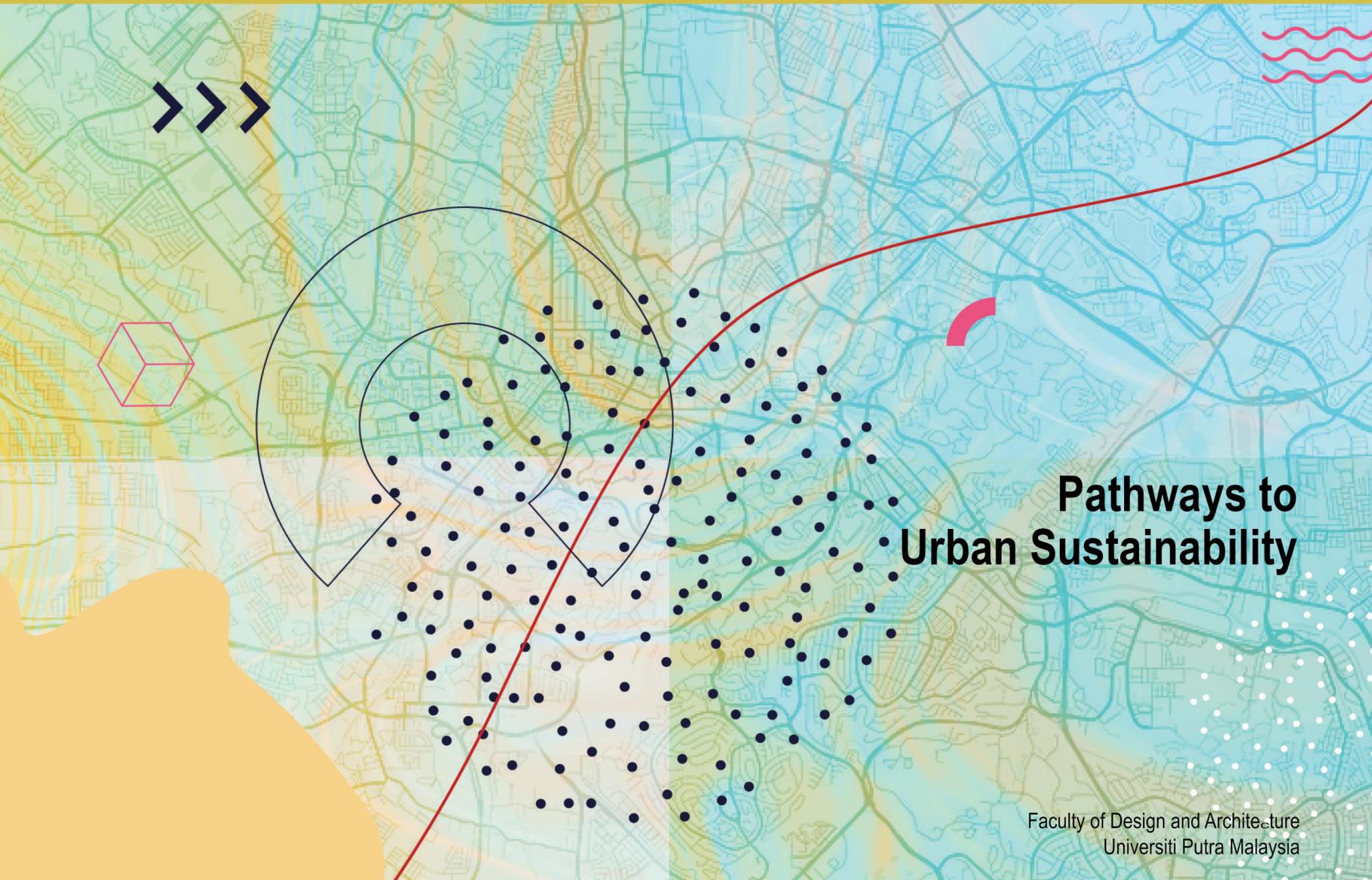


Alam Cipta

International Journal on Sustainable Tropical Design Research and Practice
Volume 13 (Special Issue 1) May 2020 ISSN 1823-7231



Pathways to Urban Sustainability

Faculty of Design and Architecture
Universiti Putra Malaysia

A l a m C i p t a

International Journal on Sustainable Tropical Design Research and Practice
Volume 13 (Special Issue 1) May 2020 ISSN 1823-7231



Faculty of Design and Architecture
Universiti Putra Malaysia

Editor-in-Chief
Suhardi Maulan

Guest Editor-in-Chief
Zalina Shari

Guest Co-Editor
Shureen Faris Abd Shukor

TABLE OF CONTENT

<i>Editorial Preface</i>	
<i>Pathways to Urban Sustainability: Protecting Cultural Heritage and Ecosystems and Achieving a Better Quality of Life</i> Zalina Shari.....	1
<i>Integration of Rural Landscape Characters of the Pahang-Terengganu Coastal Route for Tourism Route Planning</i> Nabilah Huda Zulkifli, Putri Haryati Ibrahim and Khalilah Zakariya	6
<i>Morphogenetic Process of Spatial Structure in Malay Town: A Case Study of Kota Bharu, Kelantan</i> Syahidah Amni Mohamed and Nor Zalina Harun	14
<i>Challenges of Sustaining Design Identity in Chinese Taoist Temples Built in the 19th Century in Klang Valley, Malaysia</i> Yeong Yin Mei, Khairul Aidil Azlin Abd Rahman, Nor Atiah Ismail and Nangkula Utaberta	24
<i>The Fractality of a Garden City: A Comparison of the Relationship of Road Network and Green Spaces in Singapore and Quezon City, Philippines</i> Cindy P. Pornelos and Nappy L. Navarra, D.Eng.....	32
<i>Using Mean Patch Size as a Landscape Metric to Determine the Effectiveness of the National Green Policy In Quezon City, Manila</i> Franklin Jr. Fontanoza and Nappy L. Navarra, D.Eng.	40
<i>A New Approach to Nature Consumption Post Nature-Based Therapy</i> Ulrik Sidenius, Patrik Karlsson Nyed and Ulrika K. Stigsdotter.....	48
<i>From Research to Practice: Operationalisation of the Eight Perceived Sensory Dimensions into A Health-Promoting Design Tool</i> Ulrika Karlsson Stigsdotter, Ulrik Sidenius and Patrik Grahn.	57
<i>The Influence of Geographical and Physical Attributes on User Activities in Erbil Square, Iraq</i> Omar Hussein Ali, Nor Haslina Ja'afar and Mohd Khairul Azhar Mat Sulaiman	71
<i>Visual Communication on Food Products Packaging for Japanese Elderly Persons</i> Pibool Waijitrtragung	81
<i>Instructions to Authors</i>	

EDITORIAL BOARD

Editor-in-Chief : SUHARDI MAULAN, Universiti Putra Malaysia, Malaysia
Guest Editor-in-Chief : ZALINA SHARI, Universiti Putra Malaysia, Malaysia,
Guest Co-Editor : SHUREEN FARIS ABD SHUKOR, Universiti Putra Malaysia, Malaysia
Associate Co-Editor : RAJA AHMAD AZMEER RAJA AHMAD EFFENDI, Universiti Putra Malaysia, Malaysia
MOHD JOHARI MOHD YUSOF, Universiti Putra Malaysia, Malaysia

International Scientific Committee

PHILLIP JONES, Cardiff University, United Kingdom

Editorial Board Members

KHAIRUL AIDIL AZLIN ABD RAHMAN, Universiti Putra Malaysia, Malaysia
MEOR MOHAMMAD FARED MEOR RAZALI, Universiti Putra Malaysia, Malaysia
MOHD RAMZI MOHD HUSSAIN, International Islamic University Malaysia
MOHD HAMDAN HAJI AHMAD, Universiti Teknologi Malaysia
DZULKIFLI BIN AWANG, Universiti Teknologi Malaysia
RAHINAH IBRAHIM, Universiti Putra Malaysia, Malaysia
MUSTAFA KAMAL MOHD SHARIFF, Universiti Putra Malaysia, Malaysia

NOORIZAN MOHAMED, Universiti Putra Malaysia, Malaysia
NORSIDAH UJANG, Universiti Putra Malaysia, Malaysia
OSMAN MOHD. TAHIR, Universiti Putra Malaysia, Malaysia
BELINDA YUEN, Singapore University of Technology and Design, Singapore
JACK STEVEN GOULDING, University of Wolverhampton, United Kingdom.
PATRICK MILLER, Virginia Polytechnic Institute & State University, U.S.A.
TONG MAHN AHN, Seoul National University, REPUBLIC of KOREA
NEZAR ALSAYYAD, University of California, U.S.A.

TOMASZ ARCISZEWSKI, George Mason University, U.S.A.
CECIL C. KONIJNENDIJK VAN DEN BOSCH, Sveriges Lantbruks Universitet, Sweden
RICHARD DE DEAR, University of Sydney, Australia
ARMAN HASHEMI, University of Cambridge, United Kingdom
ASHRAF M. SALAMA, University of Strathclyde Glasgow, United Kingdom
MIROSLAW J. SKIBNIEWSKI, University of Maryland, U.S.A.
VERONICA SOEBARTO, University of Adelaide, Australia

Reviewers

MUSTAFA KAMAL MOHD SHARIFF, Universiti Putra Malaysia
ISMAL SAID, Universiti Teknologi Malaysia
MOHD YAZID MOHD YUNUS, Universiti Putra Malaysia
MOHD SHAHRUDIN ABD MANAN, Universiti Putra Malaysia
SHAMSUL ABU BAKAR, Universiti Putra Malaysia
MOHD JOHARI MOHD YUSOF, Universiti Putra Malaysia
SIOW MAY LING, Universiti Putra Malaysia
MARIANA MOHAMED OSMAN, International Islamic University Malaysia
ZAKARIA ALCHEIKH MAHMOUD AWAD, Universiti Malaya

ZUMAHIRAN KAMARUDDIN, International Islamic University Malaysia
SUMARNI ISMAIL, Universiti Putra Malaysia
HAZRINA HAJA BAVA MOHIDIN, Universiti Malaya
NOOR FAZAMIMAH MOHD ARIFFIN, Universiti Putra Malaysia
NORHUZAILIN HUSSAIN, Universiti Putra Malaysia
NOR AZLINA ABU BAKAR, Universiti Putra Malaysia
MUHAMMAD ZAFFWAN IDRIS, Universiti Pendidikan Sultan Idris
KHAIRUL AIDIL AZLIN ABD RAHMAN, Universiti Putra Malaysia
SREETHERAN MARUTHAVEERAN, Universiti Putra Malaysia

Index

Scopus, MyCite, National Library, UPM Intellectual Repository, Design and Applied Arts (DAAI), Arts and Humanities Index (CSA Illumina), EBSCO and ISC (Islamic World Science Citation Center)

EDITORIAL PREFACE

PATHWAYS TO URBAN SUSTAINABILITY: PROTECTING CULTURAL HERITAGE AND ECOSYSTEMS AND ACHIEVING A BETTER QUALITY OF LIFE

Zalina Shari^{1,2}

¹Guest Editor in Chief

²Department of Architecture, Faculty of Design and Architecture, Universiti Putra Malaysia

zalinashari@upm.edu.my

As the global population passes seven billion (United Nations, 2012), humans face significant economic, environmental and social challenges related to increasing demand for and consumption of natural resources. These activities lead to a variety of issues including climate change, food and energy shortages, habitat degradation, air and water quality issues, and increased pollution. Thus, there is an urgent need for significant changes in the way we design and retrofit our cities to accommodate a future of growth without compounding our current problems. Developing sustainable communities requires resilient and efficient economic, environmental and social systems.

The international community has harnessed the momentum with several key events, such as the September 2015 release of the 2030 Agenda for Sustainable Development (United Nations, 2015). The groundbreaking plan is the first international agreement to acknowledge sustainable urban development as the fundamental precondition for the prosperity of cities. The agreement comprises 17 Sustainable Development Goals (SDGs) and 169 actionable targets that aim to be achieved by 2030. Particularly relevant is the 11th SDG—sustainable cities and communities— which seeks to “make cities and human settlements inclusive, safe, resilient and sustainable” by recognizing urbanisation and urban growth as a transformative force for sustainable development (United Nations, 2015).

Across the world, many cities are placing themselves on a path toward sustainability and implementing innovative ideas to efficiently manage urbanisation (e.g. Copenhagen, New York, Singapore, Seoul, and so forth). However, many other cities are in urgent need of effective planning and financing strategies to meet today’s critical urban challenges. In line with this realisation, the Urban Sustainability Framework has been developed by

the World Bank (2018) to help build a shared understanding of sustainability within an urban context, and provide practical guidance to cities on how to pursue urban sustainability through integrated approaches, among others. The USF provides tools and methods that cities of different sizes and levels of development can use to improve their sustainability over time.

The measuring framework builds a shared understanding of sustainability within the urban context through two “enabling” and four “outcome” dimensions. The enabling dimensions and their associated goals are as follows:

- (1) **Governance and integrated urban planning:** to achieve integrated, well-planned urban development;
- (2) **Fiscal sustainability:** to ensure accountable governance and fiscal sustainability. Whereas the outcome dimensions and their associated goals are as follows:
 - (1) **Urban economies:** to attain sustainable economic growth, prosperity, and competitive across all parts of the city;
 - (2) Natural environment and resources: to protect and conserve ecosystems and natural resources into perpetuity;
 - (3) **Climate action and resilience:** to work toward mitigating greenhouse gas emissions while fostering the overall resilience of cities;
 - (4) **Inclusivity and quality of life:** to work toward creating inclusive cities and improve cities’ livability, focusing on reducing poverty levels and inequality throughout cities.

Three of the above-mentioned urban sustainability dimensions, i.e. “Governance and integrated urban planning”, “Natural environment and

resources” and “Inclusivity and quality of life”, are the broad categories of the nine papers presented in this special issue. Each of the papers in this special issue is unique in its emphasis. However, there are several consistent areas of overlap (see Table 1). This editorial paper first provides a cursory overview of this special issue. It then explains the four key focus areas, and under each area, a brief introduction to relevant paper(s) of this special issue is presented.

Table 1: Focus areas of nine papers presented in this special issue

Urban Sustainability Dimensions	Key Focus Areas	Authors
Governance and integrated urban planning	Cultural heritage	Zulkifli, Ibrahim and Zakariya Mohamed dan Harun Yeong, Abd Rahman, Ismail and Utaberta
Natural environment and resources	Ecosystems and biodiversity	Pornelos and Navarra Fontanoza and Navarra
Inclusivity and quality of life	Health and well-being	Sidenius, Nyed and Stigsdotter Stigsdotter, Sidenius and Grahn Ali, Ja'afar and Mat Sulaiman
	Social cohesion	Wajjitratum

Overview of this Special Issue

This special issue of Alam Cipta contains a collection of nine extended papers from the International Conference on Resilient Smart Technology, Environment and Design (ReSTED 2018), held on 13-15 November 2018 in Bangi, Selangor. ReSTED 2018 was jointly organised by Universiti Putra Malaysia (UPM), Universiti Kebangsaan Malaysia (UKM), Asian Reflective Foil Association (ARFA), and Integrated Environmental Solutions (IES). The conference aimed to provide an advanced platform for researchers, academicians, and industry professionals to present their research results and activities regarding topics on three broad areas: 1) renewable energy technologies and applications; 2) building performance, simulation and energy-efficient design and technologies; and 3) sustainable planning of landscape, neighbourhoods and cities. With the central theme “Creating Solutions for Future Survival”, the ReSTED 2018 emphasised a balanced approach to environmental, social and economic aspects of sustainability to build a better future. This conference provided myriad opportunities for the delegates to exchange new ideas, set up research relations, and find partners for future collaboration. After rigorous double-blind refereeing processes, 44 papers were accepted and presented at the conference. The presenters and attendees of the conference were from Malaysia, Singapore, Thailand, the Philippines, Denmark, and the UK.

