gaps in the construction sector in Egypt concerning sustainability. The survey questionnaire distributed to professionals, academics, researchers and students in the construction sector aims to gauge the level of education and training achieved at pre and post professional levels. The results are presented and discussed in the first stakeholders’ consultation workshop where academics, professionals and researchers in the built environment were invited to contribute. The outcome is to develop in-depth understanding of opportunities and challenges for the integration of sustainability in the built environment in education and practice in Egypt.

Keywords: Education for Sustainability, Sustainable development, Education, Training, Egypt
Education with (in) practice: Reducing the gap between architectural practice and education

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Abstract: At the Faculty of the Built Environment (FoBE), as with other Architecture or Engineering programmes, students at the end of a particular year are required to find a site on which to undertake Industry Placement. Over the years though, following assessment of student work and observation on subsequent tasks it was evident that students did not necessarily acquire the knowledge, gain the skills nor develop the expected dispositions. This is mainly because not all sites or potential site managers are organised enough, resourced adequately or capacitated to make the student site experience gainful. Studies reveal that an icebreaker is in the extension of learning to involve the practicing architect in strategic ways. In the academic year 2016/17 the FBE pioneered an alternative approach on the Field Experience (Industry Placement) course where three practices embraced the idea of hosting site-based workshops. Preliminary feedback suggests that this approach is a more gainful learning experience. The participation in site meetings, site walks; and later a closer engagement with key members of the project team has proven useful. The expectation to do more research while visiting other sites of one’s choice in order to contrast key lessons has given the students an impetus to constantly reflect on their learning as opposed to the passive attitude that was observed in previous years. In addition, peer-to-peer workshops were organised and during these each group was expected to facilitate a session as another way of clarifying key concepts amongst themselves. In terms of architecture detailing and getting to grips with construction, each student was expected to submit iterations of their thoughts in journals and build both CAD and physical models. Students continue to struggle with building construction, reading scales and scaling building construction components. In future, it is planned that more targeted and frequent visits will bridge the gaps overall.

Keywords: Practice, Education, Site, Workshops.
Integration Of Sustainable Design Education in to Architectural Design Departments and Implementation Proposals in Studio/Project Courses

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Abstract: Sustainability can be described as an inclusive concept which is developed and proposed as an answer for social and environmental problems. Nowadays, while transforming into sustainable culture gains vital importance, field of architecture should not only be evolved in terms of professional practice, but also should be improved and transformed in means of education to include sustainable design criteria. One of the main aspects of this required transformation is the transformation in teaching and learning methods. Problem Based Learning approach is being used in many undergraduate programs of many different fields and is proposed by many researchers to integrate sustainability criteria into curricula. This paper consists using of Problem Based Learning principles within the scope of sustainable design in an architectural design project/studio course. According to findings of this paper, proposal has been put into practice in a studio/project course and the success of proposal was measured by analyzing student projects.

Keywords: Architectural design education, Sustainable Design, Problem Based Learning

Paper 173
Sustainability and Transformational Education: Reflections on Architectural Education in East Africa

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Abstract: Across East Africa, sustainability in architectural education is still viewed with a heavy dose of scepticism, and not been fully embraced as a means to engage with the developmental needs of the region. It is often viewed as a hindrance to development, rather than a means to better engage with the diverse socio-economic factors that are perceived to constrain architecture practice. Sustainability itself is taken as a technoscientific endeavour, unrelated to social-cultural or political issues. This view of sustainability has restricted its uptake, and the growth in knowledge and restricts the implementation of sustainable practices in contemporary architecture, in turn influencing the approach taken by students, who look at the state of practice as a benchmark for engagement with these issues. In rethinking engagement with discourse on sustainability, there is a need to transcend deep rooted socio-political and ideological factors that have determined how sustainability is viewed, and defined its place in architecture and architecture education. As part of a catalyst for transformation in architectural education, and with increasing calls to transform societies and to decolonise education across East Africa, can the sustainability paradigm respond to these transformational challenges? This paper reflects on these issues as part of continuing discourse and research on tropical modernism and educational pedagogy. Through experiences of ongoing developments in architectural education, ideas of sustainability and its place in the architecture curriculum in East Africa are explored.

Keywords: Architectural education, Decolonise, Sustainability, Transformational education, Unlearning
Vernacular Neighbourhoods as Models for Socially-Sustainable Vertical Cities: A Computational Approach

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Abstract: The Middle East and North Africa (MENA) region has one of the world’s most rapidly expanding urban population. This issue has dramatic impacts on the built environment and increases the need for constructing sustainable vertical buildings. However, most recent developments in the study area have focused on utilising technology and have ignored the potential of incorporating social needs and cultural values. Information gained from a post-occupancy evaluation for contemporary apartment buildings in MENA region show that there are several problems affected the social life of residents. These include lower levels of social support, lower sense of community and familiarity with neighbours, and impacts on children as parents keep them inside apartments due to safety concerns and difficulties of supervision at a distance. Moreover, the excessive use of glazed facades and the standardization of floors destructed the privacy of the family and the identity of each unit. In contrast, vernacular neighbourhoods in the study area represent a successful example of a socially cohesive and healthy environment. For instance, the hierarchical configuration of public spaces and private courtyards allow for a high degree of social interaction between families, and at the same time maintain their privacy. This research aims to benefit from potentials of such horizontal clusters for generating socially-sustainable tall residential buildings that trace the cultural values of the society. Spatial analysis of various traditional neighbourhoods was adopted as a rigorous method for understanding the layout complexity and discovering logical topologies that have social or experiential significance. Using principles of shape grammar, results extracted from the analytical process, associated with specific requirements for vertical buildings, were used to identify sets of parametric rules that combine geometrical properties of spaces with aspects that enhance the social life of residents. Samples of potentially sustainable social solutions, generated by a computational tool, are presented.

Keywords: Tall Residential Buildings, Social Sustainability, Courtyards, Spatial Reasoning, Parametric Grammars
"Reimaging sustainable design" A critical comparative analysis for sustainable design approaches and results

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Abstract: This paper aims to re-image the understanding of sustainable design practice. It classifies sustainable design philosophy in the built environment into two approaches of different results. The first approach is of quantitative measurements i.e. points of design that can achieve measurable credit points. The second approach is a qualitative one that seeks qualitative values of design such as beauty, social respect, physiological comfort and other similar points. The research will introduce two terms under which sustainable design approaches can be classified. The first term will be introduced as quantitative approach for sustainable design and assessment (QN.A.S) and the other will be qualitative approach for sustainable design and assessment (QL.A.S). The reason for this classification is that sustainable design criticism rating systems are mostly based on quantitative scores with less regard to qualitative aspects and variables. Through this new classification the research would offer scientific possibilities to re-evaluate sustainable current design practice results; and through comparative analysis the research will offer two complementary models for the values of sustainable design quantitatively and qualitatively which can end with a new vision for criticizing sustainable products.

Keywords: Sustainable design, Qualitative sustainability, sustainability criticism
Defining the Characteristics of Design Process Models as a Basis for Proposing a More Sustainable Integrative Approach

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Abstract: Current architectural design process has proved unsustainable when it comes to coordinating various tasks among the different disciplines. Even sustainable architecture approaches- which largely advocate the need for an integrative process- have no explicit recorded evidence in extent literature with regards to the associated process. Sustainable architectural design has mainly been associated with the final product, i.e. the building, rather than the integrative process. Based on the concept of a sustainable building requires a sustainable process; this research introduces a comprehensive critical analysis of current design processes to determine and define major characteristics of an integrative design process.

Keywords: Design process model, Architectural design, Integrative design process
Learning to improve: An investigation of quality management routines in UK housing development

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Abstract: In the UK, housing demand outstrips supply. The number of new homes is increasing but there is a substantial shortfall. In 2016, a parliamentary inquiry investigated the quality and workmanship of new English homes. It found that, as housing output increased, the quality of workmanship, levels of customer satisfaction and dwelling performance fell. This has particular consequences for sustainability targets. This paper explores dwelling performance from a new perspective. Rather than focusing on monitoring new homes in use to assess any performance gap, it investigates how, upstream, a UK volume house builder is learning to eliminate defects through implementing a new quality management routine.

This qualitative study of three regional offices within a large UK volume house builder organisation uses the following methods: document analysis of quality management routines and related standard operating procedure literature; semi-structured interviews with staff; and participant observation of daily work practices across multiple teams.

By developing a new multi-level framework, analysis suggests that there are four simultaneous learning cycles in operation at Individual, Team, Regional and Organizational levels. Social interactions at each level generate new shared learning, drive each learning cycle and link levels together. Time, communication and trust issues create disconnects between the levels, positively and negatively affecting learning cycles around the new quality management routine, with implications for new dwelling performance. This study adds rich qualitative, multi-level, empirical evidence to the current organisational learning literature in an under-researched sector of the construction industry.

Keywords: organizational learning, multi-level learning, performance gap, housing, qualitative research
Framework for capacity based sustainable design & development; towards resilient communities

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Abstract: The most fundamental struggle for realizing a sustainable built environment still lies in the use of non-renewable resources in its articulation. Although effort has been taken to increase the use of sustainable materials (bio based, C2C, etc.) the vast majority of the building sector still relies heavily on steel and concrete. This article debates that the most fundamental contributors to sustainable development are the evaluation and incorporation of inhabitant capacities. Evaluating the proximity of available natural materials, inhabitant skills and tools could play a fundamental role in creating (social) sustainable societies and environments. However, inhabitant capacity models insufficiently cover the various capacities into one model (both inhabitant and community). Therefore, this article describes: a framework for evaluating inhabitant capacities; how to map available resource capacities; how these capacities can be incorporated into sustainable housing development and planning. The framework was developed as a part of a support tool, which helps designers and engineers to evaluate inhabitant capacities. To describe the framework and support tool a rural Sub-Saharan community is used- their capacities are relatively less complex compared to a ‘western’ or urban context. Moreover the articulated built environment is relatively uncomplicated. The article concludes that the framework shows great potential in reducing the use of unsustainable materials. Moreover, that it could enable social sustainability by creating self-reliant and resilient communities.

Keywords: inhabitant capacities; resource capacities; social sustainability; resilient communities; self-reliance
Building Performance Evaluation (BPE)
Indoor Environmental Quality (IEQ),
health and wellbeing
Post Occupancy Evaluation (POE)
Value Architecture (VArch): As another Approach of Value Engineering (VE)

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Abstract: Architecture has principles and unique design basis, which support the building with physical and nonphysical functions forming its shape by using the effective structure system in the presence of appropriate technology. Besides, the necessity of conserving energy, is to achieve savings on the long-run and satisfying the need of occupants, directing towards sustainability. Value in architecture is therefore not only a necessity of modern living, but also a cultural status of a developed society. It therefore goes beyond the basic human needs with minimum costs including “Art” in its own definition. This makes it is important to know “how to measure and quantify value architecture for architectural projects.

This study aims to clarify the concept of Value Engineering in construction industry, and its shortages in fulfilment of architectural values. A new term which is called "Value Architecture" has been proposed, which covers the shortcomings of evaluating the architectural values of projects to ascertain the validity of the hypothesis which is “Value Architecture is a more effective tool used to evaluate architectural projects than Value Engineering”. Therefore, a methodology is proposed to evaluate the architectural buildings during the contracting phase from the point of view of Value Architecture, considering that the main axes of Value Architecture are: (Ideal Functional Performance “physical and non-physical” - Ideal Cost).

Keywords: Value Engineering (VE), Value Architecture (VArch), Sustainability, (Physical or Non-Physical) Function, Ideal Costs
Passive Cooling Design Strategies for Retrofit of Residential Tower Blocks in Northern Cyprus

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Abstract: This research investigates potential passive design strategies for improving the thermal performance of existing residential tower block (RTB) in Famagusta, Northern Cyprus. In a Mediterranean island that experiences hot and humid temperatures throughout the year, residential buildings need to be adaptable to the climate in order to improve the thermal comfort of occupants. The current housing stock includes a prevalence of high density, medium and low-rise residential tower block developments without implementing any insulation materials. The objective of this study is to develop and test passive cooling design strategies into retrofitting ill-performing residential tower blocks in the coastal city of Famagusta. As an initial step, the performance of a case study was modelled and simulated via employing Integrated Environmental Solutions - Virtual Environment (IES-VE) software add-ins Apache-Sim Dynamic Thermal Simulation. The results from the base case model were analyzed according to the adaptive comfort of CIBSE Technical Memorandum 52 guidelines: The Limits of Thermal Comfort – Avoiding Overheating in European Buildings. The spaces studied (living room and bedrooms) within the case study sample flats were observed to exceed the acceptable limits of thermal comfort; particularly living rooms with this zone exceeding the upper limit for overheating by up to 9 hours daily. The main reasons for the problematic thermal performance were identified as resulting from: infiltration through the building fabric, the lack of sufficient ventilation through the living spaces and excessive heat gains through the large areas of glazing. The internal operating temperatures of the simulated flats remain high throughout the day and night in a typical summer day, ranging from a maximum of 36.5°C to a minimum of 28.5°C. The study also analyses the effectiveness of two basic passive cooling strategies (shading and night ventilation) of 3 sample flats sharing the same orientation, and floor plan but located at different levels within the RTBs. Furthermore, the implications in the seasonal cooling and assessment when considering the adoption of climate-related set-point temperatures (i.e. adaptive comfort approach), beyond the assumed common standard, are also evaluated.

Keywords: Building energy performance, Overheating, Passive cooling strategies, Thermal comfort, Retrofit.
An innovative energy efficiency application development: through the evaluation of occupants’ behavioural issues and its impact on domestic energy consumption in the UK

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Abstract: The research investigates the reason why low-carbon retrofit programmes always may not meet expectations. It is explored by focusing on a series of ‘hard-to-quantify’ factors, especially the energy-related behaviours and their impact on energy performance. The research assumes that the abovementioned parameters have not been thoroughly taken into consideration for optimising domestic energy performance. This is also the cause of the phenomena of ‘Building Performance Gap (BPG)’. To cope with this issue, the correlations between occupants’ behaviours and energy performance are investigated by adopting a mixed research methodology where questionnaire survey and the review of energy efficiency tools were carried concurrently to collect and analyse quantitative and qualitative data. The data collected is mainly quantitative but supplemented by qualitative data from a few open questions and in-depth interviews. This paper primarily focuses on the research survey design and how the required data was collected and analysed to help achieve the research aim. The preliminary data analysis was also presented in order to draw a general picture of the conditions of social housing in London. The issues encountered during the distribution of the questionnaire were also discussed in order to inform relevant future studies. At the end, the found correlations could help to form an innovative smart phone application in order to adjust occupants’ energy-related behaviours and provide incentives in taking up the low-carbon retrofit projects. Thus, reducing the BPG and increase energy efficiency in the UK housing sector.

Keywords: domestic building, home energy performance, occupants’ behaviour, questionnaire survey, energy efficiency application
Investigation of Environmental Conditions in Transitional Spaces of Buildings – Field Studies in Cardiff, UK

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Abstract: Transitional spaces are popular architectural elements in building designs nowadays; they can be found in the form of atria, lobbies, corridors and covered streets. Being the common features of building developments, they occupy about 10-40% of the total volume of different types of buildings. However, challenges are posed to building designers and engineers in terms of provision of an acceptable thermal comfort for transitional spaces; in fact, thermal discomfort has been revealed in such spaces of several newly constructed buildings. Furthermore, there are still no recommended acceptable comfort range and thermal comfort prediction methods for transitional spaces. This paper aims to investigate the environmental performance and people’s adaptive comfort in transitional spaces. During the summer period, field studies, which included on-site questionnaire surveys and physical measurements, were conducted in three selected case buildings in Cardiff. They were The National Assembly for Wales – Senedd, Hadyn Ellis Building and Royal Welsh College of Music and Drama. The total number of 736 responses were collected from the questionnaire surveys. In this paper, the findings from the field studies are first presented, followed by the in-depth investigations on the human adaptability to its thermal environment. Strong correlations between the clothing value and indoor operative temperature were identified. In addition, people’s responses to an open question in the questionnaire, which was about how people would act to overcome the uncomfortable situations, were analysed. Two main findings were drawn from this research work. Firstly, fine control of the indoor temperature of transitional spaces is not necessary. Secondly, self-adaptive actions tend to be taken by people to make themselves feel more comfortable in transitional spaces.

Keywords: Transitional spaces, thermal comfort, environmental condition, questionnaire survey, adaptability
Suitability of neighborhood-scale massing models for daylight performance evaluation

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Abstract: Access to daylight in buildings is the combined effect of a building’s own physical attributes along with its surrounding physical context. There is thus growing interest among researchers to extend the use of building performance simulation (BPS) tools for daylight performance evaluation, not just for an individual building, but to the neighborhood scale and beyond. In the design process of neighborhoods, massing models are often utilized and are a pivotal early design-stage work-product. These models are typically simple and delineate broad geometric dimensions of built enclosures. They are thus attractive for fast early design stage assessment using BPS tools and maybe used to determine daylight access potential. However, at this stage, the designer may have limited and imprecise information regarding the building façade, the vital element for daylight intake and distribution in the building interior. In this study, we assess the dependability of simple massing models for comparative indoor daylight assessments of neighborhood forms. Useful Daylight Illuminance (UDI) metric based performance values were calculated for five neighborhood design options using common practice for façade related inputs in early design stage simulation models and then ranked in decreasing order of performance. A virtual progression of the design-process was then carried out to develop multiple plausible façade design solutions for all proposed massing schemes. The main finding of this study is that significant changes can be observed in neighbourhood rankings when increasing the degree of detail in the façade design solutions. While the highest performing designs were found to maintain their ranks, the rankings of other projects shifted considerably when façade related information was supplied. This work informs on the possibility of erroneous design decisions resulting from simplified façade inputs in early design stage models and fosters the growing discussion on appropriate utilization of BPS tools for informing design decisions.

