In Praise of Biomimicry
Applying biomimicry to design building envelopes that lower energy consumption while optimizing thermoregulation

Authors: Daphne Fecheyr-Lippens and Pravin Bhiwapurkar

When Pravin Bhiwapurkar, professor in architecture, and Daphne Fecheyr-Lippens, a biologist and trained Biomimicry practitioner, started approaching the question “How can nature inform the creation of a more responsive building?” they quickly discovered the benefits of taking an interdisciplinary approach. In the article “Applying biomimicry to design building envelopes that lower energy consumption while optimizing thermoregulation” they provide elaborate insight in the solution-based biomimetic approach they took as well as to how to perform energy savings simulations. The proposed biomimetic building envelope incorporates design components inspired by the Hercules beetle and the African reed frog. The use intensity (EUI), which includes decrease in HVAC, related energy use intensity (EUI) by 66%, primarily for cooling. Their collaboration pushed them to approach and write this article in such manner that makes it understandable for a broad audience. They hope that sharing their learnings will stimulate applications of biomimetic principles for performance based and environmentally sustainable architectural design practice, which will make its implementation more prominent.

From the editor ...

Welcome to the last newsletter for this year. This brings to a conclusion the 60th volume of ASR. This year has seen two Special Editions and four other Editions from the general call to papers. There has also been a Virtual Edition which has cited the most read. The URL for this is as follows please copy into your browser to access these papers:


In addition I would like to bring to your attention the following changes to the Editorial Board.

Dr Michael Christenson, North Dakota State University, USA, who has been promoted to Professor.

Dr Francesco Fiorito, has been appointed Professor, Polytechnic University of Bari, Italy.

Dr Kathryn Janda, Energy Institute, University College London and Environmental Change Institute, University of Oxford has been appointed to the Editorial Board.

In this newsletter we feature the papers in two Editions. 60.5 has 6 papers as follows,

1) Richard Hyde, Editorial. ‘Refining the principles of passive design.’
2) Daphne Fecheyr-Lippens and Pravin Bhiwapurkar. ‘Applying biomimicry to design building envelopes that lower energy consumption in a hot–humid climate.’
3) Or Aleksandrowicz. ‘Appearance and performance: Israeli building climatology and its effect on local architectural practice (1940–1977).’
4) Wael A. Yousef Moussa, Werner Lang and Thomas Auer. ‘Assessment of the impact of window screens on indoor thermal comfort and energy efficiency in a naturally ventilated courtyard house.’

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Abstract

Exploring measures to improve the energy efficiency of office building in Saudi Arabia

Dr Mansour Alulayet
Phd Study

Currently Saudi Arabia uses a building code, which relies on prescriptive measures to achieve low energy consumption in office buildings through setting minimum requirements for each building envelope characteristic. This thesis argues that new measures are needed to improve the energy efficiency of buildings in Saudi Arabia to meet changing targets in the region and worldwide.

To understand what measures should be used the thesis investigates the Saudi energy building code requirements for office buildings. In addition, the extreme external environmental conditions create additional impacts on energy performance. The research examines the interplay of parameters such as the building envelope, the building typology and the active energy systems in the building on energy performance.

Using a thermal simulation methodology, it was possible to understand the potential performance benefits of the prescriptive measures. However, with the continuing innovation in the technologies used in buildings, the harsh external conditions and the development in synergies between these technologies, suggest that additional performance-based measures are needed to better capture the potential efficiencies that can be created.

Conference Index

27 January 2018
International Conference on Architecture, Landscape & Interior Design
(ALI 2018) Kuala Lumpur, Malaysia
The 4th NZAAR International Event Series on Natural and Built Environment, Cities, Sustainability and Advanced Engineering
http://www.nzaar.com/ali2018/

7 February 2018
9th International Conference on Environmental Science and Development
ICESD 2018 Paris, France

5 March 2018
Twelfth International Conference on Design Principles and Practices
Barcelona, Spain

24 May 2018
Eighth International Conference on the Constructed Environment
Detroit, United States of America

26 September 2018
Islands, Resources, and Society: Sustainable Development under Globalization and Urbanization
(ICUA 2018) Zhoushan, China

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5) Guedi Capeluto and Boris Plotnikov, ‘A method for the generation of climate-based, context-dependent parametric solar envelopes.’


The final Edition 60.6 for this year has the following papers.

1) Richard Hyde, Editorial ‘Space, form and process in architectural science.’

2) Feray Maden, ‘Adaptive multihypar structure.’

3) Yasha J. Grobman, Roy Kozlovsky and Hanna Levy, ‘A multifunctional computational approach to waterfront design.’

4) Seung Hyun Cha, Koen Steemers and Tae Wan Kim, ‘Modelling building users’ space preferences for group work: a discrete-choice experiment.’

5) Xianbo Zhao, Yingbin Feng, Josua Pienaar and Darryl O’Brien, ‘Modelling paths of risks associated with BIM implementation in architectural, engineering and construction projects.’