After the conference, we sought papers that received good reviews from the conference reviewers and are relevant to Alam Cipta journal, mainly

non-technical or non-engineering papers. The authors were then invited to revise their conference paper for journal publication and in accordance with customary practice to add 30% new materials. The revised papers again went through the normal journal-style review process and finally, nine extended papers had been accepted and presented to the readers in the present form.

Cultural Heritage

A city that seeks to establish a unique and memorable sense of place will make it different from other cities. A unique sense of place can be established by protecting and incorporating natural features such as rivers, harbours, lakes, forests, and hills. Unique city identity can also come from protecting and conserving the city’s cultural and historical heritage (monuments, townscapes, landscapes, archaeological sites, and culture) (Hmood, 2019). This result benefits the city by enhancing social cohesion and encouraging a sense of pride in the city. It also strengthens the appeal of the city to businesses and tourists (Said, Aksah and Ismail, 2013).

Sustainability recognises the critical importance of ‘sense of place’ and heritage in any plans for the future (Government of Western Australia, 2003). In some definitions of sustainable development, the concept of compatibility between the use and the qualitative and quantitative conservation of resources has been extended considerably: from looking purely at natural resources to including the conservation of cultural assets and collective historical memory for the benefit of future generations. The preservation and continued use of historical buildings may produce additional benefits for the community over and above those which more modern buildings provide (Hmood, 2019). These additional benefits arise from:

- their historical and architectural importance;
- their role in the development of a sense of identity for the local community; and
- their role in encouraging tourism and investment.

The first three papers of this special issue emphasise on the preservation of cultural and historical heritage, each at different spatial scale. Zulkifli, Ibrahim and Zakariya’s paper titled ‘Integration of rural landscape characters of the Pahang-Terengganu coastal route for tourism route planning’, call for the preservation of certain viewpoints, vistas, natural backdrops and cultural sceneries in the future planning and development of coastal areas of Pahang and Terengganu states. They suggest that maintaining the unique and scenic landscape settings of the region is essential for the sustainability of its tourism industry.

In ‘Morphogenetic process of spatial structure in Malay town: A case study of Kota Bharu, Kelantan’, authors Mohamed dan Harun analyse the spatial formation and transformation process of the old town centre of Kota Bharu city. Through archival research and site observations results, the authors reveal the structural changes throughout the historical development of the old town. They hope that the results would guide the city’s urban conservation planning in the future.

The third paper calls for historical heritage preservation at a building scale; titled ‘Challenges of sustaining design identity in Chinese Taoist Temples built in the 19th Century in Klang Valley, Malaysia’ by Yeong, Abd Rahman, Ismail and Utaberta. This qualitative research paper highlights the poor maintenance of a 19th-century Chinese temple in Malaysia that results in the loss of its original design identity. It provides a deep understanding of appropriate preservation measures for all 19th-century Taoist temples in the country to ensure the sustainability of the temples’ antique design characters.

Ecosystems and Biodiversity

Sustainability acknowledges that all life has intrinsic value, is interconnected and that biodiversity and ecological integrity are part of the unique life support systems upon which the earth depends (Government of Western Australia, 2003). Growing greener cities involves the promotion of activities that employ, recognise, or conserve nature in its many helpful forms to sustain urban life while limiting or reducing its depletion. A sustainable city is renowned for its many beautiful public parks, gardens and public spaces (Lehmann, 2011). This pride is best formed through a strong focus on local biodiversity, habitat and urban ecology, wildlife rehabilitation, forest conservation, and the protection of regional characteristics. Protecting, conserving, restoring, and promoting ecosystems, natural habitats, and biodiversity are vital to the effective functioning of city systems. For example, they provide water, attenuate floodwater, filter particles from the air, promote pollination, help control climate, support nutrient cycles. The loss of biodiversity can be mitigated by enhancing the natural environment, increasing urban vegetation, as well as landscaping and planning the city using ecological principles.

The next two papers of this special issue promote ecological integrity in the Philippines context. The paper by Pornelos and Navarra, titled ‘The fractality of a garden city: A comparison of the relationship of road network and green spaces in Singapore and Quezon City, Philippines’, argues that the building of roads greatly facilitates habitat fragmentation or influences the surrounding

ecological patches. Based on their results of fractal dimension, the authors call for protection of green areas or patches with a high fractal dimension to be protected from road construction and expansion to reduce habitat fragmentation.

The next paper, ‘Using mean patch size as a landscape metric to determine the effectiveness of the National Greening Program in Quezon City, Manila’, by Fontanoza and Navarra, highlights a method to measure the expansion of green patches in a city. The authors subsequently demonstrate the success of the Philippines government’s greening program that was implemented between 2011 and 2017 in Quezon City. This paper provides insights not only into the method used in the research but also the worthiness of replicating the similar greening program in other cities or regions.

Health and Well-being

One of the aims of sustainable development strategies is to improve the quality of life and well-being continuously. A healthy population can enjoy a good quality of life and make a full contribution to the economy (Mella and Gazzola, 2015). Access to adequate health care services is essential for promoting and maintaining health, and achieving health equity, and so on. Effective welfare services are also crucial for ensuring people have access to adequate care, accommodation, and nutrition care to support health. Good access to public parks, open spaces, gardens and recreational facilities, along with walkable streets, also encourages healthy lifestyles (Braubach et al., 2017). They provide health, recreational, cultural, and spiritual benefits to city residents, which are the essential components of a healthy city (Lehmann, 2011). Research has shown that positive interactions in urban green space can bring social cohesion, social capital and vital health-promoting behaviors that may enhance psychological health and well-being (Jennings and Bamkole, 2019).

The subsequent three papers of this special issue promote human health and well-being through two different perspectives and approaches. Sidenius, Nyed and Stigsdotter’s paper titled ‘A new approach to nature consumption post nature-based therapy’, draws attention to the potential of the natural landscape as a therapeutic to restore the health and well-being of those diagnosed with stress-related symptoms. Through a mixed-method approach, the authors show positive results among nature-based therapy participants. Specifically, they would use nature more frequently, have better insights into nature consumption, and have a higher ability to gain their nature-based experiences for their health and well-being.

The next paper also uses the landscape approach: 'From research to practice: Operationalisation of the eight perceived sensory dimensions into a health-promoting design tool' by Stigsdotter, Sidenius and Grahn. The authors argue that the capability of green spaces in promoting mental restoration depends on eight Perceived Sensory Dimensions (PSD). These PSDs (Serene, Space, Nature, Rich in Species, Refuge, Culture, Prospect, and Social) were identified through a questionnaire survey and later applied through a demonstration project involving an establishment of eight different yet connected spatial settings on a two-hectare land. The authors then develop an appropriate design tool that put the eight PSDs into use, together with six steps as practical guidance for landscape architects and urban planners.

On the other hand, Ali, Ja'afar and Mat Sulaiman's paper, 'The influences of geographical and physical attributes on user activities in Erbil Square, Iraq', highlights the social values of urban squares in urban lives. The paper argues that such values fall short in Iran due to weather and design factors. Through a quantitative pilot study with Erbil Square as the case study, the authors provide an early indication of a positive correlation between geographical and physical qualities of urban square design on users' activities.

Social Cohesion

Social cohesion is also one of the critical changes identified in the sustainable development strategy. Sustainability recognises that an environment needs to be created where all people can express their full potential and lead productive lives and that significant gaps in sufficiency and opportunity endanger the earth (Government of Western Australia, 2003). Communities that are active and well-connected with one another contribute to the bottom-up creation of a city with a strong identity and culture. An inclusive society overrides differences of race, gender, class, generation, and geography and ensures inclusion and equality of opportunity. Engaging multiple stakeholders in decision making helps align different perspectives, leverage knowledge, and ensure that no group or community is side-lined.

The last paper of this special issue, however, addresses social inclusion, not at an urban scale but product scale. 'Visual communication on food products packaging for Japanese elderly persons' by Waijitragum, focuses on the application of graphic design in Thai food packaging targeted for elderly Japanese consumers living in Thailand. The paper explores the thesis that Japanese older people are usually more attentive to the functional attributes rather than the aesthetic attributes of product packaging. The paper suggests that packaging with certain visual communication approach and material has a better potential to attract elderly Japanese consumers.

To conclude, it is hoped that this special issue will contribute to the readers' awareness that sustainable design (at urban, township, site, building or product scales) is a moral obligation. However, it is essential to note that the pathways towards achieving urban sustainability cover actions beyond key areas highlighted by articles in this special issue. In a nutshell, a holistic, sustainable urban development encompasses actions cross environmental (resource consumption with environmental impact), economic (resource use efficiency and economic return), and social (social well-being and health) dimensions. Hopefully, with recent political, technological, social and cultural developments, there will be more ideas and insights for critical research, pedagogical experiences and projects that can help create better places and contribute immensely to achieving urban sustainability in cities around the world.

REFERENCES

- Braubach, M., Egorov, A., Mudu, P., Wolf, T., Ward Thompson, C. and Martuzzi, M. (2017). Effects of Urban Green Space on Environmental Health, Equity and Resilience. In Kabisch N., Korn H., Stadler J., Bonn A. (eds), *Nature-Based Solutions to Climate Change Adaptation in Urban Areas. Theory and Practice of Urban Sustainability Transitions*. Switzerland: Springer, Cham.
- Government of Western Australia. (2003). *Hope for the Future: The Western Australian State Sustainability Strategy*. Perth, Australia: Department of the Premier and Cabinet.
- Hmood, K. F. (2019). Introductory Chapter: Heritage Conservation – Rehabilitation of Architectural and Urban Heritage. In Hmood, K. F. (ed.), *Urban and Architectural Heritage Conservation Within Sustainability*. London: InTechOpen Limited.
- Jennings, V. and Bamkole, O. (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health*, Vol. 16(3): 452-465.
- Lehmann, S. (2011). What is green urbanism? Holistic Principles to Transform Cities for Sustainability. In Blanco, J. and Kheradmand, H. (eds.), *Climate Change—Research and Technology for Adaptation and Mitigation*. Rijeka: InTech.
- Mella, P. and Gazzola, P. (2015). Sustainability and quality of life: the development model. *Proceedings of the 18th Annual International Conference on Enterprise and Competitive Environment*. Czech Republic: Mendel University in Brno, pp.542-551.
- Said, S. Y., Aksah, H. and Ismail, E. D. (2013). Heritage conservation

and regeneration of historic areas in Malaysia, *Procedia - Social and Behavioral Sciences*, Vol. 105: 418-428.

- The World Bank (2018). Urban Sustainability Framework (USF). <http://documents.worldbank.org/curated/en/339851517836894370/pdf/123149-Urban-Sustainability-Framework.pdf>. Assessed March 2020.
- United Nation (2012). United Nations Conference on Sustainable Development. Rio+20. <https://sustainabledevelopment.un.org/rio20>. Accessed March 2020.
- United Nation (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. United Nations General Assembly. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E. Accessed March 2020.

INTEGRATION OF RURAL LANDSCAPE CHARACTERS OF THE PAHANG-TERENGGANU COASTAL ROUTE FOR TOURISM ROUTE PLANNING

Nabilah Huda Zulkifli¹, Putri Haryati Ibrahim^{2*} and Khalilah Zakariya²

¹Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Jalan Gombak, 50728 Kuala Lumpur, Malaysia

²Department of Landscape Architecture, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Jalan Gombak, 50728 Kuala Lumpur, Malaysia

*Corresponding author:
putri@iium.edu.my

ABSTRACT

Landscape characters of a place are shaped by its natural geographic conditions and alterations from human activities. The sceneries found along a certain route can signify the image of a place and enhance tourist experience. This study addresses issues regarding the fragmentation and disconnection of landscape characters that have potentials to be planned and integrated, so that a practical approach can be used by relevant authorities to plan the tourism route and sustain the rural landscape characters. The aim of this paper is to delineate the coastal landscapes characters along the Pahang-Terengganu east coast route. The methods used for this research are content analysis from various literature reviews to derive a conceptual framework, field observations and assessment of the landscape characters found along the Pahang-Terengganu east coast route, and describing the landscape characters from aspects of natural factors and cultural social factors. The findings of the study revealed that the coastal landscape characters for the Pahang-Terengganu stretch are highly influenced by human interactions with the natural resources that are native to the area. The dominant landscape characters that are visible along the routes are composed of natural and cultural settings such as vegetated areas, the seaside and traditional villages, as well as industrial and commercial areas. Future plans and developments need to integrate the natural and cultural landscape characters of the route, towards establishing the Pahang-Terengganu coastal route as one of the scenic tourism routes in Malaysia.

Keywords: Rural landscape characters, Tourism planning, Coastal landscape

1. INTRODUCTION

Rural landscape characters in the coastal areas of Pahang and Terengganu are a splendid asset that can be used to promote the east coast region while elevating the income of the local people through tourism activities. The scenic beauty of the rural landscapes can be used to promote and create better or stronger tourism attraction activities such as cultural, traditional and educational tourism. The rural tourist experience can be enriched by offering unique rural landscape settings and integrating culture-based and nature-based activities that are significant to each local area. Rural landscape characters differ from one place to another as they depend on the geographical character of the area, natural features and the local's way of life. In order to create a rich tourism experience, it is crucial for landscape architects, tourism planners and the local governments to identify the uniqueness of rural landscape characters and integrate them with the existing tourism attractions.

The Federal Government of Malaysia has established a tourism corridor which is called as the Northern Corridor, focusing on the states of Penang, Kedah, Perlis and Perak, situated in the northern part of Peninsular Malaysia. The Northern Corridor was planned in line with the National Rural Physical Planning Plan 2030 (National Rural PPP 2030) that focuses to integrate spatial planning with the rural development in Malaysia. The National Rural PPP 2030 aims to strengthen the inclusivity towards a fair society by transforming the rural areas and elevate the welfare of the rural community parallel with the 11th Malaysia Plan (Economic Planning Unit, 2015). The notions are in line with the second mission of the National Landscape Policy (National Landscape Department, 2011) which is to ensure the natural resources are used

optimally, maintained, preserved and conserved by sustainable management systems, especially for tourism purposes and heritage preservation. Back in 2008, the East Coast Economic Region (ECER) Master Plan was approved by the Government to guide the regional transformations of the coastal states of Kelantan, Terengganu, Pahang and the district of Mersing in Johor (ECERDC, 2018). These plans signify that route developments are critical aspects of the regional corridor developments as they can physically connect and integrate different states. However, some of the landscape characters and attractions are segregated by interstitial developments that cause the coastal route image to be less unified and lack integration. Rural attractions are seldom being tied together to facilitate and encourage multi-destination visits (Hamzah and Ismail, 2008). As a result, it leads to less attractive journey for tourists to experience when they engage with self-drive tourism. Parallel to the nation's agenda to become the top 20 country in the economic development, social and innovation advancement, it is clear that rural areas also play a vital role in helping the Government to fulfill its missions. Despite the various agendas and countermeasures outlined in the policy, National Rural PPP 2030 has not listed specific measures to assess rural landscape characters as the existing checklist delivered in the Rural Tourism Master Plan (Ministry of Culture, Arts and Tourism, 2001), which is conceivably outmoded.