Keywords: BPS best practice, design process, daylight, façade details
Holistic sensitivity analysis on urban geometry and its effect on building performance in hot arid zones

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Abstract: There is a need to assess the growth of urban communities through analytical frameworks that have a multi objective and holistic approach. In this paper, a sensitivity analysis was conducted on urban geometry with a holistic and integrative approach as it has a significant influence on the building heat loss/gain that determines the energy demand needed to achieve indoor thermal comfort. Simulation tools that analyse urban geometrical variables are available in commonly used parametric design software. This study analysed urban geometrical variables such as (height, built area ratios, orientation and window to wall ratio). In addition, it gives an insight into the buildings’ inter-shadowing effect by adding the context buildings’ built area ratio in the tested grid. Furthermore, the study includes daylighting sensitivity analysis by changing the lighting control systems. Two sets of materials were used to refine the results for the study conducted for the city of Aswan in Egypt which has a hot arid climate. Additionally, the study investigated the effect of changing lighting controls (standard ON/OFF controls vs. dimmers) on cooling energy consumption. Using the Daylight autonomy results to change the lighting schedules of the tested energy zones is time-consuming, suggesting that the daylighting distribution is better suited for later design stages rather than being a key component of energy analysis in early design stages. The geometrical variables’ relative importance on energy performance on the energy demand for cooling of mid-rise residential buildings in hot arid zone urban configuration are as follows: Window-to-wall ratio (WWR); built area ratios; heights; and finally orientation. The results of this study show the need for a staged approach to early stage design with increasing simulation complexity as the design develops. This can be achieved in a single environment where simulation components are carefully combined.

Keywords: Parametric simulation, energy demand, lighting control, daylighting, urban geometry
Predicting moisture risks in solid walls retrofitted with internal insulation. The pros and cons of WUFI hygrothermal modelling
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Abstract: This paper examines the pros and cons of using the hygrothermal modelling tool WUFI Pro to predict moisture risks when internal wall insulation (IWI) is retrofitted to traditional, masonry solid wall dwellings. Up to 3.4 million solid wall homes in the UK will need IWI installed if the UK is to meet its legally binding commitment to reduce greenhouse gases by 80% by 2050. Unfortunately, retrofitting IWI to masonry solid walls can introduce moisture risks – a problem exacerbated by the limited research and understanding of hygrothermal issues in the UK’s traditional solid wall buildings. It is essential to be able to predict moisture risks prior to installing IWI. This is possible with WUFI Pro but what are the challenges faced in achieving reliable results in real-world situations? This research is a case study of an Edwardian London terrace house retrofitted with IWI to the front wall. Relative Humidity (RH) and temperature were monitored within the wall for three years. The measured data was compared with a WUFI Pro model of the wall. The research cautiously suggests that there are no long-term moisture risks in the wall. However, the most certain findings relate to the modelling tool. WUFI Pro cannot be used with confidence to predict moisture risks unless used in conjunction with WUFI 2D and unless the original wall’s material properties are physically tested and comprehensive, sitespecific climate data is collected. This paper summarises practical findings for the benefit of WUFI practitioners.

Keywords: Internal wall insulation, solid wall dwellings, WUFI Pro, hygrothermal modelling, moisture risk
Performance-driven Façade Design Using an Evolutionary Multi-Objective Optimization Approach

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Abstract: The complexity of design problems implies facing several variables at the same time to reach different criteria which could be contradictory. Thus, different objectives should be considered simultaneously which could be handled using Multi-objective optimization approach. This paper focuses on the performance of building façade regarding daylighting and energy loads. Being the main element that separate between the outside conditions and the indoor built environment, it is important to consider its performance from the early design stage. It is aimed to determine the applicability of Genetic Algorithm (GA) to optimize the design of a parametric double skin façade to maintain sufficient daylighting conditions to meet LEED V4 requirements while maximizing energy savings. As a case study, the design of the external façade of a generic reading space was used. The evolutionary principles of GA were utilized to optimize this façade through the Octopus tool in Grasshopper (GH). GH is a parametric platform securely integrated with Rhinoceros 3D modelling software by which the parametric façade was modelled. Also, Diva-for-Rhino was used which interfaces Radiance and Energy plus engines for daylighting and energy loads calculations. Daylight illuminance and annual energy loads of cooling and heating were used as objective functions. The results showed the robustness of the GA in the Multi-objective optimization process to effectively evolve the design of the façade pattern considering the assigned criteria. The workflow suggested in this paper have presented promising results not only by giving a trade-off between daylighting and energy savings but also by meeting innovative aspirations and subjective requirements of the designer which may inappropriately control the design practice.

Keywords: Performance-driven, Façade design, Multi-objective optimization, Daylighting, Energy savings
Predicting Current and Future Performance of Sustainable Lightweight Buildings

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Abstract: This paper investigates the current and future performance of sustainable lightweight buildings in three regional climates in the UK. The study explores dynamic building simulation as a technique to understand the performance of two sustainable lightweight buildings (HWL - southeast facing and HHA - northwest facing) in the summertime (May 1-August 31) using the Test Reference Year (TRY) weather files. The weather files for the current (the 2000s) and future (the 2030s) weather scenarios of Luton in the Southeast (the warmest region), Leicester in the Midlands, and Manchester in the Northwest regions of England are considered for the study. The simulation results are validated using the data obtained during the field investigation conducted at the case study buildings in the Southeast region of England. The findings showed the average temperatures (predicted) range from 20.3°C to 20.8°C for the current weather scenario; while the predicted mean temperatures for the 2030s range from 23.1°C to 23.6°C. Higher external and internal temperatures are predicted at the case study buildings in the Southeast regional climate set-up than the Midlands and the Northwest regional climates set-up. The average summertime temperature is predicted to be lower by 0.1°C each when the window-to-wall ratio (WWR) is increased from 45% to 55% and the window height (WH) from 1.35m to 1.50m respectively. In the warmest region (Southeast), the predicted internal temperatures exceeded 25°C for 6.2% and 28°C for 0.5% of the simulated period (May-August) in the current weather scenario. While the predicted internal temperatures exceeded 25°C for over 32.5%, above 28°C for 11.4%, and even exceeded 30°C for 3.5% of the total simulated period (2952 hours) in the warmest building (HWL). In terms of the number of hours that exceeded the critical thresholds for occupants’ comfort (25°C and 28°C), there is no significant change in the thermal environment of the buildings when the window-to-wall ratio (WWR) is increased from 45% to 55% and when the window height (WH) is changed from 1.35m to 1.50m. However, a noticeable change in the thermal environment is predicted when the floor area (FA) is increased by 20% and the floor-to-ceiling height (FCH) by 15%. The study showed sustainable lightweight buildings are prone to high temperatures under current and future weather scenarios even when the buildings are located in regions with cooler summertime and milder wintertime. The study also identified that the future performance of sustainable lightweight buildings can be improved using various design interventions (such as an increase in the floor area and higher floor-to-ceiling height). Finally, the study highlighted that sustainable lightweight buildings are likely to use more energy in future for cooling than current scenario and this is a crucial issue that requires further research to understand energy-load distribution during high demand period in sustainable lightweight buildings.

Keywords: current and future performance, sustainable lightweight buildings, regional climates, building simulation, design interventions.

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Assessing the Impact of Degree Day Base Temperatures on The Development of an Energy Index to Measure Energy Reduction

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Abstract: Refurbishment projects must be monitored before and after technology or behavior changes implementations to be able to assess their effectiveness and to drive conclusions on their applicability. An Energy Index approach has been previously developed and at its foundation, is the implication of base temperature selection on Degree Day for assessing energy reduction. The base temperature used to calculate Degree Days in the UK is 15.5 degrees.

The aim of this study was to assess the impact of Degree Day base temperatures on the development of an Energy Index by means of correlation between energy consumption and Degree Days.

The methodology was based on a low budget energy management strategy, in which the following information was collected: meter readings, internal temperature and outdoor conditions by means of degree-days. The methodology was employed in thirteen flats, with a control group of six flats having electric storage heaters and a further seven flats retrofitted with heat pumps. The flats were retrofitted with heat pumps; meter readings were collected around monthly intervals, while internal temperature was collected at 20 minutes intervals. Energy consumption was correlated to Degree Days based on 15.5 degrees and then compared to the correlation when the base temperature for Degree Days matches the internal flat temperature.

The results show that by matching the base temperature to internal flat temperature, the average correlation improves from 0.55 to 0.76 and the average standard deviation improves from 0.36 to 0.19, meaning that the spread of results is reduced and a better evaluation of refurbishment technology or behavior changes can be achieved. The control group, with electric heater storages, experiences the greater correlation and standard deviation improvements.

Matching the Degree Day base temperature to the internal temperature allows a more realistic accountability for the energy consumption to assess refurbishments by the Energy Index.

Keywords: Degree Day, Base temperature, Energy Consumption, Energy Reduction
Argumentations of Visual Comfort Metrics in Dynamic Day Lit Spaces

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Abstract: “Natural light is the only light, because it has mood... it puts us in touch with the eternal. It is the only light that makes architecture.” - Louis Khan.

Daylight is one key aspect to enhance the sense of place and influence the personal interpretations and impressions that last long after leaving the place. However, visual discomfort and glare can distract architects from achieving the most of daylighting. To better achieve visual comfort in dynamic daylit spaces the time and space dynamics of the daylight condition, and the representation and re-imagining of these dynamics need to be considered.

This paper examines logical argumentation through the exploration of various visual comfort metrics. The argument investigates several factors that affect visual performance and occupants comforts. Some of these factors include lighting level, uniformity of illuminance, color rendering, avoiding hard shadows, contrast rendition, physiological glare, balanced brightness distribution, luminance levels variation, discomfort glare, illuminance uniformity in the area around the visual task, and the balance between artificial lighting and daylight. The argumentation concludes a compilation of different visual comfort evaluation metrics. These metrics aim to consider the two key dynamics of daylighting; time and movement through spaces to achieve the most adequate daylighting performance with the most visual comfort. The research outcomes are expected to provide researchers, designers, and decision makers with a new approach to designing spaces to improve visual comfort, energy performance and the quality of the place.

Keywords: Occupants comfort, Daylighting, Visual comfort.
Parallel Parametric Simulation for Optimizing Non-Conventional Solar Screens: An Approach for Balancing Daylight and Thermal Performance in Hot Arid Climates

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Abstract: Growing interest in digital design tools and generative systems in the architectural discourse, especially parametric systems and optimization algorithms, has the potential to be of greater value if capable of expanding their scope from form generation tools to a more ecological-conscious approach by coupling them with performance simulation tools within a collaborative methodology. The work presented in this paper is a part of a comprehensive study aiming to compare between parametric simulations and Genetic Algorithms as a tool to optimize and analyze the effect of non-conventional solar screens on daylight, thermal and energy performance for south facades. This paper focused on the parametric simulation study of a non-conventional solar screen driven by daylight and thermal performance. It integrated simulation tool with parametric design using DIVA, and Grasshopper respectively. The simulations were conducted for a south-oriented office space’s façade in Cairo, Egypt. The screen various parameters; sizes, rotation angles, scale ratios, and protrusion values were modeled parametrically and aligned to this façade. Daylight analysis was conducted using Daylight Dynamic Performance Metrics specifically; Spatial-Daylight-Autonomy (sDA300/50%) and Annual-Sunlight-Exposure (ASE1000/250hr), that comply with both LEED v4 and the new IES approved method, and Daylight Availability. While thermal analysis based on a comparison approach of the thermal performance results to a specific base case. Moreover, the screen shading coefficient was calculated to overcome the current limitations of thermal simulations in sufficiently recognizing the complex geometries such as the proposed screen. Finally, the simulations relied on parallel computing algorithm, which saved time by 8 times more than the default runs. Meanwhile, an algorithm inside Grasshopper was specially developed for this study to overcome current limitation of running parallel thermal runs. The paper presented a comprehensive analysis using an exhaustive search method for the effect of the screen parameters on daylight and thermal performance.

Keywords: Parametric design, Solar screen, Daylighting, Thermal Performance
A checklist for the assessment of energy performance of public schools in Cairo, Egypt

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Abstract: In developing countries education is a constant struggle on most fronts, from the development of curricula to the design of schools. In Giza, Egypt, the public education population is rising rapidly, and classrooms available for education are few. In 2014 the average classroom density was 57.3 pupils/class for primary education, 52.2 for preparatory education, and 50.2 for secondary education. The UNICEF Child Friendly Schools’ manual strictly limits classroom density to 30 pupils/class. Classroom occupancy affects the school energy performance; occupancy levels in Egypt are often below 0.8m²/person; this compares poorly with the range deemed acceptable in the UK (1.8 to 2.4m²/person). There is need for change in approaches to the design, construction and operation of public schools. Currently the Egyptian Energy Efficiency Building Code does not include education buildings. This study investigates avenues towards developing a checklist to follow for public education buildings, with a focus on loads generated by occupants.

The study reviews the rating systems to emphasise the importance energy efficiency parameters in education buildings. The methodology is performance-based, utilising an Energy plus application. The experiments investigate the variables (orientation, window-to-wall ratio, U-value, SHGC, shading and occupancy) affecting the energy consumption of classrooms. The classroom samples are based on the supplementary classroom buildings provided by the Egyptian General Authority for Education Buildings. The results demonstrate the influence of classroom occupancy; they also establish the parameters for optimisation for thermal comfort, providing a checklist to follow for the design and build of public schools.

Keywords: Energy Efficiency, Education Buildings, Occupancy, Egypt
Building Performance Evaluation of an Office Building in the UK - A case study of a university office building

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Abstract: The efficiency of office building design has become increasingly important in recent years. This is both due to the negative impact inadequate office building design may have on the built environment due to excessive mechanical heating and cooling systems, as well as the impact of unsatisfactory thermal comfort and poor indoor thermal condition on the occupants’ health, wellbeing and productivity at work. With the aim of discovering how the thermal comfort, and energy performance of a modern office building can be improved, a study of an existing office building, at one of the London based universities, and its occupants is carried out. The occupants had already reported several issues with the indoor environment that causes discomfort in summer and winter seasons, hence the significance of the study. An analysis of potential issues reported concerning occupants’ thermal comfort and building energy performance is investigated to develop a potential design intervention to improve both aspects. In order to solve this problem, a quantitative research design has been adopted including three methods for data collection and analysis. Initially an occupant survey is carried out including questions on occupants’ activity, comfort and overall experience with the indoor environment. Secondly, data loggers have been placed in the building to record air temperature and relative humidity for one whole year. At a later stage, computer simulation modelling will be used to further explore inefficiencies in the building and the potential interventions to improve the building performance and occupants’ thermal comfort. The initial results show that different parts of the building have been deemed uncomfortably warm with a lack of air movement in the summer months and unacceptably cold and draughty in the winter months. This is expected to be due to the lack of adequate natural ventilation in some areas, and the lack of adequate heating and cooling in some rooms.

Keywords: Thermal comfort, building performance, questionnaire survey, field monitoring, office building
Multi-criteria optimization for better indoor environment in UK homes

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Abstract: The design of more comfortable and energy efficient indoor environments can be achieved when thermal comfort, daylight and ventilation are considered concurrently. In the UK, dwellings, through the enforcement of Part L1A of the Building Regulations the fabric performance is regulated while the other parameters are attended to only at planning stage. This research explores the implication and outcome of simultaneous compliance and multi-criteria optimization in the design of midrise apartment blocks. The outcome as a guideline adheres to the existing Part L1A regulation for fabric performance, BS 8206 and BR 209 for daylight & sunlight, the Part F and BS 5925 for natural ventilation and the TM52 for overheating risks. The research adopts a dynamic simulation method with climate based input for daylight and for overheating risk assessment. The guideline is the outcome of the post processing of the results generated from a dynamic and integrated script developed using the native grasshopper plug-in in Rhino to create a parametric model which is then modelled and tested using DIVA for daylight, Ladybug for accessing sunlight hours and overshadowing, the Honeybee on Energy Plus interface for calculating the thermal load, energy gains and losses and finally the maths component for checking against overheating. Single aspect apartments are evaluated to arrive at best fit ranges in terms of window to floor ratio for thermal comfort, window to wall ratio for daylight, effective aperture opening size for ventilation and spatial layout for sunlight. Visualization tools are developed to intelligibly comprehend the relationship between different parameters. The research tool is envisioned to provide information to designers, practitioners and students for educational and research purpose. The guideline aims to help designers to make better informed design decisions and appreciate the trade-offs between daylight, heating demand and ventilation.

Keywords: Research tool, Building regulations, Multi criteria optimization, Parametric design

Paper 115
Towards a typology of listening: The balcony as a sonic interface in evolution

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Abstract: This paper is an opening towards a comprehensive typology of listening that corresponds to the emerging forms of residential building interfaces. In this paper, we are focusing on Balconies as a main study object. In fact, ecological approaches in designing residential buildings (Concerto, HQE, eco-districts) produce highly developed architectural typologies of building facades under the form of double skin, deep balconies, large loggia, covered or semi covered terraces, that should be analyzed as such.

The main corpus on which this paper relies on is the research project Esquis’Sons! on « sustainable soundscapes » conducted by Cresson research center - ENSAG. The project is about studying the sound qualities of intermediate spaces such as Balconies, Loggias, Terraces and Corridors (BLTC). The project’s main objective is to elaborate a catalogue of remarkable listening situations of these interfaces through crossing the physical form, sensory phenomena and social practices. Based on this database, the current article overall aim to elaborate a typology of listening situations that categorizes in homogenous types the new forms of sound composition corresponding to new architectural vocabulary that building facades afford.

Focusing mainly on three sustainable districts in France: Vigny-Musset, Caserne de Bonne and Trapèze-Ile-Seguin, the elaborated methodological protocol put together a collage of methods in situ and in vitro that are systematically applied to each BLTC: sound recording up to 10 minutes, acoustic measurements, architectural sketches with accurate dimensions, in addition to short interviews with the inhabitants. This typology shall strengthen the sound culture of architects and urban designers by showing the spatial and sound variations on both urban and architectural scales.