6) Yeliz T ulubas Gokuc and David Arditi, ‘Adoption of BIM in architectural design firms.’

7) Wajishani Gamage, Stephen Lau, Hao Qin and Zhonghua Gou, ‘Effectiveness of air-well type courtyards on moderating thermal environments in tropical Chinese Shophouse.’

8) Shon, Donghwa; Piao, Gensong; Kim, Youngwoo; Lee, Jungwon, ‘CFD Modelling of Air Temperature Reduction and Airflow Induced by the Use of Chilled Wall Panels Based on the Biological Principle of Zebra Stripes.’

For 2018 we will feature a Special Edition from the Architectural Science Association, guest Editors Dr Veronica Soebarto and Dr George Baird. We are also trying to put together more Special Editions one from the PLEA conference this year and one on the Urban Heat Island. ASR continues to attract a large number of papers and we have seen an increase this year in interest from authors. However, there has been a greater number of papers and increase diversity in the research topics hence we are trying to become more focused in the topics we can support.

I would like to take this opportunity to thank the authors and referees for the assistance this year; it has been a large effort to make this happen.

Merry Christmas
Books

Haig Beck and Jackie Cooper (Eds) UME Clare Design - Works 1980-2015
Publishers ORO Editions, California, USA, 2015

Note from the Publishers
In 272 pages, with photos and drawings (including design and construction details) Haig Beck and Jackie Cooper show 30 environmentally sustainable buildings spanning 35 years of the practice of one of Australia’s foremost architects, Clare Design. The Clares, practising as architects on the far side of the world, approach their work with a philosophical position that produced beautiful, climatically responsive, low-impact, environmentally sensitive buildings. They achieved this working not from a body of widely accepted theory and practice but from first principles, applying native can-do empiricism to their designs. These buildings made in partnership with clients — are demonstrations of this architectural philosophy.

Book review

This book forms a catalogue of work that shows the development of climate responsive design from its early period of passive design to sustainable buildings through the work of the highly awarded architects Clare Design. I have chosen this book as it provides through the narrative by Haig Beck and Jackie Cooper, some of the ideas behind the buildings that I have been investigating through ongoing research for a number of years.

The book emphasizes the role that environmental design plays in underpinning some of the important ideas of a modern regional architecture. Beck and Cooper provide a blend of architectural theory and practice, which brings the work to life.

An overview is provided of thirty projects, supported by sketches, plans, construction details and photography to explain the key concepts. I find it interesting that the that the architects still use crafted drawings to describe their buildings. In the days of rapid computerization and artificial intelligence it is a lesson to us all that the traditional skills of the architect are still important.

The structure of the book is organized around two essays by editors, Beck and Cooper and thirty case studies with a commentary on each project from the architects. The first essay examines the notion of ‘Designing with intent’ and this explores the design thinking of the architects and how this has been realized in the projects from the early 1980s. The narrative starts with the formative ideas of the architects and then moves to how their work sits within the evolution of modernism in Australia. The interesting part of this discussion is that Beck and Cooper ground the work of the Clares in the Empirical tradition, with its technological inventiveness necessary to the pioneering process of the first settlers to Australia.

Much of this thinking is about design in response to context - a principle articulated by Christopher Alexander (Alexander 1964). Alexander stated that rules can be followed in a prescribed order to make a building however the architect makes choices about what and how to use the rules - based on context—to translate concepts to form. Defining the inherent components of the problem (or the context) is a continued endeavour throughout the design process. This process helps understand the work of designers such as the Clares who continually assess what is important in each project. Included in conditions as Beck and Cooper describe are the ‘topos, typos and tectonics.’

The interplay between the topography and its mesoclimate- the type and form of the building- the technology and its integration. In many cases this leads to experimenta- tion with these factors to create innovative solutions to the particular design problem. In this essay the Editors conclude that the work of the Clares is based on low impact environmental design however the buildings have an existential quality, which reinforce the occupants’ experience of place. This introduction helps the reader to understand the case studies that follow.

The second and final essay by Beck and Cooper provides a final analysis of the work of the architects giving it the accolade of creating buildings, which have a timeless quality. This is a slippery concept, hard to grasp without reflection and examples. One can understand this as a building that has an enduring quality and that is representative of the thinking at that time. Vernacular and classical architecture from differing periods of history provide examples of such architecture. In many cases these create iconic buildings representing a regional architecture. Now we find in Modernism a similar pattern emerging. The timeless qualities of some the Clares’ buildings are discussed in the subsequent case studies, which provide further depth to understanding this idea.

To summarise, the Clares espouse the principle of embracing the site and its climate to make their buildings, however the philosophy goes further to create a ‘Timeless Modernism’. The design intent of the architects is carefully analysed and presented in this book and provides a well-articulated insight for those interested in environmental design and research into climate responsive buildings. However, in the book, reference is made to the way that Clare Design and other architects in Australia work to create a uniquely Australian architecture, a subject of wide interest to an international audience.

References

Alexander, C., 1964, ‘Notes on the Synthesis of Farm,’ Harvard University