2. THE FORMATION OF MALAYSIA LANDSCAPE CHARACTERS

Malaysia resides in the Sunda shelf, and tectonically inactive. It is strategically located in seismically stable plate which protects the country from most major natural disasters. The setback nevertheless, is that it cannot shield the country from flooding and landslide risks due to its tropical climate (Cavendish, 2008). This climatic condition allows Malaysia to home a wide range of geographical landforms, rainforests and landscape abundance. Today, the number of populations in Malaysia as in 2016 is 28.7 million in which 68.8% of them are from the Malay ethnics, while Chinese and India is at 23.4% and 7% respectively in the context of major ethnic groups (Department of Statistics, 2017). A study shows about 25% of Malaysian resides in rural areas known as Kampung (village, or house clusters) (Lockard et al, 2017). Due to the geographical condition, most of these villages are underdeveloped. They are sparsely populated as a result to lack of infrastructures and necessities. As a result, some people choose to leave the rural area for urban settings, which provide more infrastructures. Study by Farooq (2012) indicated that

homogeneity is commonly collective in the rural areas due to the following reasons:

- (a) Their main profession in rural residents are self-sustaining which are agricultural and nature-based;
- (b) Choice of apparels;
- (c) Informal way of life;
- (d) Strong relationship between the communities;
- (e) Lack of transportation and communication resources;
- (f) Low rate of education and modern technology because hereditary occupations;
- (g) Very minimal of pollutions;

However, the custom and culture might differ between the societies itself due to different ethnicity and cultural root. In regards to the economic situation of Malaysia currently and in the past, it was mainly determined by politics where ethnic groups were differentiated.

Landscapes play a salient part in representing the image of a country other than the language and religions professed by the populace (Shuib and Hashim, 2011). In terms of settlement, the landscape settings in the particular area are shaped and altered to suit and cater human necessities to survive. Generally, the landscape setting in Malaysia was preoccupied with agricultural products comprising of rice fields, coconut groves and rubber plantations. However, the traditional landscape of the country was dominated by oil palm plantation in the early 1970's due to the increasing demand of cooking oils worldwide. Study by Ismail (2005) and Hussain and Byrd (2012) indicated that the natural landscape was mainly inhabited by forests and coastal areas. Rice fields are cultivated in the north-western region and foothills in the east coast of the peninsular, while rubber and oil palm were mainly planted along the west coast of Peninsular Malaysia. It is almost self-sufficient for the people to make use of the resources attributable to the inherited characteristics of a natural and traditional landscape in Malaysia (Hussain and Byrd, 2012). The bounty of natural resources in Malaysia along with its scenic panoramas will

always be ample to be used by the local populations as long as the usage of remains optimised adequately. At present, agricultural activities in the rural areas in north-western region such as paddy and coconut plantations are one of the most grossing economic activities for rural communities due to its relatively flat topography and fertile soil quality. This activity contributes to the picturesque views that can be seen in the rural part of the peninsular Malaysia for instance in the states of Kedah, Selangor and Perak. Rainforests also coexist in the rural landscape such as mangroves and dipterocarp forests which are vital as ecological, aesthetic and economic resources (Abdullah, 2011). In the past, mangrove woodlands serve as timbers and charcoal productions for the rural inhabitants. However, at present, most mangrove forest areas in Malaysia are reserved and under protection due to the number that has depleted exponentially in the recent years. Meanwhile, the dipterocarp forest serves as provider for food and medical supply as they are occupied with forest animals, fruits and herbs. Therefore, it is clear that the unique and distinctive characters of the rural landscape settings in Malaysia are important assets that must be protected and optimised by the relevant agencies. Due to the continuous modernisation and extensive development happening throughout Malaysia, preservation of the rural areas must be contained in order to protect the natural resources. Preserving rural landscape is crucial as to protect natural, historical heritage thus stimulating local economy simultaneously.

2.1 Rural Landscapes Characters

The rural landscapes are comprised of diverse tangible and intangible characters and it is vital to classify them through several groups. Simensen et al. (2018) dictated that rural landscape characters can be divided into five categories which are the bioclimatic landscape variables, geo-ecological landscape variables, ecological landscape variables, land use variables and socio-cultural landscape variables. On the other hand, Swanwick (2002) pointed out that landscape can be annotated through integrated character types which are landscape character survey and analysis, biodiversity, historic characters, water and air quality and recreation, while Tudor (2014) is direct in categorising landscape through natural factors, cultural or social factors, cultural associations and perceptual and aesthetic factors. Study by Jaszczak and Zukovskis (2011) stated that the elements of rural landscapes can be grouped into farm building use, natural potential and agriculture land, cultural elements, historical objects, technical objects, greenery areas and rural gardens and visual elements. Shuib and Hashim (2011) divided rural characters into four themes: 1) scenery, settings and recreational meanings, 2) ecological and natural landscape meanings, 3) historical and socio-cultural experience, 4) rural setting, people and culture. Therefore, it can be suggested

that landscape characterizations is influenced by perceptions and experience as all the characters may be classified in various ways depending on the emphasis or context of the study. They typologies of the physical features are commonly described by the landform, hydrology, vegetation, land use patterns and settlement patterns, spatial organisations and infrastructures (Queenstown Lake Council District, 2017; Zakariya et al., 2017; Tudor, 2014). This can be annotated that the main product of landscape characters are dominated by physical attributes which it is important to be assessed by visual and sensory perceptions and preferences. In relation to landscape preference and experience, views, scenic route, coherence, disturbance, imageability or sense of place, visual scale, naturalness, historicity and heritage and cultural significance are the terms used to assess user preference and experience (Ode et al., 2008; Queenstown Lake Council District, 2017; Tveit et al., 2006; Zakariya, 2017; Geltmeyer, 2011; Tudor, 2014). Last but not least, Lv et al. (2017) emphasised that the product of landscapes settings with human interactions are security and convenience, rural landscape, residential life, natural environment and intangible cultural heritage. Based on the studies highlighted above, it can be summarised that rural landscape depends so much on its natural settings because different environment caters different human needs. Experiencing rural landscapes and its characters is crucial to determine its importance to ensure that the distinctive features are remain celebrated and preserved. Scazzosi (2013) mentioned in his study that the values of rural landscape can be sustained by establishing general notions about its management, conservations and knowledge. It is also encouraged to promote awareness by doing collaborations with multidisciplinary sectors including local communities and public-private associations (Scazzosi, 2013; Federal Department of Town and Contry Planning, 2017).

2.2 Coastal Landscape Characters

Coastal areas can be defined as an intersection point between the sea and the mainland. Pungetti (2012) describes coastal landscapes as an outline for landscape and seascape in which it is constituted from the interaction between coast, sea and adjacent waters. Study by Hill et al. (2001) elaborated that the concept of seascape can be translated into the views or settings to the sea. Despite richness in biodiversity, coastal areas hosted the most fragile ecosystems in the world namely the mangroves and coral reefs (Lakshmi and Shaji, 2016). The protection of coastal areas are necessary as it is a significant part of the nature-based tourism attractions, bestow scenic views and endowed with rich landscape resources. Balasubramanian (2011) listed five processes and landform of coastal landscapes. Firstly, is the profile of coastal zone that is divided into three categories: backshore region, foreshore region and offshore region, followed by waves, tides and currents, coastal

geomorphic processes, erosional landforms and depositional landforms which are basically subjected as geological oceanography. The quality of coastal landscapes varies depending on a particular setting, in which it is moulded by the sea actions, speed of the waves and type of rocks compositions. The stretches of coastal landscape settings can provide a marvellous scenic settings that is important to promote the natural resources surrounding the area. In terms of characterizations, coastal landscapes are not distinctive to the general rural landscape characterizations. Shelbani (2017) suggested that the study of coastal landscape can apply the standard Landscape Character Assessment (LCA) method. First, three components of the seascape unit (nearshore, foreshore, and backshore) need to be divided into types or areas of distinctive, recognisable and common characters. Then, mapping all of the distribution of these units of common landscape character. Wahab et al. (2018) recommended that the LCA is applied in which the characteristics of landscapes are identified through site inventory and observations, followed by mapping through segments of selected or identified attributes. Based on the literature review conducted, this study summarises the pertinent components of rural characters in the coastal area in three major categories, which are the natural factors, cultural or social factors and key scenic route. Figure 1 outlines the conceptual framework of rural landscape characters that can be used as a guide to document and assess the coastal route.

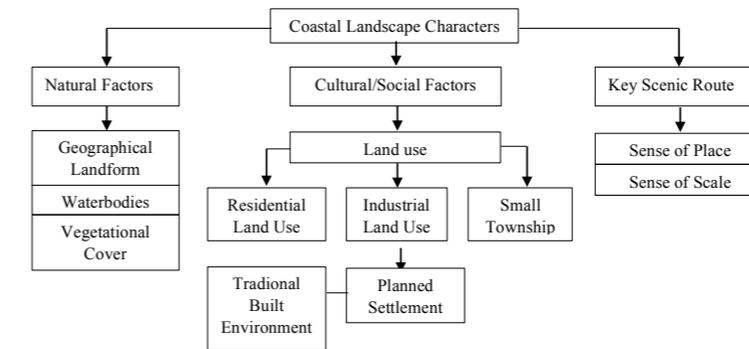


Figure 1: Framework for Coastal Landscape Characters

3. METHODS

The site selected for this study is Federal Route 3, one of the oldest roads in Malaysia, which connects the southern region to the north-eastern region of the country through the coasts. The coastal route stretches from Johor, passing through Pahang and Terengganu and ends in Kelantan. The scope of the research only focuses on the Pahang-Terengganu stretch, due to its abundance of rural attractions, which is fundamental in determining the most optimum route. Furthermore, the limitation of the study area serves to give a focus to the study as the Pahang and Terengganu coastal areas share the similar geographical characters. This study has adopted a qualitative approach to extract the landscape characters along the Pahang-Terengganu coastal route, through methods of observation and assessment of recorded checklist of the dominant landscape characters based on the framework for coastal landscape characters as elaborated in the previous section. The observation was conducted for two weeks on August 2018 and 1 week on January 2019 according to the checklist items (natural factors, cultural/social factors and key scenic route), documented in terms of the visible characters, and interpreted through descriptive analysis of landscape characters' assessment. Findings on the natural factors from the observation were validated by comparing the documented landscape characters with land cover map of the areas, while findings on cultural and social factors were sourced from actual photographs captured along the route and described based on their visible characters. The site is segmented into six areas: 1) Gebeng, 2) Cherating, 3) Kemaman, 4) Kerteh, 5) Dungun, and 6) Marang (refer Fig. 2). The total distance of the route from Gebeng to Marang is about 176 kilometres. Data from the observation were documented through descriptive field notes and photographs.



Figure 2: The selected site study, Pahang- Terengganu stretch, starting from Gebeng to Kuala Terengganu. Source: Google Maps.

4. RESULTS

Findings from the data collection revealed that the coastal landscape characters for the Pahang-Terengganu stretch are highly influenced by human interactions with the landscape settings (refer Table 1). While the most dominant features of the landscape settings throughout the segments are the vegetated areas and the coastal areas, the landscape characters along the route have been mostly intervened and altered due to manmade activities such as the industries that can be found in the area of Gebang, Pahang and Kerteh,

Table 1: Coastal Landscape Characters Findings

Segment	Landscape Characters Findings	Images of the Area
Gebeng	<p>Key Scenic Route</p> <ul style="list-style-type: none"> Mainly featured with industrial landscape and heavy machineries Rural settings are also dominant <p>Natural Factors</p> <ul style="list-style-type: none"> Dense street planting, coconut plantation as scenic backdrop for traditional houses Some barren land also visible <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> As to occupy the high number of people working on the industrial site, the residential areas are visible In some areas, the traditional houses or 'kampung' are present but it is in a scattered form Basic necessities are available but infrastructures are not adequate 	
Cherating	<p>Key Scenic Route</p> <ul style="list-style-type: none"> Tourist attractions: full of infrastructures to accommodate tourist's needs Has a huge number of food stores to sell local delicacies such as <i>keropok-lekor</i> and <i>satar</i>, which represent the local resources Beaches are sufficient to provide a lot of tourism activities such as glamping, windsurfing <p>Natural Factors</p> <ul style="list-style-type: none"> Hills and coconut plantations act as a stunning backdrop Mangrove is present in waterbodies <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> Rural township, the infrastructures is not sophisticated but proper to cater the needs of the locals and tourists 	

Segment	Landscape Characters Findings	Images of the Area
Kemaman	<p>Key Scenic Route</p> <ul style="list-style-type: none"> Heavily surrounded with industrial sector, which disrupts the sense of scale and scenic quality Can be considered as township: ample utilities, amenities and facilities Various characters and splendid natural landscapes <p>Natural Factors</p> <ul style="list-style-type: none"> Coconut plantation and mangrove landscape mainly inhabit the area, and some small hilly areas are also visible Beach as waterbodies cater a lot of leisure and fishing activities <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> Developed settlements, lack of heritage and cultural settings 	
Kerteh	<p>Key Scenic Route</p> <ul style="list-style-type: none"> Dominated with Petronas petroleum processing terminal as a landscape giving off sense of grandeur <p>Natural Factors</p> <ul style="list-style-type: none"> Limited vegetation and <i>Rhu</i> trees as a typical street planting Striking mountains as a prominent backdrop and sandy beach as waterbodies <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> Developed areas with adequate facilities Industrial areas and township is dominating the routes while settlements are located far from roads 	

Segment	Landscape Characters Findings	Images of the Area
Dungun	<p>Key Scenic Route</p> <ul style="list-style-type: none"> Natural landscapes are the dominant character of the site <p>Natural Factors</p> <ul style="list-style-type: none"> Mangroves, protected forest and protected paperbark swamp Most of the route settings is vacant and dominated with barren area and bushes <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> Basic necessities are available Stall selling goods visible along the route The people depend a lot on the road to commute and conduct business activities 	
Marang	<p>Key Scenic Route</p> <ul style="list-style-type: none"> The main feature of this area is the beach, and the scenic setting is used as tourist attractions and for evening activities <p>Natural Factors</p> <ul style="list-style-type: none"> Coconut plantation and open areas are the main landscape features Patches of corn plantation are visible at the side of road <p>Cultural/ Social Factors</p> <ul style="list-style-type: none"> Stall selling goods is visible along the route The people depend a lot to the road to commute and conduct business activities 	

Terengganu, and local settlements of traditional villages, new housing areas and commercial buildings that are sparsely distributed. The landscape settings of east coast are also dominated with natural resources that are geographically unique to the area. For example, the presence of coconut plantation along Cherating and Kemaman segments indicates the proximity towards seas and mangrove forests, protected forests and paperbark swamp are native to the area. On top of that, the striking highlands become the borrowed landscape that is located closely to the beaches and the sea. In terms of the cultural aspect, the landscape settings of rural areas in the east coast have made people adaptive to its surrounding. The use of the vernacular resources, for example, the traditional houses that can be found in the area of Marang, and keropok lekor (fish-based snacks) that derive from fishery activities, show how the geographical characters influence the locals' way of life. The high quality of sandy beaches become opportunities for business providers to cater for the high demand of tourism activities on and even introducing new ideas to accommodate recreational needs for example 'glamping', ATV and horse riding. This study found that along the route, the dominant visual landscape characters are made of natural and cultural settings, with industrial, commercial and settlement areas distributed in between these settings. The stunning views that are prominent in these particular areas must be preserved and integrated into future developments, so that the cultural heritage and scenic characters of coastal landscape remain visible to be experienced by locals and tourists.