Keywords: sonic ambience, balcony, facades, typology, eco-district, sound affordance, interface
Thermal Comfort and Behaviour Control in Mixed-mode Office Buildings in Harbin, China

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Abstract: This paper presents findings from a two-week longitudinal case study of occupant thermal comfort and related behaviour control in offices in Harbin, northeast China. Long-time data were collected from on-line questionnaire surveys and data logger measurements of the thermal environment and occupant behaviour in the summer of 2017. A total of three mixed-mode buildings with four different types of office rooms and their occupants were selected. Behaviour was examined against both environmental and personal thermal comfort variables. Results indicated that thermal feelings and behaviour control differed with the type of office space. The three most commonly used methods for achieving better thermal comfort in summer were to open or close windows, switch on fans and switch on air-conditioning. The results show that the window control behaviour was always accompanied by the use of a fan or air conditioning. The results also show the influence of different variables on occupant behaviour, including environmental variables, personal factors and the geometry of the office rooms. Furthermore, the results from this study may provide a useful reference when designing and managing a better thermal environment for office buildings in northeast China.

Keywords: thermal comfort, behaviour control, office building, mixed-mode office
The Impact of Natural Ventilation on Indoor Thermal Comfort in Office Buildings in the Mediterranean Climate

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Abstract: The aim of this paper is to quantitatively investigate the impact of natural ventilation on indoor thermal comfort in office buildings, in southern Europe. For this purpose, a field research study was conducted in a typical open-plan office layout of a typical medium-weight construction, in the urban centre of Nicosia, Cyprus, during the hot, summer season. The analysis is achieved through the interpretation of the in situ measurements of air and globe temperature and air velocity in the indoor and outdoor environments. Initially, the effectiveness of various ventilation strategies, i.e., daytime, night-time as well as full-day (24-hour) ventilation, was assessed. The analysis of the results shows that night ventilation is the most effective strategy for passive cooling during the hot summer period, compared to the other two ventilation strategies. Furthermore, in the case of night ventilation, an in-depth investigation was conducted, using different window opening patterns, i.e. single-sided and cross-ventilation. The results indicate that the night-time cross ventilation strategy takes full advantage of the relatively low outdoor air temperatures during the night hours. The specific strategy reduces peak indoor air temperatures during the following day and thus drastically improves indoor thermal conditions during the operating hours of the office buildings. In terms of thermal performance analysis, Cooling Degree-Hours (CDH) was used as a quantitative indicator of the thermal performance efficiency of each ventilation strategy and window opening pattern. The research findings are presented in a comparative manner and evaluated in a quantitative way, offering valuable information to the relevant field. Moreover, they confirm the positive contribution of natural ventilation to passive cooling in typical open-plan office layouts, in the hot and dry climatic conditions of the Mediterranean basin as well as in other areas, where similar climatic conditions can be found.

Keywords: natural ventilation, passive cooling, thermal comfort, cooling degree-hours, hot and dry climate
Influence of the glazing system on visual comfort in the elementary school buildings: Case study of a building in Eskisehir-Turkey

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Abstract: Various investigations have confirmed that pupils and teachers’ performance and health depend significantly on the quality and amount of the daylight and indoor conditions. On the other hand, visual and thermal performance plays a significant role in energy efficient building design. The primary aim of using natural light in schools is not only increasing students’ performance through the quality of light but also reducing the artificial energy consumptions and costs. Furthermore, building envelope design could improve the energy performance of the building, which could apply to the new and existing building. An appropriate design of windows causes to improve visual comfort by reducing the glare and distributing illuminance, and the thermal comfort by controlling the solar heat gain. The study focuses on the impact of different transparency ratios (WWR), window combinations and directions on the visual comfort in the classrooms. The case building is one of the typical elementary school projects planned to construct in Eskisehir. Two classes of the building are selected to study; one of them is directed to the East, and the other one is headed to the West. These two classrooms are simulated with the aid of the lighting simulation programs DIALux Evo 6.0, which is verified by the International Commission on Illumination (CIE) to evaluate the visual comfort. Results of simulations for visual comfort are evaluated for two days in two different hours. Based on the academic calendar, 20 of March and 21 of December are selected as critical days and 10:00 a.m. and 02:00 p.m. are defined as crucial hours.

Keywords: Glazing System, Transparency Ratio, Daylight, School, Illumination Level
Systematic Literature Review: Customer’s Requirements for Social Housing Design

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Abstract: The high demand of housing units (HU) in Brazil, result of housing deficit, coupled with the need to deliver low cost HU’s and with minimum requirements of quality, that can promote comfort, health and safety to users (final client), form a complex and challenging scenario to professionals related to the built environment. This article is inserted in the context, since it deals with the partial results of a project of scientific initiation entitled: quality of social housing design (SHD) in the municipality of Maraba, state of Para, in the Brazilian Amazon: customer’s requirements. In this sense, the objective of the article is to identify the quality requirements of the SHD, through systematic literature review (SLR). For this, the SLR based on the 07 steps suggested by (Camargo and Morandi, 2015): Definition of the central theme and conceptual framework; aggregative or configurative revision; choice of work team; search strategy; selection of data; research of, eligibility and codification; synthesis of results. It was analysed 22 published studies related to the research problem and it was possible to identify 15 requirements. The SLR results were useful for the characterization of SHD, in addition to offering guidance subsidies for the search string, insofar as the theoretical information served as a reference to analyse the projects implemented, potentials and failures. Finally, the work contributes to the identification of some gaps in the theme and, consequently, the opening of opportunities for new research.

Keywords: Social Housing, Requirements, Customer
Post Occupancy Evaluation of University Buildings in the UK (Case Study: The Diamond, Sheffield)

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Abstract: The Diamond, housing teaching and research space for the Faculty of Engineering, represents the largest ever capital investment for the University of Sheffield. Costing £81m, construction began in 2013 and the building was officially opened on 28th September 2015. The building employs a complex Building Management System to manage the internal environment. It is an example of a modern building that has been designed to take control away from occupants and use automated systems to control environmental conditions and mitigate interventions by occupants. This relies on the Standard Effective Temperature model to assign comfort temperatures. This is based on the PMV thermal comfort model derived from extensive laboratory experiments to establish mean thermal comfort scores (Fountain et al., 1996). However, beginning with a range of field studies in the 1970s, Humphreys and McIntyre have shown that the range of temperatures that building occupants report as ‘comfortable’ is wider than reported in controlled laboratory conditions.

Leaman and Bordass (2001) define Post Occupancy Evaluation (POE) as a process for creating a dynamic, continuous and improving knowledge base that can be used to continuously improve a building’s performance over its life time. (Bordass et al., 2001). As many design stage decisions are based on broad assumptions of how a building will perform, conducting POE provides an opportunity for gathering real information to improve and inform future projects (Zimmerman and Martin, 2001).

The aim of this research is to investigate the relationship between the use of automated systems for indoor environmental control and user satisfaction in the Diamond building, contributing towards improving building performance and the quality of the indoor environment for users. The research employs POE as a strategy for investigating the building, including a bespoke survey to gather information about user perceptions of comfort and satisfaction with the environment.

Keywords: Post Occupancy Evaluation, Thermal Sensation, Occupant satisfaction, Building evaluation
What are the social benefits of energy efficient retrofit of social housing?

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Abstract: Current understanding of effective climate change mitigation acknowledges the requirement for a sociotechnical approach that addresses environmental, economic and social issues. With the prediction that the cumulative cost of social inequality related issues, between now and 2050, may be more than double that of the impact of climate change in the UK, and that the most economically vulnerable will be the most negatively impacted by climate change, the paper investigates whether these issues can be addressed simultaneously. The research investigates the social benefits of a social housing energy efficiency retrofit programme. It focuses on the case study of a 1960’s inner city council estate that underwent an energy efficiency refurbishment. The study explores the effectiveness of the retrofit in reducing gas and electricity consumption, CO2 emissions and the impact of the retrofit on the residents. The retrofit was assessed using empirical data that measured CO2 emissions pre and post refurbishment, energy use in apartments, interviews with residents, the council and comparative research literature. The evaluation of the findings confirms some reduction in gas consumption and CO2 emissions. The research finds the socio-economic impact on the residents includes confidence in maintaining an affordable warm home, increase in disposable income and wellbeing. The retrofit provides long-term security of resident’s homes and community pride. The negative impact included additional use of electric heating and cooling due to inadequate retrofit. This creates doubt about the efficacy of energy savings. The occupiers commented on “construction fatigue”. The paper concludes that there is potential to address aspects of social inequality and climate change through informed energy efficient retrofit. Critical to its success is stakeholder engagement at all levels and stages supported by clear communication on energy saving benefits. To achieve this, multi-disciplinary input, funding, support and education led by the UK and local governments is required.

Keywords: Social housing, benefits, energy efficiency, retrofit
Harmonising energy use behaviour of British Asian households towards sustainable housing

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Abstract: Recent studies show that actual energy demand from low carbon new-build homes can be up to 40% above expectations and energy savings from thermal upgrades are often under predicted. The inefficient behaviour of its occupants is identified as a contributing factor of this “performance gap”. This behaviour is also believed to be significantly correlated to the households’ socio-economic characteristics. While building simulation has made significant progress, the representation of occupants and their behaviour needs further work.

This research investigates the energy use behaviour of a specific demographic and ethnic group, the British Asian households. A large-scale housing survey is used to gather self-reported information about the British Asian households’ energy use behaviour, for instance, heating patterns, appliances use, ventilation behaviour, as well as other socio-economic characteristics. Data collected will be analysed and transformed into energy models, which includes Space heating behaviour models, electrical appliances and lighting use models, Ventilation behaviour models, and architectural archetypes that represent behaviour patterns for different demographic groups. The outcome of this research demonstrates how social perception and economic aspirations limit the acceptability of sustainable design and construction strategies.

This research involves active community participation and engagement; a major part of the dissemination will aim at communicating the research findings to the British Asian households, which will have a direct impact of energy reduction by informed behaviour choice. Further, this research will define the low carbon housing strategies and improved energy use predictions for the British Asian households.

Keywords: Energy behaviour, British Asian, Sustainable housing
Smart Sensing & POE for Heritage Buildings: A Comparison between Results of a POE Study and Actual Field Study Measurements for Evaluating Thermal Comfort in a Heritage Building

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Abstract: Smart sensing has been a term widely used in the field of thermal comfort in the past few years. However, this method holds a few barriers concerning the accuracy of the collected data. This paper introduces Post-occupancy evaluation (POE) as an additional tool for evaluating thermal comfort in occupied heritage buildings. POE acts as a supporting tool to increase the accuracy of the overall evaluation process. An office space within an occupied heritage building located in Downtown Cairo, Egypt was selected for the purposes of this study. The paper aims to compare results between a POE study and actual thermal measurements obtained from sensors installed in the office in order to evaluate thermal comfort and gain perspective for the purpose of evaluating the accuracy of the collected sensed data and provide a list of assumed barriers that might have caused the gap. Sensors were installed for 6 months during summer period collecting data for temperatures and humidity. The POE study was conducted through a survey questionnaire for occupants of the office space. Results of both were then compared determining the barriers causing lack of accuracy in the data collected.

Keywords: thermal evaluation, data accuracy, smart sensing, comfort level, Post-Occupancy Evaluation.
Bioclimatic and passive design
Energy efficiency in buildings
Zero and low carbon design
Built Form Driven Effects on the Urban Microclimate of Neighbouring Buildings and Streets - City of London Case Study

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Abstract: Taking the City of London as a case study area this paper reports on an early investigating into the direct influence of built form at both the building and neighbourhood scale, on the winter urban climate, and reports on a preliminary investigation into how built form influences passive resources i.e., solar access, wind and ventilation, which in turn influences climate sensitive design. This paper reports on a series of preliminary microclimate measurements taken between December 2016 to February 2017 along the route of an established urban climate walking tour in and around the City of London. The route takes us through a series of urban streets and public spaces where we experience first-hand the direct influence of building and urban form on air, surface and near surface temperatures, wind speeds and air quality. Whilst the walk offers a novel perspective on the City’s dramatic and changing skyline, the microclimate measurements offer a more detailed analysis of the urban climate trends that result from the variations in built form found along the route. The aim of this research is to provide this level of detail and to demonstrate the long-term benefits of a ‘form’ first approach required to achieve sustainable urban development through climate-sensitive urban planning.

Keywords: Urban climate, microclimate, net-energy effects, interdependent effects, built form
Levels of Biophilia in Architecture- A Survey in Contemporary Izmir

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Abstract: Biophilia is the instinctive fondness for forms of life -flora, fauna, or both. It has been embedded in personal and social life for many centuries, since domestic animals and agriculture became parts of human activities. It has also been reflected in architecture, with the Hanging Gardens of Babylon being a legendary example from antiquity. In our times, the relation of built space with vegetation has been drawing a growing attention, especially in the so-called “green architecture”, materialized in various formats and at various levels of attentiveness. This study originates from the observation that there are diverse ways to express one’s own biophilia; e.g. from hanging a deer’s head on the wall, to demonstrate for protecting a civic park against developers. Similarly, in architecture there are different ways to merge the flora version of biophilia with buildings, according to the priorities of the building industry ‘triangle’: designers, developers, users. A survey of contemporary examples from the Turkish city of Izmir illustrates various approaches to biophilia in the local architecture, ranging from symbolic to genuine, from minimal to overwhelming. The aim is to discover the inner motivations of those behind such applications, and in general to appraise the current role of biophilia in shaping the urban environment in Turkey.

Keywords: Biophilia, Turkish architecture, Turkish biophilia, sustainability, Izmir
Daylight Assessment of an Integrated Shading System for Typical Office Spaces

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Abstract: The issue of environmental renovation of aged existing building stock for the improvement of indoor environmental conditions forms a field of high interest and extensive research. The present research aims to evaluate the integration of a movable louver shading system for the improvement of visual comfort of existing office buildings. The system was evaluated by means of daylighting analysis simulation using Ecotect 2010 and Desktop Radiance v2.0. Daylighting performance indicators, i.e. daylight factor (DF) and uniformity daylight factor (UDF), were calculated for various geometrical configurations with the louvers rotating both on horizontal and vertical axes. Moreover, an in-depth analysis of lighting levels was performed for selected horizontal configurations for south-facing spaces during different periods of the year and hours of the day. The analysis suggests that the integration of the louver system in appropriate geometrical configurations keeps high percentages of the plan area in sufficient lighting levels, while it significantly minimizes the possibilities of glare issues. The research study confirms the positive contribution of the system under study, as a daylighting regulation system. The parallel analysis of daylighting performance indicators and of lighting level offers a holistic and comprehensive approach to the investigation of the visual comfort conditions of the indoor built environment.

Keywords: existing building stock, integrated shading system, daylighting, glare issues, visual comfort
Sustainable Architectural Design of the Central Mediterranean

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Abstract: The climate of the central Mediterranean archipelago of Malta is characterised by hot dry summers and cold humid winters. For centuries, the architecture of these geoheritage islands, erected in the local limestone, has addressed the physical characteristics arising from the topography. This industrial mineral, the source of dimension stones for the building construction industry since time immemorial, is being depleted at a rapid rate. The Islands have a significant stock of buildings which, due to growing public awareness, development planning policies and central government initiatives for heritage protection, are being restored, conserved and re-used. This paper explores contemporary sustainable residential architecture completed in recent years in existing urban contexts from environmental, technical and financial perspectives. Adopting a holistic approach to architectural design, bioclimatic and passive considerations would enhance the environmental quality of the existing built environment. Integrating them in the redevelopment through modifications and extensions to existing buildings in order to meet contemporary habitable standards rather than demolishing and developing new residential developments proved to be a viable option from all three perspectives. The resulting sustainable design solution optimizes on energy and land resources through minimising the impact/s on the natural environs which future generations will be enjoying. In addition to having healthier interiors, a prerequisite for the human wellbeing of users, such an approach is financially more remunerative. Based on case studies, this study concludes that energy site sensitive environmental design decisions integrated in existing residential properties is a secure socio-economic investment in the built heritage. The re-designed modifications and extensions are not only sustainable in terms of thermal and natural lighting but also in terms of building materials and construction techniques.

Keywords: sustainable design, bioclimatic design, passive design, Central Mediterranean, Malta
Analysis of non-uniform cavity configuration of the double façade on heat stratification

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Abstract: Energy consumption of buildings over the world is approximately 40% of the total world annual energy consumption. In hot arid climate, cooling loads acts to be the influential part of energy consumption. Building envelope plays an important role in promoting energy saving in building. Nowadays architecture aims to shift towards passive strategies to decrease the energy demands. The double facade technology is introduced by several leading architects as an energy conscious architectural technology. The notion is to have a deep vision for the cavity thickness of double skin facade for its steady/constant pattern through the entire height. Properly design for the cavity, by alternation in its configuration, may have a serviceable influence on the amount of heat transfer, which consequently enhances the operative temperature inside the cavity, subsequently, affect the adjacent occupied spaces. The new approach is intending to boost the double skin facade prevalent morphology for its steady cross section, to generate an autonomous non-uniform cavity. Diversity in percentage of shading devices is proposed to provide variation in amount of controlling solar heat gain. The pattern is generated parametric pattern that provide numerous degree of alternatives based on geometric process. Optimization through amalgamation of cavity configuration and percentage of shading is observed. A developed notion is proposed to decrease the operative temperature within the cavity of the double skin facade. The connotation determines the solar radiation analysis grid on the facade using simulation and performance analysis tool, which is used to drive design decision. The aim is to monitor the influence of the proposed system on reducing heat transfer and its impact on achieving thermal comfort with low energy consumption. The Double skin facade can significantly reduce the heat gain through the building as the cavity act as intermediate layer through decreasing transmitted heat and intense solar radiation.