5. CONCLUSION

The natural settings of rural areas have made people become adaptive of its surrounding and influence the types of activities of the area. Human interaction with the land changes the characteristics of the existing natural landscapes. Consequently, the changes shape the rural landscape characters. Based on the findings, some of the human activities such as traditional settlements, local products and tourism activities enhance the coastal landscape characters because these activities derive from optimizing the natural resources of the area. However, the expansion of industrial areas, commercial areas and on-going constructions that can be found along the route cause the scenic views to be disrupted because the natural settings are no longer visible and the landscape character has diminished and reduced to only roadside streetscapes. The coastal landscape characters are determined by natural factors in which the multifaceted nature of rural landscapes allows people to interact and experience their natural surroundings. The combination of cultural and social factors of rural settlements and its components are integral in shaping and strengthening the genius loci of the particular place. As the land uses change, visitors can see and experience different landscape settings as they drive along the Pahang-

Terengganu coastal route. Thus, the enhancement of the coastal landscape characters along the route is necessary to enhance the overall scenic landscape of the Pahang-Terengganu route. This study recommends stakeholders to use findings from this research for future plans and development by incorporating and reintroduce the existing landscape characters of the area, and harmonizing it with new developments. Certain viewpoints, vistas, natural backdrops and cultural sceneries should be preserved and taken into consideration when any projects are being undertaken. Furthermore, a rich landscape character can help in sustaining the tourism industry by offering a unique experience and sceneries along the route, as well as developing the rural economy. This study concludes that the integration of the rural landscape characters into the coastal tourism route planning (as illustrated in Figure 1: Framework for Coastal Landscape Characters) can be adopted and adapted in other states or countries so that a richer tourism experience and a better quality regional destination image can be offered.

ACKNOWLEDGEMENTS

This study was supported by the Fundamental Research Grant Scheme under the Ministry of Higher Education Malaysia (FRGS/1/2016/WAB12/UIAM/02/1). The authors would like to thank International Islamic University Malaysia for their support.

REFERENCES

- Abdullah S. A. (2011) The Characteristics of the Cultural Landscape in Malaysia: Concept and Perspective DOI: 10.1007/978-4-431-87799-8_4
- Balasubramanian A. (2011) Coastal Processes and Landforms. DOI: 10.13140/RG.2.2.22363.77600
- Cavendish, M. (2008). World and Its Peoples: Eastern and Southern Asia, Volume 9. New York: Marshall Cavendish Corporation.
- Department of Statistics (2017) Press Release Current Population Estimates, Malaysia, 2016-2017 URL: <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=a1d1UTFZazd5ajJiRWFHNDduOXFFQT09>
- East Coast Economic Region Development Corporation (2018). URL: <https://ecerdc.com.my>, Accessed 3 September 2019.
- Economic Planning Unit, Ministry of Economic Affairs (2015). Eleventh Malaysia Plan, 2016-2020.
- Farooq U. (2012) Characteristics of Rural and Urban Community. URL: <http://www.studylecturenotes.com/social-sciences/sociology/360-characteristics-of-rural-and-urban-community>
- Federal Department of Town and Country Planning (2017) National Rural

- Physical Planning Policy 2030
- Geltmeyer A. (2011) Assessment of Landscape Change and Visual Landscape Character, Case Study On The Finnish Island Nötö. URL: https://lib.ugent.be/fulltxt/RUG01/001/787/496/RUG01-001787496_2012_0001_AC.pdf
- Hamzah A. & Ismail H. N. (2008) A Design of Nature-Culture Based Tourism Corridor; A Pilot Project At Kelantan Darul Naim. URL : <http://eprints.utm.my/id/eprint/5846/1/78004.pdf>
- Hill, M., Briggs, J., Minto, P., Bagnall, D., Foley, K., Williams, A., (2001). Guide to Best Practice in Seascape Assessment. Brady Shipman Martin, Dublin.
- Hussain N. H. M., Byrd H. (2012) Towards a Compatible Landscape in Malaysia: An Idea, Challenge and Imperatives. *Procedia - Social and Behavioral Sciences* 35, 275 – 283
- Ismail N. A. (2005). Responsive Open Spaces in Malay Cultural Landscape: Retrospective of Recreational Spaces. Paper presented at the Ifpra2005-Asian Pacific Congress, Kuala Lumpur, Malaysia.
- Jaszczak A., Žukovskis J. (2011) Landscape Valuation in Development of Rural Tourism: Case Study of Ostfriesland (Germany) Management Theory and Studies for Rural Business and Infrastructure Development. ISSN 1822-6760.
- Lakshmi S. R. & Shaji T.L. (2016) Transformation of Coastal Settlements Due To Tourism. International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015) *Procedia Technology* 24, 1668 – 1680
- Lockard, C. A., Ahmad, Z., Bee, O. J., and Leinbach, T. R. (2017). Malaysia. Encyclopedia Britannica, inc. URL: <https://www.britannica.com/place/Malaysia/Settlement-patterns>
- Lv G., Liu D., Zhao M., Zhao L. (2017) Research on the Characteristics of the Rural Landscape Based on the System of Landscape Evaluation. *International Journal of Science, Technology and Society*. 5 (6), pp. 186-192. doi: 10.11648/j.ijsts.20170506.13
- Ministry of Culture, Arts and Tourism (2001). Rural Tourism Master Plan . Kuala Lumpur Malaysia (2001) Rural Tourism Master Plan. Ministry of Culture, Arts and Tourism: Kuala Lumpur.
- National Landscape Department (2011) National Landscape Policy. Kuala Lumpur: Ministry of Housing and Local Government.
- Ode A, Mari S. Tveit & Fry G. (2008) Capturing Landscape Visual Character Using Indicators: Touching Base with Landscape Aesthetic Theory, *Landscape Research*, 33:1, 89-117, DOI: 10.1080/01426390701773854
- Pungetti G. (2012) Islands, Culture, Landscape and Seascape. *Journal of Marine and Island Cultures* 1, 51–54.
- Queenstown Lake Council District (2017) Wakatipu Basin Land Use

- Planning Study URL: <https://www.qldc.govt.nz/assets/Uploads/Council-Documents/Full-Council-Agendas/2017/20-April-2017/Item-2%20Wakatipu%20Basin%20Land%20Use%20Study%20/Wakatipu-Land-Use-Study-Att-B-report.pdf>
- Scazzosi L. (2013) World Rural Landscape. International Scientific Committee on Cultural Landscapes ICOMOS/IFLA (ISCCL).
- Sheibani M., Razavi N., Mofrad F. (2017) Coastal Landscape Characterization. The Case of the Sartol Seacoast, Bushehr, Iran. Creative Commons license CC BY-SA 4.0 Firenze University Press. DOI: 10.13128/RV-22002 - www.fupress.net/index.php/ri-vista/
- Shuib K. B. & Hashim H. (2011) Cultural Landscape Values of a Rural Landscape: Perception of Outsiders and Tourists. IFLA APR Congress - Hospitality: The Interaction with Land.
- Simensen T., Halvorsen R., Erikstad L. (2018) Methods for Landscape Characterization And Mapping: A Systematic Review. *Land Use Policy* 75, 557–569.
- Swanwick, C. (2002). Recent practice and the evolution of Landscape Character Assessment, 10. URL: <file:///C:/Users/user/Downloads/landscape%20topic%20paper%201.pdf>
- Tudor, C. (2014). An Approach to Landscape Character Assessment. UK: Natural England.
- Tveit M., Ode A., Fry G. (2006) Key Concepts in a Framework for Analyzing Visual Landscape Character. *Landscape Research*, 31:(3),229 – 255 DOI: 10.1080/01426390600783269
- Wahab N. A. A., Zakariya I., Ibrahim P. H., Ibrahim I. (2018) Mapping the Landscape Characters Along A Rural Route for Tourism. *Journal of the Malaysian Institute of Planners* 16 (1), 131- 140.
- Zakariya, Khalilah and Ibrahim, Putri Haryati and Abdul Wahab, Nur Amirah (2017) *Landscape character assessment for Malaysia's rural landscape: A conceptual framework*. In: Persidangan Kebangsaan Masyarakat, Ruang & Alam Sekitar (MATRA) 2017, 23rd-24th February 2017, Penang.

MORPHOGENETIC PROCESS OF SPATIAL STRUCTURE IN MALAY TOWN: A CASE STUDY OF KOTA BHARU, KELANTAN

Syahidah Amni Mohamed¹ and Nor Zalina Harun^{1*}

¹Institute of the Malay World and Civilization (ATMA),
Universiti Kebangsaan Malaysia (UKM), Bangi, Selangor, Malaysia.

* Corresponding author:
nzalina@ukm.edu.my

ABSTRACT

A systematic assessment of urban morphological analysis is crucial to understand the patterns in which cities are built and transformed henceforth revealed its character. However, there is a significant lag in integrating the analytical process of urban morphological approaches to explain the spatial formation and transformation process of Malay towns which remains unclear. Aims to excerpt the morphogenetic processes that had shaped and influenced the spatial structure of Malay town, a case study in Kota Bharu, Kelantan were employed to present the historical evolution of the town and recognise the socio-physical influences contributed to the structural changes based on data gathered from archival research and site observation. From a diachronic comparison, the mapping analysis process outlined three morphological phases between the years of 1816 until 1909 at five defined urban morphological zones (UMZ). The findings revealed significant changes had occurred at the level of urban block which created a more complex spatial structure in its composition and layout. This study enhanced the understanding of the organic forms of spatial evolution in Malay town for delineation of area-based in urban conservation planning.

Keywords: : character, Malay town, morphogenetic process, spatial structure, urban block, urban morphological approaches, urban conservation

1. INTRODUCTION

The emergence and growth of Malay urban centres or town started with the dispersal of the villages (*kampung*) as an independent nucleus unit typical for Malay settlement. Arose along the rivers, especially at the mouths or at the confluence of two rivers, these villages merged with several other villages that were built surrounding the palaces (*Istana*). The construction of the palace, in close relations to the state capital, marked as a focal point which eventually influenced the development of the surrounding settlements into an urban area (Khor et al., 2017). Conveniently navigable by boat, the area grew naturally into ports that supported its growth into a commercial centre where trading activities were closely administered by the Malay Rulers. Therefore, several distinct characters can be inferred from its evolutionary process, which are: (i) A strategic location close to rivers and seas; (ii) Heavily dependent on rivers as an essential reference for habitation and transportation; (ii) Developed due to flourished port-trading activities; and (iii) Established and administered by Royal Malay ruler as an early capital for Malay States.

These characters henceforth augmenting the position of the towns referred either as Estuaries Towns (Sendut, 1962; Arbi & Talib, 1986) or esteemed as Royal Towns (Shukri et al., 2018; Samsudin et al., 2018) as well as recognized as Early Malay Towns (Rajoo, 1998; Harun & Jalil, 2012; 2014) and Traditional Malay Town (Ossem et al., 2010). Regardless of the various terms referred to these towns, this study generally classified the town as 'Malay town' due to its historical significance in terms of Malay state formation. States such as *Chieh-cha* (Kedah), *Chih-tu* (Kelantan) and *Teng-ya-nung* (Terengganu) had been described in China's imperial record long before the establishment of Malacca Empire, as being achieved the level of 'city-states' surpassing the 'Kingdom' (Wheatly, 1961). In a similar vein,

Sendut (1962) believed that these states formed as a 'convergence of areas' and recognised as '*Pulau Budaya*', a depiction of the higher status achieved within the surrounding of the primitive settings.

In the beginning of 19th century, the influence on colonial political development with the introduction of modern capitalism had considerably changed the physical form of these towns such as Alor Setar, Kota Bharu, Kuala Terengganu, Kuala Dungun, Johor Lama, Bandar Maharani, Pekan, Kelang and Kuala Selangor into a more complex and organized political entities (Arbi & Talib, 1986; Harun & Jalil, 2014). Apart from these aforementioned towns, Alor Setar (Kedah), Kota Bharu (Kelantan), Kuala Terengganu (Terengganu) and Johor Bahru (Johore) remained as the state capital since its establishment. With the political transformation following Anglo-Siamese Treaty signed in 1909, these states including Arau (Perlis) were categorised as five protected Malay Sultanates known as Unfederated Malay States (UMS) by British administration (Khor et al., 2017).

In urban morphological research discourse, understanding how the physical form for each particular towns and cities has been formed and transformed has received a significant contribution in shaping various approaches to analyze the evolutionary process. For example, Kropf (2013; 2014) argued for a more contained version who firmly stated that the primary focus of urban morphological analysis is to reveal the process that contributed to the changes rather than enlighten the historical meaning and genesis of such form and pattern as contended by Conzen (2013). Central to any approaches in urban morphological analysis, apparently, evaluating its morphogenetic process is the utmost priority and unequivocally importance.

Assessing the morphogenetic process of Malay town requires elucidation of the various dimension of influences due to the organic growth of the towns that adapting to the specific conditions of the dominant activities (i.e. port trading) and which change over time. In order to understand such dynamic of influences which had shaped the spatial structure of the town, several studies had attempted to provide a theoretical formation and transformation of Southeast Asian cities in regional context such as McGee (1967), O'Connor (1983), Miksic (2016) as well as reconstructing the morphology of the Malay towns in local context; for instance the study conducted by Tajudeen (2005) and Kassim et al. (2018). These studies had provided an insight into the early physical forms of the observed Malay towns that identically display similar patterns in its spatial structure. Nevertheless, further research needs to be done to systematically analyze the evolutionary process that had contributed to imprint such patterns which then portrayed as the unique characters for Malay town.

This study, therefore, aimed to excerpt the morphogenetic processes that had shaped and influenced the spatial structure of Malay town prior to the advent of Western colonial influence. A vital feature involves mapping of the various physical forms within urban areas. Accordingly, the study used three main principles that were fundamental in urban morphological analysis approaches that are: (i) Morphological elements, (ii) Different levels of resolution, and (iii) Historical time comparison as identified by Moudon (1994) and further conceptualised by Oliveria (2016) to provide a framework for evaluating the morphogenetic process at the selected case study area in Kota Bharu, Kelantan. The established framework based on the hierarchical structure of time-related layers of the town able to guide for a systematic intervention in conservation planning, which response to the historical and cultural significance and settings of the town.

2. METHODOLOGY

The study uses qualitative research methods to provide an in-depth understanding of the spatial formation and transformation processes that formed the significant components of Malay town. In an attempt to comprehend such a dynamic process in a real-life phenomenon, a case study approach had been employed as a strategy of inquiry. A particular design case at Kota Bharu, Kelantan was purposefully selected to analyze the evolutionary process of spatial patterns that carved upon within the purview of urban morphological analysis framework. The site was chosen as a representative of Malay traditional town on the basis of four distinct criteria; that are: (i) Retains an intact significant components of physical structure within a proximity of a defined area, reflecting the typical spatial layout of Malay town (Ossem et al., 2010); (ii) Among the early Malay States founded, developed and continually ruled by the Malay Sultans with minimal British intervention (Harun & Jalil, 2014); (iii) Remains its administrative center in Kota Bharu since 1845 which then encouraged the growth of the surrounding settlement into an urban area (Salleh, 1984); and (iv) Constantly accommodates a highest proportion of Malay population as recorded in the earliest official census data of British Malaya Population Census 1911 until present (Gullick, 1989; Graham, 1908; Talib, 1995).

Data acquisition in urban morphological research typically applies multiple sources of evidence (Scheer, 2015). Accordingly, the data collection method in this study henceforth entails a combination of qualitative data which include two main techniques that are document analysis and fieldwork. The document analysis technique involving archival research collected from various sources of data such as cartographic materials (maps and town plans), visual data (photographs) and historical documents (books

and reports) that were extensively reviewed to extract relevant information on the study area. Meanwhile, fieldwork involving direct observation, mapping, and photographic survey conducted in five delineated zones of the study area to capture the multitude of contextual settings that contribute to the spatial changes of the area. Data collected from these two techniques were retrospectively converged, compared thematically analyzed according to the emergent themes to disclose the changing patterns. These themes composed of three general categories, which are: (i) Morphological Phase; (ii) Morphological Zone; and (iii) Morphological Elements (Buildings, Streets, Blocks and Open Space). Consequently, Mapping analyses were then performed according to diachronic comparison intending to reveal the changes in spatial pattern throughout its morphogenetic process.

It is worth to note that, in concern on the accuracy of the precise location of physical structure to depict the overall spatial composition before the observed period (1816-1909), several limitations with regards to data acquisition were encountered due to the insufficient sources of data recorded and documented systematically. For instance, spatial mapping of the town, particularly in 1816, the findings were mainly deduced from historical writing that limits its discussion according to descriptive explanation. In a similar vein, for the subsequent phases up to 1909, the delineation of spatial boundaries were deduced based on diagrammatic drawings of town plan for 1910s as provided by Salleh (1984). This plan, nevertheless, were not prepared based on the accurate measurement and showed little more than built-up area and streets. The situation made worse with the massive demolitions and replacement of high-rise buildings at the present area during the regeneration of town starting from the 1970s, therefore completely changing the town's morphology along the Kelantan Riverbank.

Therefore, to encounter the limited sources of data, this study was aided with the applied use of toponyms; a subject of study concerning on place names which are significantly employed by geographers in geographical and cultural landscape study (Yeh, 2013). In urbanism context, such strategy had been adopted by several scholars including Sandhu & Wheatly (1983) in reconfiguring the urban hierarchy of 14th century Southeast Asian cities and Tajudeen (2005) in reconstructing the traditional city of Gelam-Rochor Kallang port town in Singapore. In this context, the use of toponyms noticeable on street names, which usually denotes the 'area of influence' by Sultan and aristocrats assists in outlining the location and function of different parts within the town. Ideally, the integration of multiple techniques applied in the data collection process helps to facilitate the validity of the research.

3. STUDY AREA

The location of the study area, which is concentrated at Kota Bharu's built-up area is located in the state of Kelantan, at the north-east of Peninsular Malaysia. Geographically sits on the basin of the Kelantan River, the state has a short coastline facing the South China Sea. The north side of the state, bordered by Narathiwat Province through a small river of Sungai Golok and formed an international boundary between Malaysia and Thailand. To the rear of the state both in the south and west part, the high mountains delineated the boundaries with the other Malay States of Perak and Pahang; while Sungai Semerak on the south-eastern part demarcated the boundaries with Terengganu. The town of Kota Bharu strategically lies near the mouth of the Kelantan River at 6°8'N 102°15'E town serves as the state capital of Kelantan. Figure 1 depicts its geographical location in the regional context.

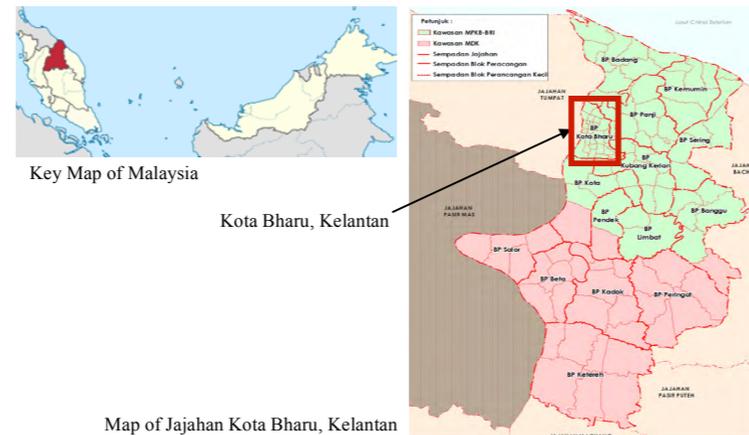
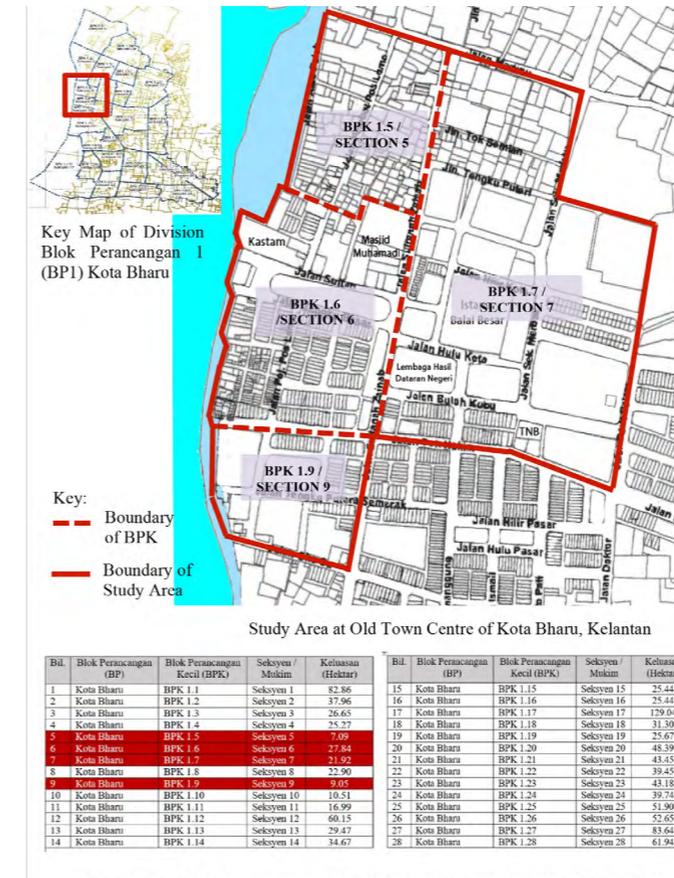


Figure 1 : Location of Kota Bharu, Kelantan from the Regional Context

Concerning the administrative and planning division, the state of Kelantan was divided into nine districts known as Jajahan. The most thriving district is Jajahan Kota Bharu, which is where the town of Kota Bharu is located. To facilitate the planning and management of Jajahan Kota Bharu executed by the local authority of Majlis Perbandaran Kota Bharu (MPKB), this area is parcelled into 15 Planning Block (*Blok Perancangan, BP*). Kota Bharu formed a central focus for Planning Block 1 (BP1), further channeling into 28 Small Planning Block (*Blok Perancangan Kecil, BPK*) and had the most

developed land areas (Rancangan Tempatan Jajahan (RTJ) Kota Bharu 2020). The concentrated area of study at the town Kota Bharu is focused on four designated areas delineated according to the administrative and operational boundaries of BPK boundaries or previously referred as Section (*Seksyen*). Covering a total area of approximately 65.90 hectares, these areas comprised of BPK 1.5/Section 5, BPK 1.6/Section 6, BPK 1.7/Section 7 and BPK 1.9/Section 9. Over the last 174 year, these four areas have been the center of attraction to the early growth of Kota Bharu town since 18th century, established as Old Town Centre of Kota Bharu (*Pusat Bandar Lama Kota Bharu*). Figure 2 delineates the concentrated study area.



Tabulation of land area size in each Blok Perancangan Kecil of Kota Bharu (BP1)
Figure 2: Study Area at Old Town Centre Kota Bharu, Kelantan

4. MAPPING ANALYSIS

4.1 Morphological Phases

Extracting from phenomenological formation and transformation of the historical construction of 'Kota' as a central dominating landmark representing the growth of town or city, significant changes in the spatial structure of the town were observed in a diachronically time series comparison; that is viewing the same area in a different period. Three formative periods between the years of 1816 until 1909 were identified and outlined as morphological phases in accordance with the historical events which had subsequently influenced the spatial structure of the town. The systematic evaluations according to the morphological phases delineated provide an in-depth understanding of the dynamic mechanisms of the formation and transformation of spatial structure that indeed had strongly tied to a multitude of contextual factors including social, economic and cultural influences occurred in that particular period. These three morphological phases described as follow:

- (i) **Phase I: From 1816 until 1844;** a substantial period that marked the changes of location from Istana Kota Galuh in Kampung Sireh (7km from the study area) to the nearer area of the present site in old town Kota Bharu (within the study area boundary). The year of 1816 indicates the sequential establishment of state capital following the tradition of fort construction with the construction of Istana Kebun Mengseta in Pulau Saba by Sultan Muhammad I. The area, however, had vanished entirely due to the recurrent erosions at the riverbank of Sungai Kelantan, resulted to destruction of the surrounding place of Pulau Saba.
- (ii) **Phase II: From 1845 until 1902;** a significant period that witnessed a rebuilding of the new fort and palace, translated as Kota Bharu from the former site of Istana Kebun Mengseta to the present location of Istana Balai Besar circa 1845 by Sultan Muhammad II. As such, the momentous year of 1845 often being associated with the historical

- (iii) **Phase III: From 1903 until 1909;** a transformative period that signifies an early intervention of foreign influence, notably the Siamese and British in Kelantan state administration. The 1903 Treaty and 1909 Anglo-Siamese Treaty, lead to influence the development growth of Kota Bharu with an establishment of various institutions being separated from Istana, thus changing and diversify the inherited spatial composition, characters, and fabric of the town.

4.2 Urban Morphological Zones

On the substantial ground for site inventory and analysis to observe the changes according to the three formative periods identified earlier, the selected four areas of Old Town Kota Bharu (BPK 1.5/Section 5, BPK 1.6/Section 6, BPK 1.7/Section 7 and BPK 1.9/Section 9) were grouped and re-classified to be analyzed according to the Urban Morphological Zones (UMZ). Defined as a set of urban areas laying less than 200m apart, UMZ can be determined from land cover classes which contributing to the urban tissue and its function (EEA, 2014). Indeed, understanding how urban tissue has developed and reconstructing the process of its development based on artefacts and spatial forms deposited in the existing tissues were regarded as the fundamental in urban morphological analysis. The conception of urban tissue is interrelated with land use that being applied within zoning systems of planning and development control. Nevertheless, a clear distinction can be seen concerning objective classification between UMZ and land use zone in which UMZ classifies the area according to form-based rather than use-based zoning. The intensification of such approach can increase the sensitivity of zoning systems to the nuances of a wider range of both specific urban forms and activities on the one hand, and increase the level of control in areas of particular historical or cultural significance on the other (Kropf, 2017).

The areas of UMZ were distinguished and marked based on comparative analysis of archival data gathered through document analysis and delineated its context and definite boundaries through detailed site observation as well as with the assistance of aerial photos and drone image captured during fieldwork. The classification of UMZ was made in accordance with Corine Land Cover guidelines established by the European Environment Agency (EEA) and was tailored according to the research as well as site context. Particularly, four parameters were used to ascertain the zoning that are land-use types, socio-economic function, historical or cultural significance and building period. In certain circumstances, however, where the absence of details information on the particular area is evident, the rules for outlining the UMZ might include other measures that are deemed significant and defined primarily according to the rooted historical and cultural function of the area. Accordingly, five UMZ were identified as illustrated in Figure 3. Detailed description of each zone delineated is as follows:

i) Urban Morphological Zone 1 (UMZ 1): Royal Palace Complex (RPC)

The zone mainly comprised of BPK 1.7/Section 7, which partly included within 'Cultural Heritage Zone' as outlined by *Kajian Pelan Tindakan dan Garis Panduan Rekabentuk Bandar Kota Bharu Bandaraya Islam 2005*. The area accommodates a

significant component of the grand palace and its surrounding ground that are substantial in any formation of Malay States. The Palace (i.e., Istana Balai Besar), mainly positioned at the core centre of town to signify the centralised power of Malay Sultanate and tied strongly to the concept of king fort, fort palace or locally referred to 'Istana Kota'. The features within the palace complex serve multipurpose functions extended to royal administration and royal residences which were surrounded by the fort (Kubu) for defense purpose and approachable through a remarkable gateway as the entrance to the town.

(ii) Urban Morphological Zone 2 (UMZ 2): Institutional Building Area (IBA)

The interconnected zone with RPC which covers the upper part of BPK 1.6/Section 6 and areas adjacent to Istana Balai Besar in BPK 1.7/Section 7. This particular area composed of several institutional buildings that play a pivotal role in the administration of traditional Malay States. Indirectly, these buildings composed the significant setting of Malay town. Such buildings includes: (i) The Mosque (i.e Masjid Muhammadi) in the vicinity of the Istana Balai Besar which symbolizes the centre of Islam as the main religion in influencing the spiritual, intellectual and social development of the Malays (Ossem, 2002); (ii) The Syariah Court, built close to the Masjid Muhammadi holding the authority for the implementation of Shari'a laws; (iii) Land Office (Pejabat Tanah) established to perform as a commission assisting the Sultan in terms of land ownership issues; and (iv) Treasury building (Bilik Perbendaharaan Negeri) as a vault which located within the palace compound to keep the State's currency, financial records and important documents.

(iii) Urban Morphological Zone 3 (UMZ 3): Open Recreational Ground (ORG)

The zone forming an axial line consists of the central area of BPK 1.6/Section 6 extending to the open ground in BPK1.7/Section 7 overlooking the palace of Istana Balai Besar. Served as a recreational ground, this grass-covered area known as Padang (Padang Merdeka) held an important social occasion related to the vast array of royal celebration, parades, stage performance as well as a venue for sports activities. Padang, therefore, provides a vital ground for public gathering either in formal or informal social occasions.

(iv) Urban Morphological Zone 4 (UMZ 4): Traditional Commercial Street (TCS)

The zone located along the shore of Kelantan River at BPK 1.6/Section 6 and BPK 1.9/Section 6 were predominantly focused for trading and commercial activities that were made close to the river as the main transportation routes during the early growth of the town (i.e. at the riverbank along Jalan Pos Ofis Lama and Taman Sekebun Bunga). Such activities along the street of Jalan Pos Ofis Lama contributed to the growth and vitality of Malay estuaries towns during the last decade of 17th until the 19th century (Arbi & Talib, 1986). Strategically located near the jetty (Tambatan DiRaja), this area consists of a marketplace that serves as a hub for trading and exchanging goods carried from suburb and remote hinterland areas to the town.

(v) Urban Morphological Zone 5 (UMZ 5) : Early Malay Village (EMV)

Existed in all four sections of the study area, the settlements of Malay villages were located along the edge of Kelantan River and close to the palace complex. These villages formed a large area of land stretching the from present location of Kampung Atas Paloh downwards to Kampung Gajah Mati (Salleh, 1984). Among the early identified villages that were densely populated were Kampung Kota Sultan (presently an area of Royal Custom Department) and Kampung Masjid (surrounding the Masjid Muhammadi). Apart from that, there were also villages resided by Malay aristocratic and palace officials such as Kampung Kota Bendahara and Kampung Tok Semian. These villages eventually developed into a town ward that influences the increase of urban population in Kota Bharu.

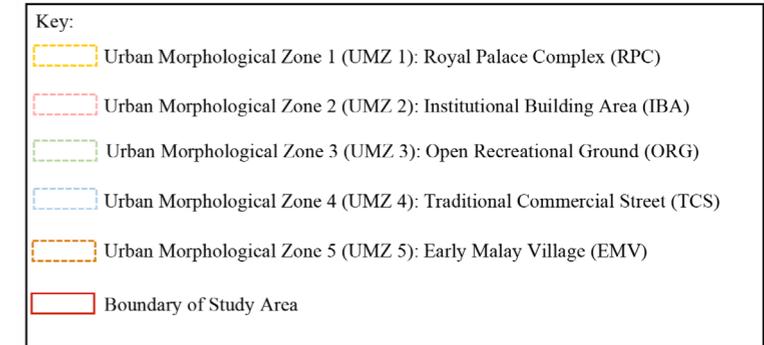


Figure 3: Delineated Urban Morphological Zones (UMZ) of Old Town Centre Kota Bharu, Kelantan

4.3 Morphological Elements

Urban pattern reflected in its spatial composition of urban forms ingrained as a distinctive morphological structure that evolves in time according to the changing needs and choices of society (Kaya & Bolen, 2017). In the context of this research, a close examination on the hierarchical level of the urban block can be used as indices to reveal the structural changes of spatial patterns and characteristics of wider urban level according to the observed period occurred at Old Town Kota Bharu, Kelantan. The position of urban block within the morphological frame of the traditional city's growth represents a key morphological concept (Nikovic et al., 2014). Urban block formed as the

basic unit or segment of urban tissue reflects the characteristics of the town on a smaller scale, which is a logical consequence illustrating the gradual growth formation of the traditional town that is developed according to the organic principles.