Keywords: Double Skin Façade, Solar radiation, Heat transfer

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“Green Pockets” as Microclimate Modifiers in UK Urban Schools

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Abstract: The rapid densification of many UK cities poses significant pressure on the design of schools within inner city centres. London’s air quality has been associated with increasing mortality and pollution while noise levels have exceeded acceptable standards. As a consequence, most schools are mechanically ventilated and have little to no contact with the outside world, causing detrimental effects for the physical and mental development of the students. This study investigates the possibility of improving the design of usually neglected and underexploited outdoor and semi-outdoor spaces within urban learning environments in order to convert these spaces into microclimatic modifiers and natural air filters. The study was based on field work, analytic work and design studies on a case study project for a secondary school in a high density site in London. This is a collaborative thesis project conducted with a London based architectural practice, who shared our interest in the environmental potential of outdoor and semi-outdoor spaces within schools. The research focused on the integration of green spaces into three different environments: outdoor courtyard, semi-outdoor break-out space and indoor classroom. It is later explored how the connection between those typologies effect the air pollution levels, natural ventilation potential and thermal and visual comfort of the occupants. The findings of the analysis and design implementations indicate that the positive microclimatic effect of the green courtyard can be successfully used to achieve thermal comfort in semi-outdoor and indoor spaces throughout the year while improving visual comfort and air quality. The outcome is a guideline based on the post processing of the findings from all the stages of this research. It is aiming to help designers take better-informed design decisions in response to current challenges that UK’s urban schools are facing.

Keywords: green school, pollution, vegetation, mitigation, urban heat island
An Overview of the Competition Projects in Architecture Coded with Sustainability Criteria: The Case of International High-rise Award 2014/2015

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Abstract: One of the public issues regarding the skyscraper and urban relation that have gained importance in the world scale in recent years has produced popular concepts such as sustainability, ecological and green architecture. As seen in many of the developing world cities, when looking at vertical dense building projects using ecological data in the context of sustainability, they cannot go beyond superficial interventions in which several energy-saving technologies are installed in the structure and placed in some intermediate spaces of the green building. It is clearly seen that the image of ecological high-rise buildings is symbolized through various signs such as sustainability certificates and green architecture discourses. On the other hand, in terms of developed world cities, sustainability and ecological architecture become an important issue, and architectural practice is making considerable progress in this direction. International high-rise building awards are not only concerned with the matters such as architectural image, form or height claim, but also how much high-rise buildings are concerned with ecological data and environmental awareness. The paper aims to discuss the quality of competition projects in architecture encoded with sustainability criteria on the case of International High-rise Award in 2014/2015. There are five finalist projects, Bosco Verticale in Milan-Italy, Fira Hotel in Barcelona-Spain, De Rotterdam office in Rotterdam-Netherlands, Sliced Porosity Block in Chengdu-China, One Central Park in Sydney-Australia, selected in the scope of the research analysed through the signs of sustainability showing how the criteria of sustainability design is described in the process of architectural competitions. In terms of high-rise buildings, the provision and the encouragement of ecological life principles is considered as one of the main issues. These projects show that the sustainability issue is not only regard to building scale, but also, with holistic design criteria, it needs to be addressed at urban scale.

Keywords: Architectural competitions, ecological architecture, high-rises, signs of sustainability, urban design.
A Design Chart to Determine the Dimensions of a Solar Envelope as a Function of the Latitude and the Geometry of the Site

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Abstract: The main objective of this paper is to introduce a simple quick tool for architects and urban designers, represented by a design chart that determines the dimensions of a solar envelope as a function of the latitude and the geometry of the site. Solar envelopes are mainly designed to assure maximum access of direct solar radiation, which is needed for maximizing passive solar heating especially in the upper latitudes where cold climates exist. Such constructed envelopes or forms could also be used in lower and mid latitudes while designing certain elements such as: skylights, sunspaces, monitors, etc., that could be used in cooling of such hot or temperate climates.

This design chart involves the integration of both horizontal solar angles (AZI) and vertical solar angles (ALT) to design and construct the required solar envelope with its different dimensions, ensuring the optimization of the direct solar radiation access within the selected hours (cut-off times), for any city all over the world, if knowing its own latitude (LAT).

Keywords: Design Charts, Solar Envelopes, Climatic Envelopes, Solar Geometry

Paper 199
The Role of Architects in Promoting Sustainable Principles in the Design of Residential Projects in Amman, Jordan

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Abstract: Managing energy demand is one of Jordan’s major challenges. More than 96% of the country’s energy comes from imported oil and gas from surrounding countries. This reliance on foreign energy resources is among the highest in the world, equivalent to 18% of gross national income. Energy use in the residential sector represents 23.1% of the national total (Jaber, Jaber, Mohsen, & Akash, 2003). The need for measures to reduce energy demand is urgent: despite efforts to promote sustainable design solutions, statistics suggest that less than 20% of houses are constructed using energy saving measures such as solar panels or solar heating systems.

The role of architects in addressing wide-scale problems in the built environment, (e.g. energy consumption in the housing sector) is still not fully recognised in the Jordanian context. By studying architect – client communications in the early design stages, this research proposes improvements that demonstrate the additional value that architects can bring to the construction industry, particularly in housing, through improved design quality and building performance, embedding sustainable principles (whether design principles or applications) and saving time and money. As most design decisions are taken in the early design stages and architect-client interactions are most frequent at this time, especially in residential projects, it provides an important opportunity for the architect to promote sustainable design principles and introduce different energy-saving strategies to the client.

This paper is part of ongoing PhD research entitled: ‘Complexities of Communication and Practice in Architect-Client Interactions’ that aims to investigate early design stage communication between architects and clients in residential projects in Jordan. This paper give insight to the early findings of the empirical work for the PhD research, especially in Architects’ understanding of their role in promoting sustainable design principles.

Keywords: Architect-client interactions, sustainability, Jordan.
Enhancing Building Envelope of Existing Residential Buildings and Using PV Panels to Reach nZEB

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Abstract: The aim of this research is to develop a method to be used in solving the decision making and analysis of alternatives for local energy problems related to existing buildings. The method addresses the retrofit strategy with emphasis on the envelope material upgrades. The research suggests using energy simulation and the utilization of the nZEB (net zero-energy buildings) guidelines as well as cost information to develop a decision tool. The outcome of the research combines both retrofitting and renewable energy strategies to convert existing residential buildings to nZEB buildings.

The research utilizes energy simulation to validate the initial assumptions and to test the feasibility of the proposed guideline on a case study building. Another outcome is developing steps of converting existing residential building to an nZEB. Specific retrofit actions are selected, specific PV system is considered and a complete cost analysis as well as a return on investment study is performed. A nZEB building was reached using envelope retrofit and the use of PV panels.

Keywords: Retrofit, Zero energy buildings, existing residential buildings, PV panels.
Towards Advanced Active Façades. The development and assessment of a new façade concept, which combines passive and active design strategies

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Abstract: In Switzerland, as in many European countries, new energy directives focus on decreasing the carbon footprint of buildings by promoting passive and active energy strategies and systems. Among the latter, Building Integrated Photovoltaics (BIPV), which function both as envelope materials and electricity producers, are rapidly improving their performance. However, their potential remains largely unrealised due to diverse barriers. Among them, the poor expressive qualities of many BIPV products are preventing architects from using these systems. In reaction, and with the goal of bridging the gap between technology and designers, a new façade concept has been developed integrating BIPV expressive issues. This is the Advanced Active Façade (AAF) concept, which results from analysing the evolution of façade requirements and solutions over time. The AAF combines passive and active façade design strategies. This is to say; it simultaneously aims to achieve low embodied energy by benefiting from passive low-carbon design strategies, and to generate energy by integrating BIPV technology. The AAF construction system is the direct application of the AAF concept to construction practice. It is a wood-based, self-supporting and demountable façade system, which meets the most exigent insulating targets and is compatible with a wide range of existing BIPV formats and emerging technologies. The development of this system is paired with a series of design strategies which present a variety of scenarios where the AAF concept can be applied. In addition, his concept is assessed regarding its environmental impact, cost and architectural quality. The AAF construction system and design strategies have provided the basis for realizing a real scale active prototype. Ultimately, the output of the research will provide architects with a system and assessed design strategies to optimize design process of BIPV façades, meeting the new energy directives performance standards.

Keywords: Building Integrated Photovoltaics, Low-carbon façades, Design Strategies, Energy efficiency
Optimizing WWR for conserving energy in office buildings for cooling dominant climates with and without daylight utilization

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Abstract: It is estimated that the building sector consumes up to 40% of global energy and is responsible for around 30% of global GHG emissions. The commercial sector has become the fastest growing energy demand sector globally. The construction of fully glazed commercial building facades responsible for high energy consumption has become a common architectural practice worldwide irrespective of the climate. Nonetheless, careful analysis of glazing configurations at early design stages can help control building energy consumption. Only few studies have analyzed the optimization of glazing system in the buildings for cooling dominant climates. This paper presents the methodology to optimize the Window to Wall Ratio (WWR) with and without daylight utilization to reduce energy consumption in office buildings for the climate of Lahore, Pakistan using a simulation tool COMFEN. An office building reference room with double glazed clear glass was developed and series of simulations were performed on each orientation. The impacts of the solar heat and daylight entering through the building façade with reference to different WWR and orientation were explored for the selection of optimum WWR. The optimum WWR was selected on the basis of least energy consumption and satisfaction of preset threshold criteria. When daylight is not utilized, the energy demand is minimized by the lowest possible WWR. With daylight utilization, energy demand is optimized by use of WWRs of 13% to 30% according to orientation. The optimum WWR with daylight utilization saved up to 12% more energy in comparison to optimum WWR without daylight utilization. However, the energy demand increases significantly with WWRs higher than the optimum WWR in both the cases. The methodology used in this study can be applied to any location around the world to find optimum WWR for any glazing type (such as tinted, reflective, low-e).

Keywords: Optimum WWR, Building energy demand, Daylight utilization, Cooling dominant climate, Threshold criteria
Classification and evaluation of Double Skin Façade Technologies in office Buildings in Hot Climates to Improve Thermal Comfort of Multiple-Skin Facades

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Abstract: The research aimed to Evaluating Double Skin Façade Technologies and their applications on Architectural Design FOR HEATING, COOLING AND VENTILATION to Improve Buildings Energy Performance and Enhancing Thermal Comfort using a simulation tool to test efficiency.

The concept of the DSF depends on the Stack Effect, which is created between two glass screens to remove the heat from the building in hot seasons or by using the greenhouse effect to warm up in cold seasons, Ventilated double skin façade (V.DSF) type, especially which depends on "Mixed-Mode" ventilation of both: HVAC system & Hybrid System ventilation strategy is considers the most Suitable, Economic application of (DSF) types in "Hot-arid" climatic zones such as Egypt.

Double wall technique, with variables of air gap, construction material, opening dimensions, and opening position, was investigated within local summer conditions using Energy Plus as a (CFD) simulation engine to study the system efficiency on flow rate and thermal comfort using Double Skin Façade Technologies with all orientations of solar exposure (east, south, and west orientations).

The analysis of gathered data conclude that (DSF) can give great benefit to indoor environment thermal comfort, air quality, daylight, noise protection compared to single skin glass facades, if involves a series of detailed performance analyses.

The research has shown that double façade configuration has possibility of providing acceptable internal thermal comfort through "Mixed-Mode" ventilation strategy in hot climate, this is important in determining the possibility of DSF in incorporating "Mixed-Mode" ventilation reducing energy usage in heating and cooling demands and is proven By applying a simulation using " Design-Build" software of "Energy plus "simulation engine on a case-study of a model of Office building with two façade alternative Basecase.

Keywords: Double Skin Façade, CFD, natural ventilation, Heating & Cooling load.
Dynamic lighting and cooling demand simulation in an urban context

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Abstract: The conventional building simulation method places the sensor at centre of the room to control the lighting output of the whole room without considering urban context. In the practical situation, sensors will be placed in a position that control a zone of light fixtures. This research aims to propose a new method for optimising the daylight sensor position in different urban contexts and creating a lighting output schedule from those sensors for use in dynamic building energy simulation. The model shows the most optimal position to place daylight sensor for each orientation and urban context and at which point more overshadowing increases energy consumption. This research also shows that building simulations without and with context can produce different results for energy consumption of up to 30%.

Keywords: parametric, daylight sensor position, building energy simulation
Investigation of strategies for optimal retrofitting of London Victorian houses to prevent overheating

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Abstract: Climate change predictions determine the building industry to reduce carbon emissions and prevent indoor overheating risk. Future weather files predict high temperatures in London, with an increase in the heatwaves frequency. The 2003 and 2006 heatwaves led to a high number of deaths across Europe, including in the UK. Without improved design or mechanical cooling, these high outdoor temperatures transfer to the buildings’ indoor environment, impacting on inhabitants’ thermal comfort and health. As 75% of existing housing stock will still be standing by 2050 (SDC, 2006), it becomes paramount to retrofit them optimally. Pre-1919 Victorian houses represent 20% of existing London buildings (DCLG, 2015). Reaching new building standards on overheating and avoiding CO2 emissions due to mechanical cooling requires retrofitting the existing buildings, with focus on using passive design solutions on walls and windows. This paper investigates passive retrofitting strategies to identify optimal solutions to prevent overheating risk in London Victorian houses, without increasing carbon emissions through air conditioning. The strategies involve single and combined solutions for fabric (external/internal insulation) and glazing (triple-glazing and 50% reduction of the windows’ area). Two occupancy profiles were considered: 18:00-08:00 working professional, and 24-hour. The occupancy pattern was significant in terms of the exposure time and temperatures, the 24-hour users being more affected by overheating. The rooms investigated are two south-west-facing bedrooms on the first and second floors, for difference in level. The results showed that the most efficient methods for preventing overheating referred to glazing, by replacing double-glazing with triple-glazing, and especially the 50% windows reduction strategy, the less efficient ones referring to the fabric, external and internal insulation, with the internal insulation the least recommendable. The second floor bedroom had generally slightly lower temperatures, with potentially different results for higher height differences.

Keywords: overheating, retrofit, passive design, existing buildings, energy efficiency
Development and implementation of a cloud-based IoT platform to monitor and maintain buildings efficiently using power quality data

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Abstract: Modern commercial buildings are designed and constructed with a BMS system and are linked to digital electric meters, but in most cases, these systems are not used to their full potential. The use of a digital electric meter can be enhanced by connection to the cloud, hence making an Internet-of-Things (IoT) device. The InnovateUK funded research 'Building Asset Risk Management' (BARM) focuses on the commercial implementation of such a device, to aid facility managers in operating and managing their buildings effectively and efficiently. The project has developed a cloud-based platform that extracts data from digital electric meters and then hosts this in the cloud. The cloud system uses state of the art web technology such as NoSQL and MQTT to manage the data. The installation of these monitoring systems is vital for the future of smart cities, where many devices will need to be connected to the electrical points - such as electric car recharging stations - greatly increasing buildings' power usage. In particular, greater power requirements can cause high Total Harmonic Distortion (THD), which reduces the efficiency of the electrical systems and can cause costly downtime. It can also result in nuisance tripping and short circuits leading to a fire. Reducing THD can increase mean time between failures of electrical assets; thus, this type of power quality data can significantly impact maintenance requirements, minimising critical downtimes in large buildings. The research shows how the monitoring of: THD, voltage, current and other variables to track breaker limits and identify trends in electrical power usage. This allows the facility managers to adopt predictive maintenance strategies. Three case studies are presented here which highlight the benefits of implementing such novel technology, mitigating areas of risk in commercial settings; and providing real scope for academic and industrial innovation in the smart cities initiative.

Keywords: Asset risk management, Power quality data, Smart building, Internet of Things (IoT), Software as a Service (SaaS)
Building Performance Optimisation for the Retrofit of a Council Tower Block in London

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Abstract: This study aims to optimise the building performance of a 22-storey tower block in London Borough of Newham (LBN) using energy efficient retrofitting strategies. Initial studies show that the water ingress issues within the tower block are mainly caused by a combination of inefficient building envelope and occupants’ patterns of energy consumption in their homes. The first phase of this research analysed the performance of the tower block through indoor monitoring, occupants’ interviews and building simulation in the winter season. The second phase of this project, the focus of this paper, studies two retrofit approaches of the tower block by applying EnerPHit standard, and the potential retrofit approach considered by LBN. The study builds on the results from the first phase by using building simulation to examine the reduction of heating loads and the improvement of indoor thermal comfort in the winter season when applying each retrofit strategy. The results show that improving the building envelope by using EnerPHit standard through significant improvement of the building fabric and incorporating Mechanical Ventilation and Heat Recovery (MVHR) systems, decrease the building heating energy loads to more than half of the actual energy consumption while keeping the indoor thermal environment within the standard comfort range. In addition, using LBN suggested thermal insulation material as the potential retrofitting strategy to improve the External Wall Insulation (EWI), reduces the energy consumption of the building to nearly half of the original heating energy loads, nearly similar to the first retrofitting approach in this study.

Keywords: EnerPHit, energy efficiency, retrofit, building performance, thermal comfort
Facade Retrofit of Residential Buildings: Multi-objective optimization of a typical residential building in Cairo

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Abstract: The population and the residential sector are continuously expanding especially in highly dense cities such as Cairo, Egypt. Due to high demand for cooling energy in the residential sector in Egypt recently, a great attention was paid to retrofit existing buildings to decrease reliance on air conditioning. The existing housing stock is suffering from poorly insulated buildings envelope and lack of energy conservation measures. This is mainly to minimize the initial cost of the construction process while available sustainable guidance is still not mandatory. However, yet façade retrofit solutions include a wide range of variables for wall insulation and glazing types. This study aims to identify best configurations of the building facade retrofit solutions to minimize energy consumption due to cooling and retrofitting cost. A multi-objective optimization was performed on a representative benchmark for typical residential buildings in Cairo using genetic algorithm in order to test different combinations of retrofit options that best meet study objectives. Simulation results were assessed and calibrated against monthly electricity bills using Design Builder as a graphical user interface for EnergyPlus. Best retrofit combinations were highlighted and tested using life cycle cost assessment, and then effective variables were prioritized based on a sensitivity analysis.

Keywords: Façade retrofit, residential buildings, multi-objective optimization, Cairo.

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Influence of occupant behaviour on thermal comfort and energy use in Albanian homes

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Abstract: This paper focuses on occupants’ behaviours that affect the energy and thermal performance of residential buildings in Albania. Results were extracted from monitoring of the building and occupant surveys in one selected bungalow in Tirana, a form-built that represents over 80% of residential buildings in Albania. It was built in the post-communist area and has a concrete block construction. An annual electricity consumption 35% higher than the average for Albanian houses was found and a high variation of indoor temperatures during summer and winter. Key reasons for these findings were occupants’ behaviours, that were determined by occupants’ lifestyle, preferences and perceptions of comfort as well as cultural factors. The lack of information regarding behaviours that decrease energy consumption, and the lack of determination to consistently practice what they knew, resulted in a high energy consuming and uncomfortable. Window operation was found to have the largest impact in energy load and achieving comfort. These findings strengthen the need to understand the relationship that residents have with their properties, as well as the socio-cultural context, in order to suggest energy retrofitting strategies that will be accepted, implemented and really work for them over their lifetime in the properties. These results should be used to inform and validate the baseline energy modelling rather than using untested assumptions to minimise the performance gap between the expectations and outcomes created at the design stage.

Keywords: Occupant behaviour, energy performance, thermal comfort, monitoring, retrofit
Biomimicry as A Design Guide Towards Sustainable Built Environments

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Abstract: Built environments have great negative impacts on the environment, which further increase as the urban population grows (UNFPA 2007). Efforts have been made in the past few decades to shift towards sustainable urban development, such as aiming for zero environmental impact or ‘neutral’ buildings in terms of energy, water, carbon or waste. Although these targets are valuable, they are not enough. Research suggests that even if all GHG emissions were stopped at once, the slow Earth’s response would mean that the effects caused by past emissions would still be experienced (IPCC, 2007). This implies that the built environment needs to have net positive environmental benefits to remediate the environmental damage rather than just sustaining the current status. Architects, urban designers and planners should explore novel ideas that could lead to such a shift in the way we design our cities.

This paper investigates Biomimicry, where nature’s organisms, processes or ecosystems are mimicked in design, and its potential to present a new approach for designing the built environments to be truly sustainable or regenerative. It is important to note that biomimicry is not about the mere copying of nature’s shapes, but rather the ideas, functions and principles that lie behind them. The question put forward is: how can mimicking nature be useful in finding a new methodology to design sustainable built environments?

A brief introduction to the definition, levels and principles of biomimicry is followed by the analysis and critique of international biomimetic case studies with the aim of deducing a design framework that could form the basis of a new methodology to design sustainable built environments. It is argued that the incorporation of biomimetic ideas in the design of our cities would lead to creating built environments that are positively integrated into nature rather than dominating over it.

Keywords: Biomimicry, Sustainability, Built Environment, Resource Efficiency.
From Watt to How: upgrade within existing neighbourhoods

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Abstract: Neighbourhoods are the collective reality in which urban buildings evolved for centuries, the reason for their diversity and versatility, and the key to their perseverance. Nonetheless successive European investigations and legislation favour individualistic approaches targeting only at salvageable Watts estimations, facilitating theoretical and legislative production while hampering action and compromises results.

Sustainable (re)Design requires a thorough understanding of the intertwined systems and scales, current and upcoming, to assure that Climate Change mitigation, Energy Efficiency, Energy Poverty, individual knowledge or financial (in)capabilities, to name a few, are not opposing parameters. Starting from an existing building within a UNESCO Heritage setting, documented throughout international projects and publications, the author emphasizes neighbourhood scale as a collective opportunity for action. Acknowledging that individual “deep assessments” of existing buildings (microscale) provide specific patterns that translate individual characteristics and uses, Watts included, the investigation shows that their full relevance can only be harnessed if matched with the collective goals of the neighbourhood (mesoscale) they belong to. Scale and context can help identify strategies to replicate, complementary qualities to share and space for innovative financing, contracting, deployment, operation and optimization that better match the macroscale measures defined by regional, national and international efforts. The authors demonstrate that going beyond Watt ⸺to understand What matters to each neighbourhood scale⸺ is key to understand How to make such measures viable, How to make them solve other problems beyond energy efficiency and How to merge existing infrastructure and funding opportunities; while simultaneously attracting the majority of the stakeholders interest (policy makers, academia, exterior investment, owners and users) into the win-win partnerships that better match each neighbourhood.

Keywords: Zero and Low Carbon neighbourhoods, Energy Efficiency, Energy Deficiency, District Scale, Renewable Energy.
Sustainable urban design
The Effect Of The Relationship Between The Height Of Building (H) And Width Of The Street (W) In Distribution The Physical Loads - Thermal And Visual –In The Street, For Saharian Cities, Case Study Of The City Of Biskra, Algeria

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Abstract: The urban tissue depends on the logical relationship between built and non-built space in the distribution style of the physical loads in the free space - the street-. Where the ratio between height / width is the considered as a main controller in the amount of thermal and light energy that reaches to the street. The methodology of this research was due to the field of experience in order to raise the real values of the physical loads every two hours, each three consecutive days. Where adopted to the comparison of two main axes of the physical loads, they are 1-the thermal load, 2-the visual load, through the measurement stations that are positioned via the three types of the relationship between H/W, (h≥2w, h=w, h≤0.5w). Where the street engineerings, ( open street, dihedral street, canyon street). Through the obtained results, we noticed and recorded the difference between these values in the three types of street engineering. The difference in the thermal values of the air reached 4 ° c , and the difference in the direct natural lighting periods of the high amount reached six hours. The conclusion, we can note the values difference between the three types of the relationship H/W. Where the street was of the high ratio between H/W (h≥ 2l), which knows canyon street, is the less physical loads. Thus turns out the effect of the relationship between H/W to protecting the free space –street-. This is very important for desert cities.

Keywords: physical loads; street; the city of biskra; urban tissue; the height of built
Integrated Built Typologies: An Ecological Design Approach to Regenerate Suburban Quarries, Bangalore, India

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Abstract: Quarries are often synonymous with beautiful cities, spectacular monuments and infrastructure development since time immemorial. However, the environmental disarray that it may cause often remains invisible and undocumented. The narratives of quarries in the peri urban sectors of Bangalore city present a paradoxical picture to the environs, reimagined by its rulers over several centuries, as the garden city of India. Sites seldom remain silent; the photo essays and transect studies, introduced at the under-graduate architectural studio level, captured the conflicting characteristics of quarries. They reveal the socio-political and environmental mayhem woven by these abused landscapes. The studio methodology examines critical questions on the sustainable regeneration of these hidden landscape narratives and its integration with the built environment. The study is supported by rigorous qualitative and quantitative analysis; involving ethnographic studies to premise the socio-political concerns and subsequently a precise environmental mapping conducted to reveal the landscape vagaries. The design outcome illustrates the need for a paradigm shift in the conception of architectural typologies. It proposes an ecological approach of innovative built typologies to harness and integrate these abandoned urban voids as part of the built environment; thus, constructing the design impetus into the territory where the built meets the vagaries of abused landscapes. It illustrates a series of strategies and practices that may integrate the quarry with the built environment, in its efforts to regenerate life back to the landscape. Here, harnessing water and correcting the altered water network are hypothesised as fundamental to regeneration tactics. Hence, the design demonstrates, in detail a built structure which works both as a hydraulic structure and a building which houses a public function connecting the public squares with in the campus; the Centre for Environmental Education (CEE) India.

Keywords: Education, Studio, Regeneration, Environmental Design, Ecological Approach
Impact of integrating renewable energy on the form of the city “wind corridor as an approach for sustainable urban communities”

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Abstract: The growing global interest on reducing energy consumption has increased public awareness of raising energy efficiency on different urban levels and using more benign forms of energy. This paper studies the possible impact of using renewable energy and strategies to raise the energy efficiency on urban design level in hot climate regions as a new vision for a sustainable urban community in a trial to minimize carbon emissions results from cities to reduce pollution and enhance the environment, this was achieved by creating wind corridor inside the city by using urban structure to adapt wind to flow in a certain path and increase its speed that suit generating power from wind potentials after installing small scale wind turbine in appropriate locations inside the city, also this concept will lead to a better wind ventilation. Finally a new Egyptian city was chosen based on its renewable energy potentials then evaluating and editing its master plan and implement wind corridor strategies inside it to be more sustainable.

Keywords: Sustainable urban communities, Renewable energy, Energy saving, wind corridor.
Integrated Framework for Establishing Community Based Ecotourism, Case Study Egypt

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Abstract: Earlier in Egypt environmental protection and community participation wasn’t the main concerns for traditional tourism, but nowadays engaging the community in managing ecotourism development becomes an essential target to grasp. It is noted that 93% of the Egyptian land is virgin desert areas with unbelievable combinations of biodiversity. Nevertheless, Eco lodges in Egypt face ongoing degradation and have an environmental negative impact on the present natural habitat, due to the lack of appropriate research and inadequate management strategy. The paper adopted a logical unified multidiscipline methodology (LUMD) through investigating the evolution of ecotourism, its participants, key considerations for ecotourism development at the community level, the GOs & NGOs role in promoting ecotourism, the industry demands for ecotourism, and finally the international principles & guidelines. The paper’s main aim is to explore the prerequisites for an ecotourism management plan and how it contributes to the community based developments within the Egyptian context. The results present a developed integrated framework for managing ecotourism & involving the community in the development process. Accordingly the contributed framework is considered a pilot one that firstly combines the international guidelines and the concurrent local ones taking into consideration, how to reduce the threats, strength the opportunities, and assign the role of each of the participants & partners. It also target coping with the Egyptian eco-tourism nature and grantee running its development in a sustainable way that ensure resources conservation for the new generations, and community participation.

Keywords: ecotourism, community participation, environmental impact, degradation, sustainable development.
“Leaping city” Addressing Sustainable development in small scale cities in Egypt

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Abstract: Egyptian cities face major challenges in coping with emerging economic, social and environmental crises that looming, where creating jobs for the young is one major challenge, providing fresh water, energy, and food are as well becoming both urgent and critical for the decent survival for people in Egypt.

A small-scale city, with around fifty thousand residents such as El Qusier, is where one can detect those challenges closely. The eminent climate change is making the state of those challenges even worse. As Egypt is one of highest five states vulnerable to climate change despite its very low contribution to GHG emissions. The slow response by the government, which is still shying away from addressing this situation properly, is coupled with evident economic and political uncertainty. No potentially successful planning proposal can contribute positively without addressing such context.

This paper is investigating the potential to approach Local challenges in the city of El-Qusier as developmental opportunities, using mainly the local available resources. This approach aims at conceptually experimenting with the idea of creating Small-scale interventions that can instigate a network of sustainable local environment. The modest initials of these networks are thought of to eventually develop into more elaborate environments using the help of more advanced local technologies and education. Five different types of city identified potential environments for initial developments are selected and specific proposal is developed for each as to show whether the proposed idea can work or not.

Keywords: Sustainable urbanism, red sea cities, microsystems, climate change
Principles for a Successful Riverfront Regeneration with Special Reference to Cairo

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Abstract: Cairo with a population of over twenty-one million is one of the densest metropolises in the world. However, its urban population is undeserved with public open spaces; the Nile’s riverfront regeneration holds a great opportunity for reconnecting the citizens to their city. By establishing this connection a significant improvement to their quality of life would occur considerably improving their daily lives allowing them a breath out, contributing to their development, providing social equity and strengthening the societal fabric. Although there are some plans and pilot projects for the Nile’s regeneration in Cairo, they do not meet the citizens’ expectations. The unsatisfactory quality of riverfront regeneration projects can be attributed to the lack of financial support, rules and principles, stakeholder approval and participation. Furthermore, Cairo’s riverfronts are facing trends of privatization, abandonment and pollution.

The research attempted to tackle the problem of poor riverfront regeneration principles in Cairo by adapting international design principles to the local context of Cairo. The research followed a deductive methodological approach for data collection and ensured data validation through triangulation of data sources: literature review of design principles, International case studies of riverfront regeneration analysis; as well as carrying out a questionnaire with local experts. The generated list of principles can serve as a guide for future designers, developers and governmental authorities when considering riverfront regeneration for Cairo to ensure a successful and sustainable riverfront regeneration plan.

Keywords: Cairo, riverfront, regeneration, principles, sustainable.
Rural Morphology of Nigerian Town: A Quest Towards Ameliorating Challenges in Land Use Activities Patterns

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Abstract: A considerable amount of literature has succinctly explained morphology in connection with a critical investigation of human settlement that has developed over time in terms of structure, process, and stages. However, the morphological structural features of rural settlements within the South-west, Nigeria showcased the geographical landscape via identified features that portray their individuality. The characteristic of these settlements is a reflection of natural background, social, historical conditions and human induced activities. Fewer studies have dealt with a morphological examination of a typical Nigerian town in relation with functional and land use activities patterns. Hence, this study explores the neighborhood's growth for the past five decades by establishing diverse rural challenges, features, and prospects. The town is studied in three transformation phases, using ArcGIS version 10.3. The 1st phase spanned between the year 1910 to 1959, while the 2nd and 3rd phases ran through the year 1960 to 1999, and year 2000 to 2015 respectively. Study’s objectives are in two folds. First objective is to study the associated challenges with the town through the size, growth, and land use distribution. The second objective is to investigate the perceived inhabitants’ activities pattern within the neighbourhood. The first finding revealed that some challenges needed to be resolved in a bid to meet the current basic needs. Second finding indicated that the rural settlements in Nigeria emanated from the residents’ adaptation to the environmental conditions, cum transformation through human activities. Meanwhile the third finding established that the human settlements evolved in connection to the local socioeconomic, recreation and religious virtues of traditional market place (Oja). Conclusively, the significance of the historical and social influences plays a major role in the solving challenges in the spatial configuration of the settlements. The implication of the study becomes vital to the major stakeholders and professionals in the built environment on the significance of enhancing the sustainable communities in Nigeria.

Keywords: Rural morphology, Land use patterns, Rural settlement, Human settlements, Sustainable communities
Collective analysis for Cairo’s food system flows towards deriving physical planning and policy guidance.

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Abstract: Food security is one of Egypt’s fundamental challenges for development and human welfare. Egypt has suffered a series of shocks that caused an evident decline in its food and nutrition security and problems as poverty and food insecurity that were usually perceived as rural issues are becoming a rising concern for urban areas as well. Cities are bound to food by their appetite. Yet, as urban dwellers, we are oblivious to what it takes for our urban food systems to function and the amount of resources needed to feed our cities. The complexity and low visibility of urban food systems have hindered addressing them in the same magnitude as other urban challenges. However, urban food systems are directly related to the city’s economic development, public health and welfare of its residents. An insight into the metabolism of our urban food system; where the city is reread as an ecosystem where flows of energy and materials cross, can help us manage its complexity and contribute to its sustainable development. Taking Cairo as a case study; six vital food system flows are identified: land, water, energy, goods, capital and employment. The flows are to be analysed both quantitatively; to visualize the system’s transfers and losses and spatially; to illustrate how the flows relate to the city’s spatial development. The data is to be analysed in terms of: the food system resource use, environmental impacts and inefficiencies and the system’s food security, in terms of the food availability and access dimensions. The paper will then reflect on how to relate Cairo’s food systems to the Egyptian city development policies and physical planning process; based on the previous analysis and the best planning practices on food systems and sustainability discussed in the literature.

Keywords: Food security, Urban Food Systems, Sustainable development, Urban Metabolism, City Flows.
The Role of the Spatial Configuration in Land Use Distribution in Muscat

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Abstract: This study examines the relationship between land use distribution and the spatial structure of street networks in the newly developed neighbourhoods in Muscat city, Oman. Two neighbourhoods in Al-Maabilah district in Muscat were examined using Space Syntax theory. The land use maps were developed through exhaustive site visits. While axial line maps of Space Syntax were generated using DepthMapX Software. The spatial attributes included in the study were Integration, Control, Choice and Normalized Least Angle Choice (NACH); whereas the land use variables were Retail, Residential and Mix-use. The relationships between the variables were assessed statistically using SPSS software. The results showed that the distribution of the Residential land use is significantly influenced by the spatial attributes in highly intelligible spatial configurations; with NACH being the best predictor of the distribution of the Residential land use followed by Integration. However, in areas with low intelligibility the correlation was not significant. In addition, the degree to which an area has a formal grid structure was found to have no effect on the relationship between the variables. Thus, this paper contributes to Space Syntax literature and land use distribution studies by providing evidences on how the spatial arrangements might influence land use distribution; and concludes with recommendations to the planning authorities in Oman.