Analyzing the diachronic changes in urban block according to the observed morphological phases from 1816-1909, therefore, formed the result and discussion of this research as explained in the next section. The discussion revolves around the two parameters in scrutinizing the changing of urban block that is composition and layout of the physical components in overall depicted UMZ.

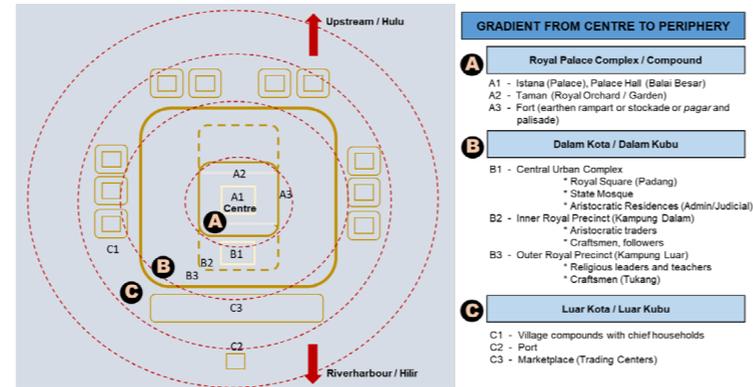
5. RESULTS AND DISCUSSION

The findings obtained from mapping analysis revealed that Old Town Centre of Kota Bharu, Kelantan has gradually developed as one of the significant town with distinct urbanization process experienced at the beginning of second morphological phase (1845-1902). The prevailing process, invariably, were mainly concentrated at the central town of Kota Bharu itself (Khor et al., 2017); which signifies its dominant position encapsulated as ‘involutional character’ (Clarke, 1976). As a dominant Malay town, Kota Bharu were densely populated by the Malays and a few Chinese that were drawn to the broad fertile alluvial plains by the river stretching the northern part of Sungai Kelantan. The strategic geographical location intensified by the reconstruction of ‘kota’ symbolized the state capital and town from Kota Kebun Mengseta to the present location of Kota Bharu, had indeed, accelerate the growth of villages which then formed as an urban agglomeration with markets and public building were built in close proximity to the palace. In a larger context, the manifested of the town’s morphogenetic process can be inferred from the establishment of kota following the traditional Malay state formation.

Thus, it is indispensable to scrutiny the term of kota as an expression to urban connotation from Malay historiographical perspective as expressed by Perret (1999) which initially entails to three meanings: (i) A center focusing on Sultanate administration and royal palace complex; (ii) An area equated with a fortification; and (iii) Town. The description of the process of formation and transformation of state capital (ibu kota) in terms of its physical structure can therefore, generally reflects the spatial composition and layout of the Malay town as whole. Though the observable period starting from 1816, the emergence of the town which depict the functional components of urban centers had indeed been recorded as early as 1777 following the transition of administrative capital from Kota Kubang Labu which is located on the west part of Kelantan River (currently known as Pasir Pekan, Tumpat) to Kota Galuh (presently known as an area of Kampung Sireh and is still referred to as Kampung Kota Lama among the locals). The growth of Kota Galuh with flourished trading activities at the port has been documented in the Chinese account, Hsieh Ching-Kao, who visited and lived in Kelantan from the 1780s to 1790s (Tweedie, 1923). It thus provides an important reference that able to illustrate in general the early spatial structure of the Malay town which can be delineated into two interconnected structure that are Dalam Kota and Luar Kota.

This spatial structure remained preserved after the subsequent shift of the state capital in 1816 to Kota Kebun Mengseta and finally the relocation of the

capital to Kota Bharu in 1845. Figure 4 illustrates the diagrammatic changes of spatial structure at the study area of Old Town Kota Bharu, Kelantan which revealed the evolutionary composition and layout of the town. Meanwhile, Figure 5 demarcates the changes of urban boundary according to the observed period.



Phase 1: 1816 – 1844

A1: Istana Kebun Mengseta
A2: Kebun Mengseta
A3: Pagar (Palisade)

B1: Padang Kebun Mengseta, Masjid Kayu (Sg. Budur Seberang Paloh)
B2: Kg. Kota Sultan,
B3: Kg. Kota Tengku Bendahara

C1: Kg. Sg. Budur, Kg. Cina
C2: Port (Tambatan DiRaja connecting to Pangkalan Penambang)
C3: Surrounding the port

Phase 2: 1845 – 1902

A1: Istana Balai Besar
A2: Palace compound
A3: Pagar (Palisade, Bamboo, Trench)

B1: Padang Kalumpang, Masjid Kota Bharu, Land Office, Bilik Perbendaharaan Negeri (Bank Pitis), Court
B2: Istana Raja Bendahara Long Kundor, Istana Tengku Mariam Tengku Kembang Puteri
B3: Rumah Pemesar Dato' Seri Paduka Raja Nik Yusoff, Kg. Tok Semian, Rumah Pemesar Dato' Menteri Hassan, Kota Tengku Besar Indera Raja, Kota Raja Muda

C1: Kg. Sg. Budur, Kg. Cina Kg. Masjid (part of)
C2: Port (Tambatan DiRaja)
C3: Pasar Besar (riverbank of Sg. Kelantan)

Phase 3: 1903-1909

A1: Istana Balai Besar
A2: Palace compound
A3: Pagar (Palisade, Bamboo, Trench)

B1: Padang Kalumpang, Masjid Kota Bharu, Land Office, Bilik Perbendaharaan Negeri (Bank Pitis), High Court, Lower Court,
B2: Istana Raja Bendahara Long Kundor, Istana Tengku Mariam Tengku Kembang Puteri
B3: Government Secretary Office (Opis Panjang), Malay School, Police Office,

C1: Kg. Sg. Budur, Kg. Cina Kg. Masjid (part of)
C2: Port (Tambatan DiRaja connecting to Pangkalan Penambang)
C3: Pasar Besar (riverbank Sg. Kelantan)

Figure 4: Changes in Composition and Layout of Spatial Structure at Old Town Centre Kota Bharu, Kelantan from 1816-1909 (Adapted and Revised from Tajudeen (2005))

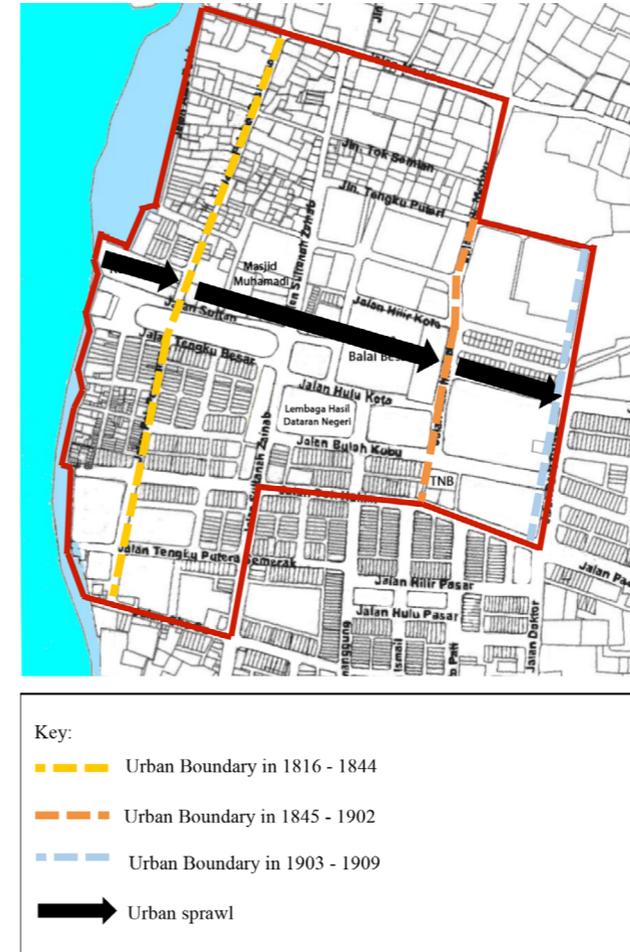


Figure 5: Changes of Urban Boundary in Old Town Centre, Kota Bharu, Kelantan from 1816 – 1909

6. CONCLUSION

This study has uncovered the morphogenetic process of the spatial pattern with regards to its composition and layout in the selected study area of Old Town Centre Kota Bharu, Kelantan. The changing process can be analyzed through systematic mapping analysis established as the framework of this research, which involves three stages, that are: (i) Identification of morphological phases within the observed period from 1816-1909; (ii) Delineation of five UMZ according to the historical and cultural significance, thus, reflected the characters of each area; and (iii) Selection of urban block as indices to represent as key morphological elements. Understanding the morphogenetic process in each town that is individually unique, not only able to depict the structural changes in the formation and transformation process throughout its historical development which is largely qualitative. However, it can be extended to recognize the interrelationship and systemic dimension of urban forms and how it is aggregated into a quantifiable term for town’s formation which is of crucial importance. From this understanding, it is hoped that it can point out some possible directions for further exploration on specifying the ‘pattern language’ of organic form of Malay town towards a comprehensive urban conservation planning.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the Ministry of Higher Education Malaysia (MOHE) in support of this research. This research is funded through the allocation of Research University Grant (GUP) for the research project code GUP 2017-072.

REFERENCES

- Arbi, E. & Talib, R. (1986). *Petempatan serta bandar-bandar awal di Tanah Semenanjung*. Bulletin of Faculty of Built Environment, University Teknologi Malaysia.
- Ariffin, N.F.M. (2007). *Role of cultural landscape in improving the identity of the Kuala Terengganu Town Centre as a Malay Historic Town*. Master Thesis, Universiti Teknologi Malaysia.
- Conzen, M.P. (2013). Substance, method and meaning in urban morphology. *Urban Morphology*, 17, 132-134.
- European Environment Agency, EEA. (2014). Urban Morphological Zones (UMZ) by Corine Land Cover Classes. Retrieved from <https://www.eea.europa.eu/data-and-maps/data/urban-morphological-zones-2006-1#tab-additional-information>

- Evers, H.D. & Korff, R. (2000). *Southeast Asian Urbanism: The Meaning and Power of Social Space*. Singapura: Institute of Southeast Asian Studies.
- Garis Panduan Rekabentuk Bandar Kota Bharu Bandaraya Islam 2005. Majlis Perbandaran Kota Bharu, Kelantan.
- Gullick, J.M. (1989). *Malay Society in the late nineteenth century: The beginnings of change*. London: Oxford University Press.
- Graham, W.A. (1908). *Kelantan: A state of the Malay Peninsula*. Glasgow.
- Harun, S.N. & Jalil, R.A. (2012). *The morphological history of the Malaysian urban form*. International Conference on Humanities, Historical and Social Sciences, 111-116. DOI: 10.7763/IPEDR.
- Harun, S.N. & Jalil, R.A. (2014). The history and characteristics of Malay early towns in Peninsular Malaysia. *Asian Journal of Humanities and Social Studies*, 2 (1), 403-409.
- Kassim, P.S.J., Ibrahim, I., Harun, N.Z. & Kamaruddin, K. (2018). Ecological urbanism in the tropics studies on the sustainable dimensions of Malay Traditional urban centers. *International Journal of Engineering & Technology*, 7 (3.9), 93-99.
- Kaya, H.S. & Bolen, F. (2017). Urban DNA: Morphogenetic analysis of urban pattern. *International Journal of Architecture & Planning*, 5 (1), 10-41.
- Khor, N., Isa, M. & Kaur, M. (2017). *The towns of Malaya: An illustrated urban history of the Peninsula up to 1957*. Kuala Lumpur: Editions Didier Millet
- Kropf, K. (2013). What is Urban Morphology supposed to be about? Specialization and the Growth of a Discipline. *Urban Morphology*, 17 (2), 128-131.
- Kropf, K. (2014). Ambiguity in the definition of urban form. *Urban Morphology*, 18, 41-57.
- Kropf, K. (2017). *The Handbook of Urban Morphology*. John Wiley & Sons Ltd: United Kingdom.
- Miksic, J.N. & Goh, G.Y. (2016). *Ancient Southeast Asia*. Routledge: New York.
- McGee, T.G. (1967). *The Southeast Asian City: A social geography of the primate cities of Southeast Asia*. London: G. Bell & Sons.
- Moudon, A.V. (1994). Getting to know the built landscape: Typomorphology. In K.A. Franck, & L.H. Schneekloth (Eds.), *Ordering Spaces: Types in Architecture and Design* (pp. 289-311). New York: Van Nostrand Reinhold.
- Nikovic, A., Dokic, V., & Maric, I. (2014). Revising the position of a city block within the morphological frame of a traditional city: Contemporary perspectives. *SPATIUM International Review*, 1 (31), 1-6.
- O'Connor, R.A. (1983). *A theory of indigenous Southeast Asian urbanism*. Singapore: Institute of Southeast Asian Studies.
- Oliveria, V. (2016). *An introduction to the study of the physical form of cities*. S.I.: Springer.
- Ossem, D.R., Aziz, Z.A.A. & Idid, S.Z.A. (2010). *The Islamic Malay traditional towns learning through the attributes: Special emphasis on Johor Bharu, Malaysia*. 1st International Conference for Urban & Architecture Heritage in Islamic Countries: Its Role in Cultural & Economic Development, 23-28 May, Saudi Arabia.
- Parret, D. (1999). Konsep Negeri dalam sumber Melayu lama berunsur sejarah dan hukum. In W.H.W. Teh & D. Perret (Eds.), *Di Sekitar Konsep Negeri* (pp. 1-26). Kuala Lumpur: Ecole Francaise D'Extreme-Orient (EFEO).
- Rajoo, S. (1998). The Malay urban tradition. In C.V. Fee. *The Encyclopedia of Malaysia Architecture* (60-61). Kuala Lumpur: Archipelago Press.
- Rancangan Tempatan Jajahan Kota Bharu Bandaraya Islam 2020, Majlis Perbandaran Kota Bharu, Kelantan.
- Salleh, H. (1981). *Bureaucrats, petty-bourgeois and townsmen: Observation on status identification in Kota Bharu*. Monash Paper on Southeast Asia No.8.
- Salleh, N.M.N.M. (1984). Bandar Kota Bharu: Sejarah Pertumbuhan dan Perkembangannya. In N.M.N.M. Salleh, *Warisan Kelantan III*. (87-111). Perbadanan Muzium Negeri Kelantan.
- Samsudin, N.A., Rosley, M.S.F., Shahminan, R.N.R. & Mohamad, S. (2018). *Preserving the characteristics of urban heritage: An insight into the concept of Malaysian Royal Towns*. 6th AMER International Conference on Quality of Life, 10-14 February 2018, Indian Institute of Technology (IIT), Roorkee, India.
- Sandhu, K.S. & Wheatly, P. (1983). From capital to Municipality. In K.S. Sandhu & P. Wheatley (Eds.), *Melaka: The transformation of a Malay Capital c.1400-1980, Vol 2*. (pp. 495-597). Kuala Lumpur.
- Scheer, B.C. (2015). The epistemology of urban morphology. *Urban Morphology*, 19 (2), 117-134.
- Sendut, H. (1962). Pattern of Urbanization in Malaya. *Journal of Tropical Geography*, Vol. 16.
- Shukri, S.M., Wahab, M.H., Amat, R.C., Taib, I. & Rozaly, M.Z.M. (2018). Definition and physical attributes that characterize settings of Malay Royal towns in Malaysia. *International Journal of Engineering & Technology*, 7 (3.9), 55-58.
- Tajudeen, I. (2005). Reading the Traditional City of Maritime Southeast Asia: Reconstructing the 19th Century Port Town at Gelam-Rochor-Kallang, Singapore. *Journal of Southeast Asian Architecture*, Vol 8.
- Talib, S. (1995). History of Kelantan 1890-1940. Monograph No. 21. Kuala Lumpur: The Malaysian Branch of the Royal Asiatic Society (MBRAS).
- Tweedie, M.W.F. (1923). An early Chinese account of Kelantan. *JMBRAS*, 26, 216-219.
- Wheatly, P. (1961). *The Golden Khersonese*. Kuala Lumpur: University Malaya.
- Yeh, Y.T. (2013). Erased place names and nation building: A case study of Singaporean Toponym. (pp. 120-155). 59th Asia Pacific Research Conference.