Keywords: Land use, Space Syntax, Street network, Oman, Integration, Normalized Least Angle choice.
Towards Sustainable Prosperity for Informal Settlements - Al Max, Alexandria and Fes El Bali, Fes as cases study

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Abstract: Egypt as one of the developing countries is in great suffer from the dense informal settlements which almost in the last few decades extended dangerously to the settlements closer, influencing negatively, resulting deterioration and service lacking. In general the informal settlements known as slum areas are considered as solutions to the housing problems in many countries by providing the inhabitants self-housing, on the contrary they hold too many negative attributes such as Urban & infrastructure deterioration, social ignorance, cultural problems, lack of educational & health services, unawareness, emergency accessibility lacking, disappearance of community urban spaces, disappearance of public and recreational spaces, lack of transport and communications, lack of social prosperity, low quality of public facilities, besides creating housing units faraway from building construction code and regulations, in addition to major construction problems, all these considered as the basis of the quality of urban life. Thus the need for solution was necessary without the intention for demolition nor destroying these settlements; yet the solution would go for a sustainable progressed approach to upgrade and enhance these settlements reaching quality of life attributes for the inhabitants nowadays and in the future towards both; the informal settlements and the neighbourhoods nearby. This paper aims at pursuit the sustainable agenda, determining the datum of accepted well-being community through determining a group of indicators and principles believed to be the sustainable base approach reaching quality of life to substitute the informal settlements to more reasonable rational settings, targeting upgrading the whole city as well, via striving experimenting national and international case-studies to reach relevant assessment.

Keywords: livability, quality of life, social sustainability, informal settlements
Towards a sustainable renewal of peri-urban neighbourhoods of single-family houses in Switzerland

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Abstract: Resulting from the society shift of the post-war period, urban growth and urban sprawl of infrastructure and settlements of individual housing are today at the centre of public policies’ focus, in particular due to their widely criticized environmental impacts. If sustainable urban planning strategies aim at avoiding the construction of new peripheral residential developments, few studies question the future evolution of existing peripheral neighbourhoods – although their inhabitants will face increased economic, social and environmental issues in the coming decades.

The on-going research presented in the paper investigates the possibility of a sustainable renewal of peri-urban neighbourhoods of single-family houses in Switzerland by 2050. In this framework, the paper first defines the research framework characterized by the recent evolution of public policies. The revision of the territorial planning law (LTP) of 2014 intends to reorient future urban developments toward existing and well-connected built-up areas. The 2050 energy strategy and the “2000-W society” vision provide a framework to consider the overall energy transition in Switzerland, as well as specific targets to reduce households’ overall energy consumption. Then the study presents the design framework of peri-urban renewal paths. It relies on the identification of peri-urban residential municipalities within the Swiss territorial context, and the elaboration of a pre-operational typology of peri-urban neighbourhoods of single-family houses. Finally, the paper presents four design scenarios based on a wide literature review and a series of interviews with urban planning and architecture experts to undertake a feasible renewal of existing peri-urban neighbourhoods of single-family houses by 2050.

Keywords: Peri-urban residential areas, policy framework, energy transition, design scenarios, Switzerland
The untold story of the urban design practice of new cities in Egypt

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Abstract: This work reveals the untold story of the urban design of Egyptian new cities according to the nature of the singularity of the city. Singularity at various patterns is attempting to re-emerge with a shape distinctive from “us.” The meaning is that there will be a distinction, in post-singularity, from one city and the other. That is not only based on architectural form and formation but also in the differentiation of design ideas at the level of creating the city and the meaning stored in a hidden or inaccessible place in the public realm. The article comprises three questions: a ‘why,’ ‘what’ and ‘how.’ The first question is why the images of the new cities no longer affect the collective consciousness of the city residents like the traditional cities did? What made the absence of singularity of cities a dominant state? Moreover, how can be handle this lack of singularity possessed by cities? In perspective, the contribution of this paper is that it describes a new trend and concepts of urban design through which to suggest an innovative approach based on the idea of ‘Trans-Paradigms City’ and cities of singularity.

Keywords: City Imprint, City of Singularity, Singular Urbanism, Trans-Paradigm City, Urban Design
Promoting measurable indicators for sustainable development of open areas in neighbourhoods-with special reference to Khartoum Town-Sudan

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Abstract: The research reported in this paper identified indicators for sustainable planning of open areas in neighbourhoods. The research was performed in the new residential developments in Khartoum Town (El Riyadh (1972), Nasr Extension (1972) and El Mujahedeen 1988), compared to older neighbourhoods (Khartoum (2) (1950), El Diem (1953), and Alamarat (1958)). The research problem is that some of these areas are typically single-use residential areas, with small undeveloped open spaces and poor landscape design. The research is aiming to study the planning of open spaces in these neighbourhoods; collect, analyse and classify the data to find its impact on the development of open spaces. Then set guidelines to achieve well-used open spaces that can best serve the general public. The research was concerned with recognition of good practices that lead to sustainable development of open areas and promoting measurable development indicators such as index of sufficiency, accessibility, safety of the users and social-inclusion dimensions. The analysis focuses on some physical parameters of open spaces e.g. area, fencing, green coverage and types of facilities available (lighting), and some behavioural parameters i.e. type of activities, group of users, developers and managers of open spaces. The results confirmed a lack of a comprehensive development programs and reliable statistics for open spaces that leads to poor variety of outdoor activities. The research found that most of the successful examples of developed open areas of the surveyed neighbourhoods are managed by community groups (public participation).

Keywords: sustainable planning, neighbourhoods’, open spaces, measurable indicators, outdoor activities.
Towards Regenerative Sustainable Urban Development with Special Reference to the Egyptian Context

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Abstract: In a world with increasing urbanization which is facing severe environmental crises, the search for means to achieve sustainable urban developments is no longer a luxury. The philosophies behind urban sustainability have become well known. It is important to transform these philosophies into practical guidelines for specific localities to accomplish urban sustainability. This paper aims to develop a tailored set of beneficial, practical and measurable guidelines of sustainable urban development. It starts by discussing different means to achieve sustainable urban developments (rating systems, guidelines, policies and etc.). It focuses on the most critical and foundational sustainable urban design guidelines (the new urban agenda NUA, sustainable development goals SDG...etc.) in order to develop sustainable urban design guidelines tailored to fit the culture, economic and environmental conditions of current Egyptian urbanization. The research uses semi-structured interviews and questionnaires to evaluate the importance of the suggested guidelines using quantitative analysis tools and techniques.

Keywords: Regenerative urban design, the new urban agenda, urban design guidelines.

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Abstract: Livability is a concept that has been experienced worldwide. There is no standardized definition of livability, it is equivalent to the quality of living in a city and is determined by various dimensions. It is a tool to measure sustainability in many cities over the world. The term livability is an umbrella to a variety of meanings, which depend both on the objects of measurement and on the perspective of those making those measurements. This paper explores the inter-relationship between livability and urban design, focusing on the socio-cultural dimensions. It starts by reviewing the most significant urban dimensions presented in literature worldwide. This paper aims to analyse the city livability to suggest a set of urban dimensions to achieve livability in the Egyptian new cities. It measures urban livability at different urban contexts in Sheikh Zayed city in Egypt, reviews residents’ perceptions of Sheikh Zayed city. The research uses a quantitative tool (schema ball) to identify the relationship between different urban livability dimensions in the Egyptian new cities. The analysis shows the similarities and diversities of urban livability dimensions in the Egyptian context and discusses the problems most relevant to people’s lives at the moment and to propose the possible steps we can take in future to turn Sheikh Zayed city into a more livable city.

Keywords: Livability, Sheikh Zayed city, urban Dimensions, schema ball.
Motivating participation in regenerating sustainable urban neighbourhood open spaces

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Abstract: Re-generating neighbourhood communities that are physical, socially, and economically sustainable is a major challenge. A “sustainable urban neighbourhood” is a small-scale urban area within a city that comprises economic, social and environmental sustainability. However, open spaces as a vital component of the neighbourhood’s physical structure, have an important role to play. They represent the arena of both, neighbours’ outdoor interactions, subsequently building the neighbourhood’s sense of community. Several approaches have been implemented to regenerate sustainable urban neighbourhoods’ open spaces. Yet this paper adopts a new approach based on the motivational theory. This approach –based on the motivating potential score MPS- relies on a mathematical formula, which examines the motivation score that reveals the low values which have to be enhanced, and the high values which must be enriched. This paper aims to investigate the roles of regenerating sustainable urban neighbourhoods in terms of open spaces and gathering areas to enhance the communities’ sustainability. It examines how local partners can work together to raise the sense of locality and realize the aspirations of their needs and concludes with recommendations for better neighbourhoods and stronger communities. The paper offers the Motivating Potential Score as an integrated tool used to evaluate the capacity to motivate local community participation. MPS model imitates the psychological state of local community partners, motivational characteristics, and personal attributes, which influence response to challenging and complex participation tasks. Finally, the paper applies its findings to one of the open spaces in Egypt; Cairo ‘masaken Othman’ as an open space re-design. The application comes to show the validity of the conceptual application of the proposed motivating potential score upon encouraging the local community to participate in re-designing their own neighbourhood open spaces, towards the more sustainable urban neighbourhood.

Keywords: Sustainable urban neighbourhood, local partners’ participation, Motivation theory, motivating potential score MPS, regenerating urban open spaces.
Connectivity and place-making Blue-green transects: prospective potentialities towards social sustainability

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Abstract: Isolation becomes a phenomenon that defines the contemporary Cairene urban fabric seen, on the one hand, in the massive implementation of gated communities, and on the other hand, in the forms of imposed siege surrounding informal settlements. A particular urban topology composed of the network of the irrigation and drainage water canals of the former agriculture land located in the intersection between the rural and urban limits could be a mean to struggle against this phenomenon. Thus, our aim is to rethink an intelligent transformation of these blue-green courses as an agent of “connectivity” on spatial and social levels. Proposing a conceptual framework pursuing “connectivity” will be achieved via crossing three main corpuses: first, the fundamental human needs (FHNs) coined by Max Neef; literature on social sustainability associated with social capital; and finally, the different potentials of water urban context for achieving community social capital. Based on this conceptual framework, an in-situ approach along Al-Maryouttia Canal, Cairo, Egypt as a representative case study will be adopted to raise awareness and to understand the possible prospective potentials that these blue-green transects possess for achieving social capital in the Cairene urban context.

Keywords: Social sustainability (SS), social capital, connectivity, segregation, watercourses
Exploiting Sustainable Managing Resources for Heritage Tourism in El Alamein, Egypt

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Abstract: Today, heritage-based tourism has emerged as a leading growth sector in global tourism markets. Natural and cultural heritage can fully provide the development of tourism by exploiting intellectual and material resources. It is important to understand these resources as including not only cultural institutions, museums and historic monuments, but also all ancillary resources related with tourism services, such as historical and cultural monuments, historical and cultural centers, sites of important cultural events, natural heritage and other places of worship, cemeteries, etc. Hereby, heritage tourism is considered to encompass elements of living culture, history, and natural history of place that count as community's value for the future. These elements are very specific to a community or region. To maximize the revenue potential offered by the heritage tourism industry, it is necessary to give more technical attention to managerial guides and sustainable development principles on their components. It could be reached by better fit of tourism development or planning along with a better understanding of natural and cultural tourism. Thus, the aim of this study is not on primary cultural heritage objects, but on resources which have a better implementation in managing the sustainability in tourism destinations in El Alamein as a final objective. To tackle the objective of this paper, firstly, definitions of cultural and natural heritage were stated. Secondly, the linkage between heritage and tourism were emphasized. Moreover, the case study of El Alamein, as a tourism destination in Egypt, was analyzed by implementing sustainable managing resources for tangible and intangible heritage elements. Results of this paper took the form of managerial guides and sustainable development principles of the heritage tourism industry resources.

Keywords: Heritage Tourism, Sustainable Development, Managing Resources, El Alamein.
The Dilemma of Public Spaces in Cairo: A New Model Investigation Tool

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Abstract: What is the essence of a “public space”? A public place is a space made meaningful and it is governed by the specific social norms that produce it. Long ago, urban spaces, such as the Agora, emphasized a unique affinity for a society’s state of well-being. It represented a democratic situation that enabled people to exercise marketing and social activities freely. Nowadays, the definition for a public space has changed! The squares and open spaces have become inherently political and a window to show a nation’s political state and government that was influenced by the concept of globalization and liberal values. Cairo exhibits an ample amount of forms of public places: extending from the physical places as large gardens and open spaces to other ones such as streets, communal enclosed space and even more. Sometimes the government and private officials have control over the activity and ownership of the place. Similarly, a public space could be affected by design, on a macro and micro scale level, and by social and cultural norms.

What are the factors that make and control a public space? The first purpose of this research paper is to develop a solid theoretical standard of publicness as a practical tool: a model for assessing public places. Five key dimensions of public spaces have been presented and differentiated: Ownership, Design, Animation, Civility, and Control. Through their synergic interaction, where the sum of all is greater than the parts added together, they create the publicness of public space. The second aim is to translate the assessment model into a practical methodological tool to define, understand, and compare public spaces. Different and contemporary typologies of public spaces throughout Cairo was examined and compared. Case studies included Al-Azhar Park, Asr Al-Shamee’, and Cairo Festival Mall.

Keywords: Public Spaces, Cairo, Ownership, Design, Civility, Control, Animation
Role of Local Festivals in Promoting Social Interactions and Shaping Urban Spaces

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Abstract: Urban Spaces have played an important role in people's psychological life and in their integration with environment, as it is the mediator between people and their environment. Despite its importance, many communities suffer from the absence of positive communication between people and place. And this lead the governments to seek for a solution and they found that events can be used as a tool of enhancing the social engagement as they can reach a broad swathe of the population and have potential social benefits, like offering celebrations and building social networks within communities. In addition, they can help in build cohesive communities, offer employment opportunities and attract visitors to destination. More recently, there has been a focus on their ability to deliver social or political messages to audiences. Festivals are considered the most effective patronize for social formats impact on the spatial formation, since the human is the main sponsor for forming the spaces that contain all the events that may be specific or temporary, thus it was essential to show physical and non-physical components for space formation in order to gain access to identify the reciprocal relationship between people and place and highlight the successful spatial expressions that help boost the spirit of communication between people and develop a sense of place. The paper seeks for identifying the relation between people and urban spaces and how the dynamics of social life shaped the special spatial arrangements created. An analytical study was formed by observing the varieties of social behaviours occur within the urban spaces and analysing the reflection of these behaviours on the transformation of this space during local festivals. The results shows how the spatial setting and structure of the place can organize and control these relations and can contribute the feeling of belonging.

Keywords: Urban Spaces, Festival, Social Interactions, Human Behaviours, Enclosure, Centrality, Axiality, Permeability and Connectivity
Social Sustainability and Urban Form in the Cities of Developing Countries: The Case Study of Mersin

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Abstract: There have been limited researches about the social aspects of sustainability in the context of cities of developing countries. The cities in the developing countries are growing rapidly due to their high economic growth rate but on the other hand this brings serious problems to the city (Like insufficient infrastructure, urban poverty and housing) (UN HABITAT, 2006; UN ESCAP, 2005). The main aim of this paper is to evaluate the relationship between social sustainability and urban form in the context of cities of developing countries. Selected aspects of social sustainability were examined in the context of Mersin. Mersin is the one of the harbour cities of Turkey which has SYRIA immigrants. We collected data from the 3 case study neighbourhoods of different densities (higher, medium, and lower) and built forms within the Mersin Metropolitan region to evaluate relationship between social sustainability and urban densities. Findings showed that there is a significant relationship between residential density and the associated types of housing and social sustainability.

Keywords: Social Sustainability, developing countries, urban form.
Emergent Trends in Architecture and Urbanism in Modern Cairo: Shifts in the Built Environment

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Abstract: This paper examines the shifts and transformations of the different built environments within Greater Cairo’s urban agglomeration and argues that shifts and transformations are inevitable in order to achieve sustainability, especially social sustainability in the urban context. The methodology adopted by the research is based on historical facts, comparative analysis and field studies. It starts out by depicting a quick image of modern Cairo, while highlighting the shifts and transformations that inevitably occurred in the built environment over time. New Cairo City- to the east of Greater Cairo- is taken as an example of these contemporary shifts and transformations, demonstrating the problem of unsustainable urban development and concentrating on the lack of social sustainability. At the end, an approach towards a solution to achieve social sustainability within the urban context is discussed.

Keywords: shifts, transformations, built environment, New Cairo City, social sustainability
Smart Solutions in New Cities as main actors in Regenerative Urbanism: "The Creation of Resilient Cities through Circular Urban Metabolism and decreasing Ecological Footprints"

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Abstract: The urbanisation process has- since the industrial revolution- marked the planet earth with several grave phenomena, such as climate change and the loss of biodiversity to mention only a few. This resource-intensive process affects the world's ecosystems and is mainly demonstrated through ecological footprints, which must be decreased in order for cities to become more environmental-friendly. Regenerative urban development is considered an effective concept that could help with decreasing ecological footprints and thus, restoring damaged ecosystems. This integrated approach aims at reaching circular systems of resource use instead of linear ones. This is accomplished through adopting regenerative relationships between cities and their ecosystems, as well as embracing comprehensive, environment-enhancing strategies, whose intentions are not only to sustain existing resources, but also to enhance cities’ ecosystems in order to supply resources through circular urban metabolisms. We believe that adopting interrelated smart solutions in new cities could play a major role in attaining an advanced stage of regenerative urbanism. This paper starts by demonstrating current urbanisation problems and how the ecological footprints of cities are representations of where cities stand in relation to their ecosystems. It then shows how the world is moving on to decreasing ecological footprints through creating resilient cities and adopting circular urban metabolisms, as well as regenerative urban practices, which become more effective and efficient when applied through smart solutions. Examples are given of the relationship between regenerative urbanism and smart solutions, as to how they could be integral parts of the planning process of new cities. For example, such smart solutions could help with the efficient use of renewable energies, with the improvement of waste management systems and with efficiently sticking to the new cities’ hinterlands, which ultimately help in reaching suitable ecological footprints that do not exceed the productive land on earth.

Keywords: Ecological Footprint, Regenerative Urbanism, Circular Urban Metabolism, Resilient Cities, Smart Solutions
REDUCING THE EXPOSURE TO GASOLINE IN EGYPTIAN NEW SETTLEMENTS: A PUBLIC HEALTH CONCERN

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Abstract: With the evolution of ecological awareness concerning the relationship between urban development and the environment, attitudes are being rethought, environmental problems started to motivate the emergence of a new ecological vision of society. Although, gasoline stations became an integral part of our daily lives, they are usually associated with environmental and health risks and considered a source of pollution that have a significant effect on the surrounding communities. In Egypt, like in other countries, it is relatively common to come across gasoline stations surrounded by houses, particularly in urban areas and in spite of the serious efforts to reduce air pollution; it remains a major health risk. As the contamination risk related to hydrocarbons from these stations is very severe, the research focuses on air pollution problems associated with gasoline stations along with the subsequent impacts on human health, environment and the nearby houses. The problem is that there are still no restrictions in the Egyptian local regulations and legislation concerning site selection of these stations. That's why a question was raised about what should be done to minimize potential adverse impacts of such stations. The aim of the research is developing guidelines for gasoline stations in New Sustainable Settlements in Egypt to reduce their risks and negative impacts. The research was based on inductive approach through identifying sources of air pollutants, health risks and limit values of these pollutants and the international limit values for the distance between these stations and the nearby residents. In addition to a practical study that investigates the impact of emissions of pollutants from gasoline stations on the local air pollution. As a result, guidelines are developed to provide designers and planners with suggested procedures, requirements and safety design measures for the mitigation of the effect of toxic fumes emanating from gasoline stations.

Keywords: Health and safety requirements, Air pollution, Gasoline stations, Volatile Organic Compounds, Reduction of air pollution in new settlements
Determining Attributes of Public Space for Social Sustainability: The case study of Kushimato Street in Mersin

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Abstract: The academic works about social sustainability are mostly on urban units of larger scales such as neighbourhoods, the urban region and city or country level. The aim of this paper is focuses on the components of social interaction with discussing the attributes of good public spaces, through its viability and vitality of social spaces and the interactions within these spaces. For this reason we focused on a street which is a small scale built environment unit as the primary public space in city and identify the characteristics of social sustainability through literature review in Kushimato street which is a most vibrant in Mersin City. Self-administered questionnaires are carried out by asking the respondents to complete the questionnaire themselves. This study can be used by urban planners and designers to plan and make decisions for creating more socially successful and sustainable places in cities.

Keywords: Social Sustainability, public space, viability.
Rebuilding communities through the arts: Private enterprise art patronage that contributes to the sustainability of local communities in Japan

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Abstract: Despite the emerging trend of counterurbanization, many communities in Japan are facing depopulation. The Japan Policy Council recently issued a report stating that nearly half of all the municipalities in Japan will disappear in the near future. Parallel to the counterurbanization movement, many contemporary art projects have appeared in rural areas since 2000, such as the Echigo-Tsumari Art Triennale and the Setouchi International Art Festival. These projects have had a major impact on local economies, attracting public/private investment to the area and drawing a large number of visitors. Although the public sector seems to be leading the current trend, private enterprise has begun supporting community-oriented art projects like these, as artists become increasingly engaged in the issues of declining communities. This paper explores the pioneering practices of private enterprise art patronage that contributes to sustaining local communities in Naoshima, Inujima, Momoshima, and Kosagijima, islands located in the Inland Sea of Japan. These are typical of islands with rapidly aging rural communities facing severe depopulation. As private enterprise art patronage has begun to encompass community art projects, it has taken on a significant role in sustaining local communities. Such projects form the basis of the current trend toward community-oriented public art programs in rural areas. Although initially private enterprise may not always have been interested in the sustainability of local communities, artists and art projects concerned with communal issues have inspired business to engage with these communities. As examples, these islands display different frameworks that genuine private art patronage has transformed into community-oriented investments.

Keywords: sustainable community, art patronage, the Inland Sea of Japan
Mobility and the Role of Pedestrian in the Making Public Space

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Abstract: The paper aims to evaluate and criticize literature on public space and planning in terms of the role of pedestrian and mobility in the making public space. The main question of the research is What is the role of pedestrian and mobility in the making public space (space to place progress)?

The study primarily underlines literature review on public space, mobility and pedestrian behaviour in urban planning. Literature review of the study would be examined as three main parts. Firstly, main discussions, theories and terms related with public space are evaluated. Secondly, the literature is criticized according to recent circumstances and contemporary discussions. Lastly, especially, the terms of mobility and pedestrian movement in public space regarding urban planning are evaluated.

In defined context, the recent seaside of Mersin that has been formed by different filling operations since the beginning of 20th century is selected as case study. In other words, case study area is a recently produced space while the city has been expanded.

Keywords: Public Space, Mobility, Pedestrian Movement, Pedestrian Behaviour, Seaside of Mersin
Building simulation and Building Information Modeling (BIM)
Visualization techniques for heterogeneous and multidimensional simulated building performance data sets

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Abstract: The architecture, environment and construction industry is facing, on the one hand, ambitious environmental regulations for low carbon and net zero energy buildings, and on the other hand, the emergence of new techniques such as parametric assessment and cloud computing. As a result, there is a dramatic increase of performance analysis and collected data during the building design phase. However, previous research highlighted major weaknesses of current building performance simulation -BPS- software regarding its ability to represent and explore input and output data, to interact with it, and to extract valuable data patterns and analyses. Therefore, this research aims to identify suitable visualization techniques that might increase the usability and the knowledge extracted from building simulation dataset. To that end, an interdisciplinary approach has been set up. First, a literature review allowed to characterize the specificities of BPS dataset, namely their heterogeneous nature -discrete, ordinal, categorical, and continuous-, their different correlation levels and their medium size. Second, key tasks that should be performed by BPS tools to support the design process are identified: exploration, solutions generation and evaluation. Then, two data visualization techniques that accept the BPS dataset specificities and that enable to perform these key tasks were selected within the information visualization research field: Decision Tree and Parallel Coordinates. Third, these techniques were applied to an extensive BPS dataset, generated from a series of parametric building simulations based on a high-performance building to be, called the smart living building. Finally, a qualitative comparison between the selected visualization techniques was conducted so as to reveal their strengths and weaknesses. This comparison highlights Parallel Coordinates as the most promising approach.

Keywords: building performance simulation tools, datasets, data visualization, data exploration.
Translating design details to construction details – with both eyes open

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Abstract: Sustainable designs will come to nothing if they are lost in construction process. Therefore, the accuracy of design details and the transformation to the construction details is vital to achieve initial design thinking targets. This is driven most importantly by the fact that the UK Government strategy for all new homes is on the basis of “fabric first” approach to design. This illustrates that priority is on improving energy efficiency through building envelope by increasing insulation thickness; reducing thermal bridging risks as well as making buildings more airtight. This study uses a residential building in Wales, UK as a case study to demonstrate how UK government approach is applied both in design stage and construction stage to meet essential building standards. The methodology includes dynamic thermal simulations, 2D thermal bridge analysis of the construction details and diagnostic test using air permeability test. Results demonstrate that fabric-first approach applied by contractors in housing development is not only able to rectify design errors but also is able to achieve even higher standard levels in some cases.

Keywords: Design details, heating and cooling loads, carbon emissions, thermal bridge
Predicting Daylight Autonomy Metrics Using Machine Learning

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Abstract: This study analyses the efficacy of using machine learning though artificial neural networks (ANN) to predict daylight autonomy metrics in typical office spaces. Based on a literature review of the use of ANN for non-linear problems, the chosen approach was deemed promising for its use in predicting daylight performance with the assumption that previous training data can be provided. The ANN approach, while empirical, has advantages when compared to conducting full simulations in the areas of speed and computing resources. In this study, several network architectures were analysed against several test cases. The accuracy of the obtained results mirror those in other studies when applied to daylight autonomy metrics. In addition, accuracy improved with the addition of a larger set of training data as well as the enhancement of the network architecture itself.

Keywords: Daylight, Daylight Autonomy, Machine Learning, Neural Networks
BIM-based analysis and evaluation of the integration of transparent solar panels in existing buildings facades: Case of Educational buildings

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Abstract: The energy consumption in buildings is responsible for roughly 40% of the total energy use in the European Union. The European Commission recently pledged to cut the annual consumption of primary energy by 20% by 2020. The emerging Building Information Model (BIM), as a shared knowledge resource during a building’s life cycle, can be used as a basis for building energy management. The paper aims to retrofit an existing building glass facade with transparent solar panels, to increase the energy production of the building. Using the 6D BIM data as an input of the existing situation of energy consumption, building envelop and pattern of usage, an accurate estimation can be established regarding the percentage of the annual energy savings, and thus be able to evaluate the effectiveness of this approach. The concluded work aims to analyse the configuration of semi-transparent PV panels, in terms of area and placement, to replace the normal glass panels in an existing building under retrofit operations to offset a part of the building’s energy consumption. The process is based on determining the optimum value of annual electric energy generation that can be provided with semi-transparent solar panels per square meter [kWh/m²], from the pool of possible configurations of solar panels, based on the annual solar insolation per unit of the glass parts of the façade and the Return Of Investment (ROI). In the case study, the effect of self-shading, shading from adjacent buildings, and shading from adjacent trees and landscape elements will be taken into consideration. Autodesk Revit and Dynamo are used for the modelling, analysis, and optimization procedure.

Keywords: Energy retrofit, 6D BIM, Educational Buildings, Building integrated Photovoltaics
A Study on Emergency Departments’ Design Topologies and its Impact on Wayfinding Utilizing Space Syntax Techniques

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Abstract: This paper aims assessing the achievement of preset objectives of Emergency Departments (EDs) in early design phase according to the change of topological aspect, which have an impact on the performance of medical staff and satisfaction of patients and their families. To justify design objectives of ED, Evidence-Based Design (EBD) at EDs was taken in consideration. EBD is a way of design through research, where data is gathered through an accumulative collection of solutions from existing hospitals to improve design decisions consequently, the emergency service outcomes. In order to benefit from these solutions in design phase, it is needed to quantitatively understand the impact of ED configuration-related solutions on various human behaviors. Wherefore Space Syntax techniques are utilized to quantitatively represent the strength of connections between spaces that are arranged to each other in a given configuration with respect to human behavior. Thus, utilizing Space Syntax analysis provides measures that allows predicting how far EDs design strategies/solutions could be attained from a very early stage, and which ED topology meets most of these strategies. Correspondingly, when it comes to critical departments such as Emergency Departments, it is important to study the effectiveness of Space Syntax techniques with respect to ED design strategies that were extracted from EBD in decision-making at the design phase. A comparison between syntactical measures obtained from analyzing different ED topologies in order to deduce the effect of spatial configuration in wayfinding as a strategy needed to be achieved in ED. As a result of the comparison, centralized ED topology has an improving impact on wayfinding prediction.

Keywords: Emergency Department, Evidence Based Design, Space Syntax, Wayfinding, Design assessment
Shape Memory Alloy Building Shells: A Zero Electricity Dynamic Shading System Simulation

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Abstract: In the 21st century, the energy sustainability era, climate adaptive building shells (CABS) became an appealing architectural application. Such appeal is due to the ability of such shells to move and react mechanically (macro-scale CABS) to external energy stimuli; which can control different building envelope aspects such as its thermal loads and daylight exposure. However, such moving ability intrinsically involves using sensor-actuator systems which use electric energy to move the envelope’s components. Thus, for the sustainability trend, it is appealing to use a building envelope material that directly changes its form due to thermal loads (renewable solar energy) without electricity; shape memory alloys (SMAs). Thus, the research focuses on simulating a two-way SMA (can remember two shapes) building envelope using Grasshopper tool (Ladybug and Honeybee plugins) upon two steps. First, simulating the SMA building envelope form change; the heat transfer equation –using solar thermal loads and dry bulb temperatures- is used to simulate a macro-scale form transformation of a Nickel Titanium Zirconium SMA (NiTiZr) southern building envelope panel monthly. Such simulation aims to showcase the potential form change of SMAs based on temperature changes without going into the technicalities of designing an exposed SMA spring actuator. Second, the amount of thermal loads upon a sample southern building envelope is calculated when applying an extra skin of the NiTiZr paneling. Such result is finally compared to a traditional static shading over sample selected days of the year.

The research’s results aim to highlight a potential material application to explore; relevant to using renewable solar energy. Furthermore, the research concludes with an approach to use exposed SMA spring actuators to reach similar results to the simulation. Such approach can minimize the amount of SMAs to be used in envelopes compared to the NiTiZr panelling, while reaching similar zero electricity results.

Keywords: Climate Adaptive Building Shells, Thermal Loads, Macro-scale Simulation, Shape Memory Alloys, Nickel Titanium
Revealing the Sustainable Design Properties of a Vernacular House in Alaçatı, Turkey by Building Energy Modelling

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Abstract: Alaçatı is a densely visited unique Aegean town on the west coast of İzmir, Turkey. It has been famous after 1990, because of its authentic streets with Greek architecture, nature and culture. Since the most important pull factor of Alaçatı is to be the vernacular houses, the historical vernacular houses were converted into hotels for the accommodation and cultural experience demand of the tourists. The present study deals with the hotel that is number 68 of the 1005th street, which is converted from a 150 year old Greek house in Tokoğlu province of the historical centre of Alaçatı. The purpose of the study is to reveal the sustainable design properties that the house contains by both conceptual and quantitative aspect. Regarding to this aim, the house has been modelled by a digital energy modelling program. The architectural drawings, climate and weather data from Adnan Menderes Weather Station, materials and building usage data, and the restoration and survey works of the house have been used as the needed information for the energy model of the house. The sustainable design properties were presented on the model for the winter and summer condition respectively, as the percentage effect on the heating and cooling energy need for the hotel. As the result, it is observed that some of the passive design properties reduce the heating and cooling energy, some of them don’t have any effect and some of them are recorded to be far from being sustainable as they increase the energy need of the building. It is anticipated that the elicited results from the study are to be a guide for new buildings that are going to be designed in the area in terms of sustainable architecture.

Keywords: Sustainable design, Alaçatı, building energy modelling, vernacular architecture
Spatial Mapping Analysis of Lost and Insurgent Spaces within the City of Durban

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Abstract: Durban, as well as all progressive cities, is prone to the effects of Globalization, economic stresses and poor city planning. Most cities were planned according to traditional urban design principles, which revolved around the concentric circle model developed by Ernest Burgess in 1925. Nowadays, due to rapid growth and a poor planning policies implementation in urban cities, the gap between the legal and illegal city has become more evident. New developments are moving further away from the city centre, causing sporadic growth and forming new nodes. This in turn leads to urban degeneration, lost and forgotten spaces within the city. Thus, urban poor claim the right to the city by occupying lost spaces within the urban framework.

Often mapping these lost spaces proves to be challenging to urban designers, Architects and planners who try to analyse and design ad hoc solutions. Understanding spatial qualities, socio-ecological ecosystems and economical systems, is key to create a resilient city. This paper explores an innovative research methodology of spatial mapping to analyse lost and insurgent spaces, as part of a broader PhD study. The research has two key objectives:

• To understand how space can be effectively captured and interpreted;
• To use spatial mapping as a key methodological approach in reinterpreting spaces towards creating a resilient city.

Empirical data was gathered by drone photography in a case study located within the city of Durban, to show the potential, advantages and disadvantages of spatial mapping within the city centre and periphery. Qualitative research methods (e.g. interviews and observations) are combined with spatial analysis, to fully understand how lost space can be reinterpreted and adapted. Therefore, the proposed research methodology allows for a more accurate (lived 4D-maps) mapping of scenarios affecting cities today.

Keywords: Urban Resilience, Insurgency, Lost Space, Spatial Mapping, drone photography
The Impact of Adopting Building Information Modeling (BIM) in the Construction Industry

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Abstract: The Architecture, Engineering, and Construction (AEC) industry is recently facing a major transformation due to adopting Information Technology (IT) and digital technology in the past three decades. Building Information Modeling (BIM) has been considered as one of this advanced technology which leads a significant shift within the AEC industry since traditional 2D tools are not fully integrated, or promote a complete collaboration. 2D tools can only manage length and width values, which result in inefficiency in the industry productivity. On the other hand, BIM provides virtual models in virtual environments with integrated data, these models can assist in project management process through projects life cycle phases. Therefore enhance its productivity and reduce possibilities of errors and waste. This paper discusses the impacts of adopting advanced methods of BIM and its role as a project management tool for early pre-construction phase, its benefits, and barriers to adopting these levels in the construction industry. It also investigates the BIM adoption rate in the Egyptian construction industry, by collecting data from 125 multiple stakeholders in Egypt using an online questionnaire to assess knowledge, and the use of BIM in Egypt. The results indicates that the adoption rate of BIM technology is still low and needs to be improved. However, the participants demonstrated a positive awareness of the significance of using BIM for the future construction projects. The research result also reveals two critical barriers in BIM adoption, technology-related barriers, and process-related barriers. The importance of the research is to optimize adopting advanced BIM tools in construction projects from pre-construction level, as well as understanding barriers limiting a complete implementation of BIM in future construction projects, in order to achieve the main purpose of this research which is knowing where BIM should be heading and how the AEC industry can benefit from its advantages.

Keywords: Building Information Modeling (BIM), Pre-Construction, Construction Industry, Barriers, Project Management
Reexamining the Architectural Design Process from a Sustainable Point of View

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Abstract: Currently, many of the architecture firms are putting more emphasis on sustainability in order to enhance building performance and reduce the Life-Cycle Cost (LCC) of buildings. The design process plays a key role in delivering a socially, economically and environmentally successful sustainable building within budget and on schedule. The main goal of this study is to investigate the integration of sustainability into the design process. Previous studies on sustainable design processes are collected to produce a flowchart model that provides a systematic guidance to implement sustainability through the integrated project delivery system. Analysis including feedback from experts in the field indicated that the sustainable design process is complicated and nonlinear. It consists of multiple iterative processes to ensure that the sustainability goals are implemented. Utilizing Building Information Modelling (BIM), Integrated Design Process (IDP), and involving design charrette are significant as they decrease the discrepancies and maintain the integration of the building systems. Managing and maintaining strong communication among design team members are essential prerequisites for the success of the proposed model.