Yeong Yin Mei¹, Khairul Aidil Azlin Abd Rahman^{1*}, Nor Atiah Ismail¹ and Nangkula Utaberta²

¹Department of Industrial Design, Faculty of Design and Architecture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

²Halal Products Research Institute, Universiti Putra Malaysia, Putra Infoport, 43400 UPM Serdang Selangor, Malaysia

* Corresponding author:
drkhairulazlin@upm.edu.my

ABSTRACT

Traditionally, Chinese philosophy has revealed the principle of building materials as Earth and Wood (土木). The principle applies to various buildings worldwide including the Chinese Taoist temples. The objective of this paper was to examine the interior design and materials applied within the Chinese Taoist temples built during the 19th century in Klang Valley, Malaysia, based on design typology. A qualitative research methodology was employed which involved semi-structured interviews and direct observation of ten selected Chinese Taoist temples (N=10) within Klang Valley. Interviews were recorded and sketches and photographs were compiled. The data were analysed using content analysis. The results showed that over the past century, the buildings had lost their design identity due to a lack of proper maintenance and design guideline. It was also revealed that the Chinese community, despite having many years of experience working in temples, lacks understanding in handling the preservation of the buildings. This has eventually resulted in the dramatic dismissal of the original design character. A benchmark for restoration and conservation of the buildings has to be established for the Chinese community via certain platform to ensure that the “sustainability” of ancient designs within the Chinese Taoist temples is able to propagate to the next generation.

Keywords: : Building Maintenance, Building Materials, Chinese Taoist Temple, Design Typology, Identity, Interior Design, Ornamental

1. INTRODUCTION

Generally, the philosophy of sustainable design identity is to maintain the origin, design and character of the continuity of significant tangible culture to specific buildings (Said, Aksah, & Ismail, 2013). This dynamic design identity narrates “physicalism”, a consistent virtue of the architecture building, which is often in line with the pattern of society and human behaviour as well as a response to community needs (Brahman & Torabi, 2013). In conjunction with this, restoration work is pivotal to conserve each component of a building in order to sustain the original designs and characters and enhance the building lifespan. Chinese Taoist temples are listed as religious buildings by the Jabatan Warisan Negara in Malaysia (Department of Heritage, Malaysia, 2005) as part of the Chinese Architecture established in Malaysia since the 19th century by the Chinese immigrants from the northern and southern China (Kohl, 1978). The accommodation and Chinese Taoist temples in the village were established by a group of Chinese diasporas as a place to pray and to safeguard their lives. Therefore, the temples significantly reflect the cultural traits of the builders during the 19th century.

Klang Valley, an area located in the capital of Malaysia, was listed as one of the regions experiencing a glittering period of trade mining in the 19th century (Hew, 2015). However, previous research has found that the Chinese community was completely clueless about the symbolic meaning of the ornamental art in Chinese Taoist temples established in the 19th century in Klang Valley, Malaysia (Yeong, Rahman, Utaberta, & Ismail, 2016). Notwithstanding, the respondents of this research viewed the respective

symbolic meaning as important to the folks. This indicates that there are failures in sustaining the original design identity and the symbol of the ornamental art from the century-old building in the local community, prohibiting these transcendent Chinese classical features to survive and promulgate in Malaysia. The Chinese community mobilisation in the Klang Valley is regarded responsible in making the design identity sustain successfully for the century-old temple. As such, the preservation works for these transcendental buildings are imperatively needed. This paper investigated the perception and role of the Chinese community in the process of preserving Chinese Taoist temples and assessed the design identity of the buildings built in the 19th century in Klang Valley, Malaysia, specifically in two aspects—the sustainability of the design character and the conditions of the physical buildings.

2. LITERATURE REVIEW

2.1 The Identity and Architecture Design of Taoist Chinese Temple

Extensive literature and archaeology evidence have shown that majority of the incredible design components of Chinese temples and shrines are well established and inherited since ancient China (Williams, 2012), backdated from Zhou Dynasty as an ancestral temple within the palaces (Andersson, 2001). Zhouyuan (周原) Palace, Qishan (岐山县) in the Shaanxi province and Great Shangqing (上清) Palace, Yingta (鹰潭) are both great monuments in compliance of reliable design identity. According to Brahman and Torabi (2013), all architecture buildings consist of the principles of spatial organisation, time organisation, semantic organisation, general design principles, shape and forms, building materials, and relationship with contexts in order to maintain the persistency of the design identity. Conventionally, Chinese Taoist temples possess the unbreakable privilege in sharing the same design identity and character with the royal palace (Gou & Wang, 2010). The original design characters of the physical attributes can be categorised into three sections: lower, middle and upper section (V. F. Chen, 1998) with regard to its authenticity. An iconography of the design character does not merely signify its cultural and religious connotation, it also profoundly features its physical beauty and art symbolism. Architecturally, the lower section is an earth platform constructed with vertical solid timber structure; the middle section of the building is sided with masonry wall in red colour, and the surrounding of the vertical elements, the grand column remains in a round form and in red (Jinpeng, 2009; Andersson, 2001); and the upper section is inclusive of horizontal beam, bracket and Dougong (斗拱) as a support and the ceiling covered with roof tiles, and mythical animals are rested at the roof edge (Lip, 1995) (see Figure 1 and Figure 2). Auxiliary, carpentry and jointly work (Guo, 2000) are elegantly crafted with various auspicious miniature in

the forms of animals, plants, shapes and decorative motifs within the building. The solidarity and persistence of the design identity are undoubtedly the biological culture originated from ancient China.

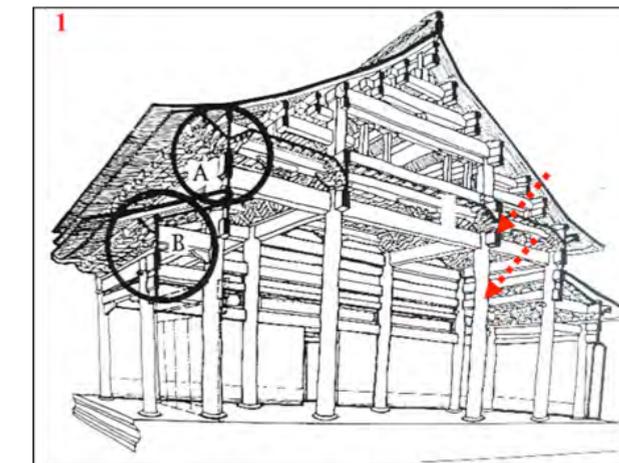


Figure 1: The original design identity of the Taoist Chinese Temple—the vertical and horizontal elements

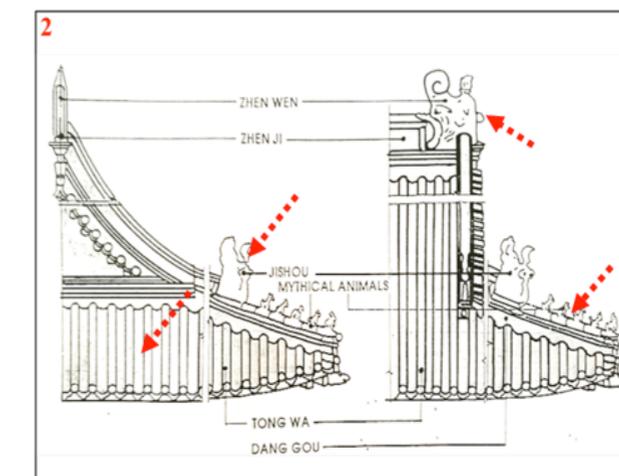


Figure 2: Mythical animal constructed on the upper section. Source (Evelyn, 1995)

These authentic classical features adopted the idea of Yingzao Fashi, formerly known as the oldest technical manual and formation for building construction, meticulously compiled by a reputable architect, Li Jie 李誡 (1035A.D.-1110A.D.) during the Northern Song dynasty (960A.D.-1127A.D.) (Gou & Wang, 2010). He was commissioned by the emperor to document all relevant design process, methodology, and theory with specific dimensions precisely in two and three dimensions as well as graphical representation for construction used. The first print was in the year 1103A.D. His ideas with regard to technical or aesthetic aspects were calculated accurately and scientifically. For example, the mythical animal demonstrates its beauty in a form of allegorical and animism expression whereby the design is associated with functionality of being fire resistant. All theories application were taken into account for the fulfilment of royal palace and Chinese religious building as a permanent identity instead of ephemeral features and in the consideration of sustaining for a minimum of two hundred years (Brahman & Torabi, 2013). Beyond Yingzao Fashi, the theory of building form, “Quadrangle” was another greatest achievement of its universal design. The open courtyard was wisely employed nationwide that included cloisters since the Carolingian dynasty (7th century AD) in the western region (Boto, 2017) due to the building optimal performance (Chen, Feng, & Wang, 1997).

2.2 The Sustainability of the Chinese Taoist Temples: Physical Building

The sustainability of the physical buildings and built environment are often correlated with the sustainability of the community events, orientation, passage of time and their perception (Throsby, 1995; Gür & Heidari, 2019). The achievement of sustainability for century-old temples is beyond beautification. It requires efficient maintenance in order to avoid deterioration and ensure potential prolongation of lifespan (Munarim & Ghisi, 2016) and sustain the original character as a whole to reflect the local authentic value and its design identity. ‘Attap’ and wooden materials were first introduced in Malaysia by the Chinese community to establish the physical building of Xian Shi temple in Kuala Lumpur (1864). However, society transformation has made changes to these building materials. Attap and wooden materials have become the society identity, which is also the reflection of Chinese diaspora, coolies or miners during the 19th century in Malaysia. Nonetheless, they were eliminated because the temple was burnt to the ground between 1872 and 1881. Sir Frank Swettertham was credited for the idea of adoption for permanent and modern materials, i.e. cement or concrete brick wall and roof tiles for buildings in 1884 (Kohl, 1978) which led to an introduction of a new intervention. These materials offered a new appearance of architecture

building, as well as a better building lifespan for Chinese Taoist temples. Also, as the building is a place for prayer, the excessive use of incense and candles is inevitable.

2.3 The Current Society Gap

Despite past research which has highlighted the importance of maintenance and management of heritage buildings (Said et al., 2013; Idrus, Khamidi, & Sodangi, 2010), there was a lack of better methodology in maintaining a religious building i. e. the Chinese Taoist temple. Incense, made up of a wide range of materials including synthetic chemicals, aromatic and essential oils, and resins that potentially releases toxic air particle such as formaldehyde (Zhang, Chen, Li, Yu, & Zhao, 2015), is being used extensively within the interior of the building. This particle is not only harmful to human health, it is also harmful to the building. Therefore, a better methodology is required to preserve the temple in order to enhance its physical durability. Sodangi, Idrus, and Khamidi (2013) hypothesised that poor maintenance and management practice would ultimately result in poor physical condition of buildings.

3. METHODOLOGY

A qualitative case study methodology was employed in this research which included site observation and semi-structured interview. There were two phases involved in the sample selection and data collection in this research. In Phase One, an inventory list of Chinese temples was created, and the process of filtration was executed to select the samples. The only criterion of temple selection was to include Chinese Taoist temples built in the 19th century in Klang Valley, Malaysia. In total, eleven (N=11) Chinese Taoist temples fulfilled the criterion; however, one of the temples was unwilling to participate. Therefore, only ten (N=10) Chinese Taoist temples were included in this research. In Phase Two, consolidation of sketches and photographs were taken which prioritised the physical building and the design typology of ornamental crafted interiorly and exteriorly. The data obtained from site observation were used for the mapping process to determine the original designs and the physical conditions of the Taoist temples. A questionnaire was systematically developed, and semi-structured interviews were conducted among the committee members to discover the general process involved in preserving the temples. Content analysis was adopted to analyse the data obtained from the semi-structured interviews. The process of transcription was conducted sequentially to obtain primary and secondary codes, and finally, themes were introduced. The themes were used to interpret the general

process of preserving the temples. This process was mainly used to ensure the reliability of the results obtained. It also provided a clearer prospect and better understanding on how respondents handled preservation work.

4. RESULTS AND DISCUSSION

Of the total of 10 respondents (N=10), one of them was a shaman, two were secretaries, and seven were chairmen of the temples. All the respondents are committee team members in the temples with an average of 10 years of experience in managing the temples (Refer to Table 1). They are frequently involved in administration as well as various day-to-day activities and events in the temples. Therefore, the responses given by them are reliable and trustworthy.

Referring to Table 1, the findings obtained from the semi-structured interviews of the ten samples (N=10) consist of six variables on the Importance of Chinese Taoist Temple (ICTT1-6): accountability (1), challenges (2), importance of preservation (3), tourism heritage (4), degenerating (5), and contribution (6). After content analysis was done, three themes were created: 1) Lack of fund, 2) Limited knowledge, and 3) Shortage of craftsman for preserving and maintaining the temples. The findings were then categorised into two aspects: sustainability of the “design character” not found and the sustainability of the “physical building” that remained in poor condition. Both were affected due to the societal gap and lack of technical knowledge for preserving the temple.

Table 1: The Finding from the semi structure interview. Source* Author 2019

ICTT1 - Accountability		ICTT4 - Tourism Heritage	
Management work	- Tangible culture	Agreed	- Strong historical value - Devotee believe - Strong contribution
	- Intangible culture	No idea	- Little contribution - No distinctive features - Less tourist
ICTT2 - Challenges		ICTT5 - Degenerating	
Temple preservation	- Lifespan prolongation	Acknowledge the trend	- Aim to propagate
Insufficient	- Expert/Craftsman - Fund - Knowledge	No idea	-
ICTT3 - Importance of Preservation		ICTT6 - Contribution	
Agreed	- Promoting art culture - Historical value - No publicity	Acknowledge the trend	- Putting an effort - No knowledge

4.1 Shortage of Fund, Knowledge and Skilful Craftsman

The results of the content analysis revealed that the respondents had limited knowledge towards the symbolic meaning of the ornaments built in Chinese Taoist temples. Design identity is a sensation. It gained value through a process from the past history of civilization in one place. It may vary, possibly permanent or reducible due to the interconnection and civilization from the attachment place that has changed over time (Aly, 2011). Obviously, the Chinese community has made the design identity “reducible”, ultimately degenerating.