Keywords: Sustainability, process, BIM, design, model

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**DynamoPlus: Synchronizing Data Exchange between Dynamo and EnergyPlus**

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**Abstract:** Over the past decade, there have been huge advances in both the field of visual programming and energy modelling. Significant efforts have been made to synchronize the geometric exchange of a full building information model (BIM) into energy modelling programs in the form of parametric inputs. However, limited attention was accorded to considering building properties as key inputs to energy simulation data. Issues of standardization and synchronization of simulation data exchange are critical to designers in their modelling workflow. As such, the lack of such an exchange increases the risk of errors causing thereby discrepancies in simulation results. Therefore, this paper presents a conceptual model that couples a visual program, Dynamo- BIM, with an energy simulation engine, EnergyPlus, to achieve two main objectives: (1) synchronizing the data exchange between two spatially distributed models without the need of any interface, and (2) illustrating the effect of building fenestration surfaces on energy consumption. A hypothetical case study example of an office building was used to illustrate how the proposed model synchronizes data and transfers visual representations as input data files for EnergyPlus. The model tests the effect of energy intervention scenarios, namely, the impact of internal and external shading devices on the building’s energy consumption. Findings of this study shed light on the importance of matching and quantifying the main elements used as inputs to energy modelling programs in order to reduce discrepancies in simulation results.

**Keywords:** Energy Modelling, Building Simulation, EnergyPlus, Dynamo
Analogue and Advanced Digital Simulation to Assist Spatial and Daylighting Design in the Educational Context

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Abstract: Architecture as a professional degree has always guided the architectural education. In addition, the user’s needs in the luminous environment related to visual comfort and the impact of light on the architectural space have now gained the significance in lighting education. As a result, there is a need to use modelling tools to predict the visual comfort conditions and spatial quality at the early design stages. This highlights the importance of the evidence-based design approach which selectively embraces the use of meaningful design tools.

This paper presents the teaching and learning experiences in architectural education through effective use of analogue and digital simulation tools for meaningful parametric analysis in spatial and daylighting design and research. The first and second parts of the paper contain a literature review. The first part discussed the benefits of using simulation tools throughout the spatial and daylighting design process in order to assist decision-making. The second part explained how to integrate meaningful testing into the teaching and learning of architectural and daylighting design. Then the literature review is followed examples of design projects and research work indicating how qualitative and quantitative analyses of light have been assessed using the analogue and digital simulation tools.

The paper concluded that the evidence informed design approach which involved using design tools in a selective manner and accurate interpretation of the testing results is the key for achieving holistic daylighting design solutions.

Keywords: Analogue daylighting simulation, digital daylighting simulation, meaningful testing in design, daylighting design process, spatial design process
Renewable energy technologies
Sustainable construction and technology
Influence of energy‐use scenarios in Life‐Cycle Analysis of renovation projects with Building‐Integrated Photovoltaics – Investigation through two case studies in Neuchâtel (Switzerland)

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Abstract: Since tomorrow’s cities are already largely built, and as many of their buildings – with a low level of energy performance – will still be standing in 2050, urban renewal processes play an essential role towards the sustainable development of European cities. In this context, Building‐Integrated Photovoltaic (BIPV) systems can potentially provide a crucial response for achieving long‐term carbon targets. Functioning both as envelope material and on‐site electricity generator, they can simultaneously reduce the use of fossil fuels and greenhouse gas emissions. Focusing on the architectural design, this paper presents the results of a multi‐criteria evaluation in terms of Life‐Cycle Assessment (LCA) and Cost (LCC) of different renovation and energy‐use scenarios. The goal is to identify which strategies can allow to achieve the ambitious targets for the 2050 horizon by integrating into the design process: 1) Passive strategies, to improve the envelope through low‐embodied energy materials and construction systems; 2) BIPV strategies, using innovative photovoltaic products as a new material for façades and roofs; and 3) Active strategies, adapting HVAC systems to improve the efficiency of the BIPV installation and reducing the dependence on the feed‐in‐tariffs to ensure the profitability of investments. An emphasis is placed on testing the impact of a proposed selection process of BIPV surfaces in order to maximise self‐consumption and self‐sufficiency, evaluating the effect of electricity storage systems with and without the possibility of injecting the overproduction into the grid. Our methodology and results are presented through the comparison of two real case studies in Neuchâtel (Switzerland). Proposing a new approach to address renovation projects of existing buildings in the urban context towards Low Carbon Buildings, the outcomes provide architects and engineers with advanced BIPV renovation strategies depending on the building typology, the architectural design goals and the level of intervention.

Keywords: Building renovation, Building‐Integrated Photovoltaics, integrated design, multi‐criteria assessment, Life‐Cycle Assessment
Building with Date Palm Rachis for the empowerment of rural communities in Egypt

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Abstract: Historically, builders in rural areas and oases depended on agricultural-based building materials to build fast and cheap houses. Therefore, the revival of the concept of Natural Building using agricultural based building materials rose as an international concept to develop poor societies from the inside. Building with natural materials encourages societies to build with their own hands using local materials such as timber and bamboo, which the communities are familiar with in the form of small projects and handmade households. This increases the sense of ownership and empowers poor rural communities by being the true stakeholders of their houses. This leads to decreasing the economic costs, environmental impacts and enforcement of the social structure and culture. Therefore, traditional building materials such as Bamboo and timber have been the focal point of many of the previous research work that aim to revive and simplify their construction techniques to introduce them as potential building materials for rural communities instead of the full dependence on conventional building materials. However, the knowledge gap lies within the absence of an integrated and comprehensive analysis of the practicality of Date Palm Rachis, which is one of the most abundant and versatile agricultural residues in Egypt, and has been used for decorations, sheathing and furnishing in oases and rural communities in Egypt. This paper aims to analyse the potentials of using Date Palm Rachis for local, simple and cheap construction, based on a qualitative analysis and practical experience to assess abundance, workability and previous researches. This paper shows that Date Palm Rachis has high potentials for further research studies to increase the efficiency and flexibility of the structures which can satisfy the social need of cheap, fast and easy construction techniques by the hands of rural communities in Egypt.

Keywords: Date palm rachis, Empowerment, Rural communities, Cheap construction, vernacular architecture
Water-Efficient Construction Practices for Housing Projects in Egypt: A Review of Literature

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Abstract: Egypt currently faces high housing demands and water stress issues due mainly to its large population, with further problems resulting from Climate Change and a per capita share predicted to reach “absolute water scarcity” in 2025. The construction of housing projects utilizes great quantities of water through both the offsite and on-site practices. This paper firstly outlines the scope and methodology of Life Cycle Assessment (LCA) for buildings, reviewing previous literature of water demand and footprint for housing construction. The paper discusses also the local Egyptian regulations for green buildings in terms of water efficiency and the use of building materials. The aim is to highlight the significant water footprint of housing construction, stating recommendations for further building assessment, development and research. The paper highlights the importance of using LCAs for pre-design decision making to achieve the sustainability of construction industry, overcoming resource depletion. While the direct water demand was mostly concerned in previous literature, the review proves that the embodied water of construction practices is significantly higher than other lifecycle phases of various housing projects. The paper also shows that Egypt lacks LCA studies of water use in residential buildings despite having vast deserts and limited water resources for future expansion.

Keywords: water efficiency, water footprint, construction phase, housing, Egypt
Low carbon, clay–based renders enhanced with polymers outperform current lime and clay renders in Hygric Properties

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Abstract: The basic property of external renders in construction is considered to be the envelope waterproofing, while limited concern is paid to its high value or high values of relevant properties for all to ensure the envelope energy efficiency. Research conducted by BRE, NIHE or IEA estimated energy savings from wide scale retrofittings in UK. Energy efficiency was reduced by up to 50%, due to insulation failures in external walls, caused by rain penetration among other reasons. Mould and fungus were also present. An external render combining extremely low Water Absorption for rain penetration, high Vapor Permeability for breathability, and an ecological low carbon binder profile, is lacking in current UK market. In addition, besides the UK or European market, the Middle Eastern and African building stock are in need of a clay-based render with the aforementioned high value properties. Specifically, the significant Earthen structures of World Cultural Heritage currently preserved in the pre-referenced areas require frequent restoration, since the existing clay-based renders should be re-applied every rainy period or every 3-5 years maximum to avoid erosion and dismantling. Therefore, report explores a potential alternative to lime render, based on an innovative composite of nanoclay and waterproofing polymeric additives. 15 different clay-based specimens with 4 waterproofing polymeric agents and 2 breathable organic aggregates were tested for their physical (density, porosity) and hygric properties (Water absorption, Vapour permeability) using gravimetric and British Standards laboratory tests. 3 out of 15 specimens achieved the desired criteria of notably low absorption rates and high VP, outperforming those of known lime renders of UK market and relevant clay renders of existing academic research. The results indicate that they have a potential application as low carbon, highly waterproofing, breathable and compostable render solution, either in traditional porous buildings or in new structures.

Keywords: Clay-based render, nanoclay bio-polymeric composites, water absorption, vapour permeability
Thermal bridging through timber elements of strawbale construction: exploring its extent, with particular reference to self-build projects

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Abstract: Strawbale building offers possibilities for low-carbon construction, with low emissions in production and operation. Its use is increasing, in particular for self-build projects. To ensure energy efficiency the availability of repeatable construction details with known thermal performance is important. Many such details in strawbale walls contain timber elements, which represent thermal bridges, reducing building fabric energy efficiency. The extent of two-dimensional thermal bridging through a range of standard strawbale construction details provided by Straw Works is calculated. Results are compared to requirements for UK Building Regulations and the Passivhaus standard. The standard details are found to perform significantly better than required for UK Building Regulations (improvements of 54% to 97% noted) indicating that existing energy assessments of strawbale buildings may overestimate energy use. Thermal performance of windows and door details falls short of Passivhaus requirements, suggesting that these would benefit from reduced thermal bridging. Simple adaptations are analysed, seeking improved thermal performance without sacrificing ease of construction. These are found to reduce thermal bridging by up to 44% over the standard details, but still fall short of Passivhaus requirements. Thermographic surveys are conducted of the standard details in a selfbuild strawbale house, broadly confirming heat flow indications from software analysis. Further work is indicated, to analyse a wider range of construction details and adaptations, and to explore a more radical redesign of the details.

Keywords: thermal bridging, strawbale building, energy efficiency, low-carbon construction, timber
Contemporary earth construction of Saudi Arabia: A state of art review

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Abstract: According to the Central Department of Statistics and Information of the Saudi Arabia (the census carried out in 2009), more than 40% of the Saudi families do not own houses, and the rate is increasing. There are many reasons that are contributing in the increment of rate of not owning a house, such as, the increasing price of conventional construction materials, government (through municipalities) limits the construction material for the residences to only steel, fired brick and reinforced concrete. Construction Cost Index of Engineering Cost Record has increased from 0.98 (98%) to 1.25 (125%) between 2000 and 2007 in Saudi Arabia. The main reasons of the government restriction on other alternative construction material such as stabilized rammed earth (SRE) include ambiguity of the structural capability and lack of evidence of environmental benefit. The development of an alternative local construction material could be highly beneficial to the Saudi Arabia in its pursuit toward affordable and sustainable house construction. Based on existing international evidences, utilizing SRE construction technology could lead to saving in the construction cost and maximizing environmental benefit compared to the conventional construction materials. But, literature review reveals that there is sparse research to date carried out to find out why are the potentialities of SRE construction not recognized in Saudi Arabia. The aim of this article is to appraise current state of art review of contemporary earth construction in Saudi Arabia formulating a research agenda. Furthermore, to achieve the aim, author adopts the desktop survey method of critically reviewing and analysing relevant literature to back the arguments of this paper.

Keywords: Stabilized earth construction, alternative construction material, environmental sustainability.
People`s perceptions of industrial hemp – understanding attitudes and prejudices towards a sustainable construction material

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Abstract: Industrial hemp (IH) is a low-carbon renewable resource which can be utilised for a vast number of applications. One very promising field of application is the construction sector where IH can be used as a sustainable building material e.g. for insulation, as alternative to plaster board or in hemp-lime wall constructions (“hempcrete”). But up to now, hemp-based construction materials suffer a niche existence. To understand the obstacles towards enlarging market uptake, this study aimed at analysing prevailing attitudes towards IH in Europe and to correlate these to the sustainable consumption (SC) attitudes and sociodemographic data of the participants. A survey was conducted as an online survey (N=138, aged between 17 and 64). The general attitudes of the participants of this study towards IH were rather positive, but a large knowledge gap regarding the historical significance and ecological benefits of hemp was revealed. Positive correlations could be found between the knowledge in these areas and the attitude towards IH, as well as the likeliness to purchase IH products. Larger studies are required to further elucidate this subject area.

Keywords: industrial hemp, attitudes, sustainable consumption
Riverside Market Project, San Isidro de Heredia, Costa Rica

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Abstract: During 2011 a client came seeking assistance for the development of a roadside property located on the main highway to the Caribbean Coast from Costa Rica’s capital San José; he had in mind a barbecue restaurant for truckers and road users, but was challenged to ponder on pursuing a truly sustainable and inclusive approach for his project. A living and evolving micro-urban system inspired in permaculture was proposed. After the initial conversations, the owner went on to study sustainable production practices, bio-intensive agriculture, wood construction and related topics. He came back on 2013 and the first phase was finally built in 2015. It all was to start as a small roadside café, with the eventual establishment of an organic marketplace. Significant portions of old walls and floors remaining on site, as fragments of a formerly burned down building, were salvaged/recycled and utilized in combination with new light wood structures, minimally touching the ground yet maximizing space quality and use. The small cafe quickly turned into a lively and successful brick-oven pizza place and gastro-pub with current plans to expand into the diversified organic marketplace once imagined. Key sustainable building features include the salvaging of existing structures and floors, the use of reforestation wood (teak, melina) processed on site, and the implementation of passive tropical design strategies. The project has its own organic orchard and composting systems and priority is given to locally sourced produce and products. Electrical energy expenditure is minimized by traditional wood cooking methods. The venue has positively influenced and contributed to the local community and the sustainable/organic culture of our small green country. It all combines together to create a business model based on sustenance, learning and information exchange, adding up to much more than the sum of its parts.

Keywords: Low carbon, adaptive, passive tropical
Sustainable Heritage Preservation (Local and International Experiences)

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Abstract: This paper is an attempt to shed light on the role of sustainability in the policies of heritage preservation. It aims to get benefit from the various methods to preserve the architectural heritage which has been studied in international experiences in order to reach a methodology to utilize the principles and techniques of sustainability in heritage preservation. The study identifies heritage preservation in terms of sustainability polices and clarifies the reasons behind its importance. There are multiple factors that threaten architectural heritage buildings of being damaged. Therefore, an urgent interference to reduce the effects of that damage is highly required. Thus, it is important to raise the awareness of heritage preservation to sustainability, through developing an understanding of the characteristics of heritage buildings and identifying the main points needed for optimizing the performance of heritage buildings. Furthermore, this paper intends to examine the extent to which the principles of sustainability are applied in the preservation of heritage buildings in Egypt. In addition, it outlines the reasons why traditional buildings are considered to be examples of sustainability and the way to develop them to be more sustainable without damaging their character. Finally, it illustrates the ways of utilizing tried building techniques and the materials to meet recent standards for sustainability and energy conservation.

Keywords: Sustainable Heritage Preservation, Sustainable Site, Water & Energy Efficiency, Material Selection, Indoor Environmental Quality
The Thermal Behaviour and Embodied Energy of Hemplime Construction

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Abstract: The transient energy ratio (TER) is a recent metric which measures the divergence between steady-state analysis and transient analysis in terms of heat transfer. This divergence is caused by the thermal mass of a building; in most buildings, it is the walls that contribute most to the overall thermal mass. The thermal mass of a building’s walls can cause either an increase or decrease in heating/cooling energy use (as compared to a static analysis), depending on a range of variables including heating strategy and weather/climate parameters.

Hemplime concrete is a material which has the potential to offer improvements over traditional construction types thanks to its thermal properties, hygroscopic nature, and low-environmental-impact production methods. As with any material, thicker walls with lower thermal transmittance can reduce the energy required to heat or cool the interior space, but this benefit ought to be balanced with the embodied energy in the thicker walls.

This work draws on recent developments in the use of the TER technique and life cycle analyses (LCA) of the embodied energy and carbon in hemplime concrete to estimate the total lifetime energy use for hemp walls in typical Cfb Köppen climate zones.

Keywords: Embodied energy, Hemplime concrete, Hemp concrete, Thermal properties, Thermal mass
We are pleased to announce the open call for papers to the Second International Conference for Sustainable Design of the Built Environment: Research in Practice (SDBE 2018) organised in London, UK on 12th-13th September 2018 (venue TBC). SDBE 2018 conference will be a unique opportunity for researchers, academics, architects, urban designers, engineers, building consultants and professionals to meet and share the latest knowledge, research and innovations in sustainable building design, building performance, simulation tools and low carbon building related technologies.

The conference focuses on Research in Practice in sustainable design, building energy performance, sustainable urban design and planning with an emphasis on a balanced approach to environmental, socio-economic and technical aspects of sustainability in theory and practice. The conference will form a platform to demonstrate state-of-the-art strategies and best practice across the world for integrating sustainable design approaches in the built environment. The conference will include prominent keynote speakers (TBC) from academia and practice to maximise opportunities for knowledge exchange.

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- Renewable energy and green technologies
- Sustainable urban design
- Resource efficiency

Key Dates
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- Abstract acceptance notification with comments: 16th March 2018
- Full paper submission deadline: 1st June 2018
- Full paper acceptance notification with comments: 2nd July 2018
- Deadline for full paper submission: 3rd August 2018
- Free conference registration for accepted papers [funded by the British Council]: 10th August 2018

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