Overall, the physical building and ornament required a skilful craftsman to serve the maintenance purpose and to enhance the durability of the building. The respondents highlighted that the ornament and furniture in Chinese Taoist temples are often made of wood and porcelain in huge quantity with distinctive profile. Unfortunately, there is no skilful craftsman available in the local market. There seems to be a shortage of skilful craftsmen in the furniture industry prevalent in Malaysia (Osman, Rahman, Rahman, & Ja’afar, 2018). The variance of societal structure over the past decade has caused the community to lose its interest towards contributing efforts in the wood-based furniture (Hamid, Rahman, & Ismail, 2018), particularly in the miniature ornament in Chinese Taoist temples. Data obtained from the observation indicated that amongst the ten temples built regardless of the northern, central or southern of Selangor, the identity of the design all remained within the character of the folk tradition instead of according to the theory of Yingzao Fashi (Figure 1 and Figure 2), a classical design for the Chinese Taoist Temple.

4.2 Design Characters of Chinese Taoist Temples

Results obtained from the respondents have revealed that no particular “preservation process” has been conducted within the samples over the past century. Only general renovation would be carried out if needed or allowed financially. From the samples, it can be clearly seen through the various typical design identities and authentic artwork skilfully produced for the temples, inclusive of interior, ceiling and roof components in bearing the Chinese and nation-specific idiosyncrasy, were found dismissed in the Chinese Taoist temple. The Xian Shi Temple (仙師爺) in Semenyih is questionable. A classical design identity, a pair of wooden swing door with a figure of door god, was dismissed and replaced with a modern element, an aluminium sliding door (Figure 3: Image 1). Door god was intentionally attached to the front door to safeguard the space users and devotees of the building. However, this general design principal was not found.



Figure 3: Design character- without the classical design identity and replace with modern materials. Image 1&2: Xian Shi Temple in Semenyih, Image 3: Nam Tian Gong in Ulu Yam, Image 4: Xian Shi Temple in Sungai Tekali. Source* Author 2018

In Figure 3: Image 2, no quadrangle or courtyard was built within the temple. The structure was replaced with the modern architecture—sliding and louvre windows instead of embodied with classical design identity. The modern features aimed to serve the purposes of maximising the natural sunlight and allowing quality air for better circulation. Nevertheless, the opening from the courtyard in serving the same purpose as a window is supposed to be associated with the water outlet constructed on the floor to achieve effective pollutant clearance (Chen et al., 1997). Despite the natural sunlight and air which are able to penetrate the interior via louvre and sliding window, there is a dissimilitude character between “open courtyard” and “louvre window”. Additionally, no water outlet built within the parameter of the floor was found; therefore, it can be concluded that the new alterations of the temple did not achieve Chen’s theory considerably. Kohl (1978) stated that the courtyard model was introduced solely in Penang and Singapore in 1869 until early 1900s by a “wealthy Chinese community”. As for the ten samples who were established by the Chinese diaspora, they were coolies or miners and did not belong to the group of “wealthy Chinese community”. They did not have the financial ability and luxurious materials in constructing the said model. In addition, a supposition for the absence of this model is possibly due to the unaffordability of land supply or local geography issues as open courtyard

requires huge land to construct the temples. However, this parameter is far beyond the study.

Research has shown that ornaments and design character applied within the temple portray historical value or Chinese cultural (Chen, 1998); (Kohl, 1978). In Figure 3: Image 3 of the Nan Tian temple (南天宮), the wooden Dougong (斗拱), usually crafted splendidly on the vertical and cantilever beam, was dismissed and has lost the general design principal. The ceiling was replaced with bare plaster ceiling instead of the classical Chinese design as recorded in Yignzao Fashi, a wooden material with cantilevered Dougong. According to the respondents, they lacked funding and had limited knowledge and expertise to preserve the temples and sustain their “classical” features with the authentic design identity. These samples were established during the 19th century by the Chinese immigrants from Northern and Southern China with their background as farmers (Amos, 1969). They intentionally left their homeland to work as mining workers or coolies with the aim to earn better income in Malaysia (Hew, 2015). This is undoubtedly the diaspora that possesses limited knowledge of design identity of Chinese Taoist temple. Farida (2014) stated the community or one-man knowledge reflects the social identity. Therefore, this is unavoidable as the samples established by the group of diaspora or peasant, prominently reflect the society’s image in “folk tradition” concept, and unlikely in the upper class or royal character.

4.2.1 The Transformation Within the Chinese Community

Kuala Lumpur and Selangor are located in Klang Valley, which is the central region of Malaysia. It is one of the highly populated regions for mining trade in the 19th century and has gone through a state transformation (Kohl, 1978) in the past century. Many small villages in these districts were established by the Chinese diaspora and coolies during the glittering period of mining trade (Hew, 2015). The increasing population in small villages has gradually transformed the place into a city credited to the country’s economic growth. It ultimately formed another urban settlement rapidly and created a new profile of the modern community. This process of transition and time interval brought new creation to the architecture identity. The advancement of the technology over the past decade was a key role in the process of society transformation. The flexibility of internet and online service formed a new living peculiar, giving more convenient to the local community. Aly (2011) mentioned that the implementation of technology is a sign of “artificial environment” and is part of the components for urban identity. In this scenario, respondents had taken the advantage of online services to purchase the needed ornaments or replacement for the temples as part of the “preservation process”. The committee prioritised the aim for purchasing beautiful ornaments based on

individual preferences within the financial budget through online services without considering the original character. Obviously, this execution was not appropriate for preserving the temples. During the inappropriate preservation process for temples over the past century, the loss of the design identity for the samples were unnoticed by the committee members as they had no ability to justify the right preservation method. Thus, the design identity of the temples remained unclear, ultimately forced to be accepted by the generation with the current perceived outcome.

4.2.2 The Ignorance of the Design Identity

As mentioned by Lip (1995), the ornaments on the roof signify the temple’s reputation and ranking. In Figure 3: image 4, the facade of Xian Shi temple (仙師爺) in Sungai Tekali was constructed with no design identity within the roof, column and façade and not even the mythical animals (see Figure 2). This phenomenon suggested that there is an ignorance of design identity of the Chinese Taoist temple within the community, which has not solely lost the design principal, but also the form and shape for this century-old religious building due to a lack of significant cultural sense in the design and building environment. Eventually, the “semantic organisation” was lost; the evocation of the religious sense was not retrievable within the physical building. Semantic organisation emphasises the feeling and perception to specific object with the value (Brahman & Torabi, 2013). The temple appeared as a residential building rather than a religious building, indicating that the Chinese community seems to show less appreciation towards the design identity of the temple. In addition, the respondents claimed they were experiencing a tough period without committee members to manage the temple over the past few years. This had negatively resulted in the deterioration of the physical condition of the building. As mentioned by Sodangi (Sodangi, Khamidi, & Idrus, 2013), the objective of the preservation was to ensure the continuity of cultural significance for the benefits of the next generation. It can be argued that the overall phenomenon reflected that preservation was not prominently practised by the Chinese community, and it was conducted based on individual preferences. Therefore, the classical design identity is not highly reliable and unable to promulgate the future.

4.3 The Sustainability of Physical Building

Maintenance is pivotal for the “sustainability” of the physical buildings (Sodangi, Khamdi, Idrus, Hammad, & Ahmedumar, 2014); (Sodangi, Idrus, et al., 2013); and (Said et al., 2013). Building material was one of the factors affecting the physical building and its design identity (Brahman & Torabi, 2013). The observation made on three of the samples shown in Figure 3

demonstrated: 1.) Inconsistent use of modern materials such as aluminium sliding door, louvre glass window, and ceramic wall tiles, plaster ceiling, were among the said materials used for the commercial and residential building instead of the benchmark for Chinese Taoist temple, and 2.) Poor maintenance of physical building without appropriate preservation occurred due to limited knowledge.

The samples shown indicated that the architectural features were built according to the folk preferences from the perspective of materials selection which caused the loss of persistency in design identity. According to the respondents, they had insufficient knowledge in preserving the permanent materials and finish for both the exterior and interior, and that was their greatest challenge. Figure 4, image 1, (Fu Ling Gong, 福) shows the ceiling that was replaced with wood panelling, and the selection of material that was done according to the folk preferences such as material availability in the market in Klang Valley and financial affordability. Figure 4, image 2, shows the broken cantilever beam and Dougong (斗拱), the century-old structure which was eventually placed in the “Display Gallery” due to lack of skilful craftsmen available for restoration work and the relatively high cost of restoring these transcendent components.



Figure 4: Building Structure-maintenance from the temples. Images 1&2, Fu Ling Gong (福灵宮), Image 3, Long Bang Temple (龙邦古庙), Image 4, Xian Shi Temple (仙師) in Semenyih. (Source: Author, 2018)

Image 3 in Figure 4 of Long Bang Temple (龙邦古庙) demonstrates the failure of maintaining the masonry wall in the century-old building. The lack of restoration work has caused the cements to crack and ultimately resulted in poor physical wall. This was impacted mainly by the excessive incense burning which disseminated harmful particles within the temple over the past century. The committee was left with no option and forced to lay ceramic tiles for easy maintenance despite their awareness of a lack of proximity between selections of material and its design identity. Similarly, in Figure 4, image 4 of Xian Shi Temple (仙师爷) in Semenyih, a mark of water leakage can be seen clearly on the plaster ceiling. This could be due to inappropriate application of material whereby the material selected was financially affordable, suit the design trend and was available in the market in Klang Valley. Needless to say, this material is not practical for outdoor use.

5. CONCLUSION

This research has yielded several constructive findings from the site observation and interview sessions carried out. It was discovered that the Chinese Taoist temples in the Klang Valley have lost their design identity and that the physical condition of the buildings remain to be in poor quality. In addition, none of the interviewees was aware of the categorisation of lower, middle and upper sections attributed to the buildings. Design identity, according to Brahman and Torabi (2013), is an inheritance, a connection with the past, immerses with distinctive features to engage with the audience. It was found that over the past decade, the physical changes of these samples have undergone extensive changes with regard to the design identity. In addition, the results obtained from content analysis have revealed that the entire preservation process was conducted without appropriate methodology and sufficient technical knowledge. This indicates that the committee members of the temples might not be the right persons to execute preservation work. Appropriate training should be provided to the respondents by relevant authority with immediate effect.

Brahman and Torabi (2013) stated that architecture components are regarded as part of the identity of a community. As such, in shaping the design identity of these temples, it has to relate to the people, place and social identity. The samples in this research serve to be a memory, a recognition and an evocative of “art production” inherited from the epochs of Malaya settlement during the 19th century bestowed to the Chinese community. Technically, the architecture and built environment of several samples still portray the image of a “religious building”. Nevertheless, it is less rhetoric due to inconsistencies and lack of reliability of the oriented-design identity of the samples. The rediscovery of Yingzao Fashi in 1919, 20th century in NanJing Jiang-Nan

library (Glahn, 1975), suggested that Chinese classical buildings constructed in the 19th century or prior to 1919, were built without making references to original design and construction, both in China and Malaysia. Therefore, it is understood that the samples from Klang Valley, Malaysia, established in the 19th century by the Chinese diaspora, were without much authentic design identity and character. The drastic loss of these unique classical features from the samples could be significantly related to the sudden dismissal of YingZao Fashi. However, further research is required to verify this supposition. The findings of this research supported the hypothesis that a lack of proper maintenance of the building has resulted in poor physical condition (Sodangi, Idrus, et al., 2013). Therefore, immediate treatment should be given to the ten samples (N=10) in order to sustain the design identity and the physical of the buildings.

Researchers asserted that the theory of indigenous knowledge (IK), emphasising the understanding of fundamental in local art, is a core practice in the discipline of art (Shaari, Aidil, & Abd, 2017). The idea of IK application could benefit the committee members of the Chinese Taoist temples. With this theory or technical knowledge, it enables the Chinese community to carry out a better preservation work. Therefore, all Chinese Taoist temples built in the 19th century should be imperatively taken over by the heritage stakeholders or relevant authorities. It is suggested that firstly, short courses be conducted to ensure the committee members are properly equipped with the fundamentals of IK theory or technical knowledge for preservation work. Secondly, it is compulsory for the samples in this research to be taken over by Jabatan Warisan Negara, Malaysia, placed under the law protection of Uniform Building by Law (UBBL Malaysia), and audited yearly by the authority. It is strongly believed that proper preservation is able to enhance the lifespan of the century-old buildings and sustain the design identity for future betterment.

ACKNOWLEDGEMENTS

The author would like to express her gratitude to Universiti Putra Malaysia for the IPS grant (GP-IPS/2018/961 7900) and her special thanks to Mr. Tan Huan Ping and Mr. Lee, committee of Chinese Taoist Temples, for giving their full support.

REFERENCES

Aly, S. S. A. (2011). Modernization and regionalism: Approaches for sustainable revival of local urban identity. *Procedia Engineering*, 21,

503–512.

Amos, R. (1969). *House Form and Culture*. Englewood Cliffs (NJ).

Andersson, J. G. (2001). Archaeology in China. In *The Antiquaries Journal* (Vol. Acta Archa, pp. 55–90). <https://doi.org/10.1017/S0003581500091071>

Boto Varela, G. (2017). Building Monastic Cloisters in the Iberian Peninsula (8 th -11 th centuries): Regular Layouts and Functional Organization. *Hortus Artium Medievalium*, 23(1), 222–239. <https://doi.org/10.1484/J.HAM.5.113716>

Brahman, Z. Torabi, S. (2013). Effective factors in shaping the identity of architecture. *Middle East Journal of Scientific Research*, 15(1), 106–113. <https://doi.org/10.5829/idosi.mejsr.2013.15.1.2357>

Chen, Q., Feng, Y., & Wang, G. (1997). Healthy Buildings Have Existed in China Since Ancient Times. *Indoor and Built Environment*, 6(3), 179–187. <https://doi.org/10.1177/1420326X9700600309>

Chen, V. F. (1998). *The Encyclopedia of Malaysia: Architecture*. Archipelago Press.

Department of Heritage, Malaysia. (2005). Retrieved from <http://www.heritage.gov.my/ms/>

Farida, A. (2014). Reconstructing social identity for sustainable future of Lumpur Lapindo victims. *Procedia Environmental Sciences*, 20, 468–476.

Glahn, E. (1975). *On the Transmission of the Ying-Tsao Fa-Shih*. Toung Pao (Vol. 61). <https://doi.org/10.1163/156853275X00062>

Gou, A., & Wang, J. (2010). The development of roof color in ancient China. *Color Research and Application*, 35(4), 246–266. <https://doi.org/10.1002/col.20564>

Guo, Q. (2000). Tile and Brick Making in China: a Study of the Yingzao Fashi. *Construction History*, 16, 3–11.

Gür, E. A., & Heidari, N. (2019). Challenge of identity in the urban transformation process: The case of Celiktepe, Istanbul. *A/Z : ITU Journal of Faculty of Architecture*, 16(1), 127–144. <https://doi.org/10.5505/itujfa.2019.47123>

Hamid, A. G. A., Rahman, K. A. A. A., & Ismail, S. (2018). The Factor of Industrial Development Problems on Bamboo Furniture Designs in Malaysia: A Concept Paper. *Global Business and Management Research*, 10(3), 881.

Hew See Tong. (2015). *The glittering history of gravel pump mining industry*. Kinta TinMining(Grvel Pump) Museum.

Idrus, A., Khamidi, F., & Sodangi, M. (2010). Maintenance management framework for conservation of heritage buildings in Malaysia. *Modern Applied Science*, 4(11), 66–77. <https://doi.org/10.1109/NatPC.2011.6136372>

Jinpeng, D. (2009). A Typological Study of the Palace Buildings at Zhouyuan and Related Issues, 100710, 164–171.

Kohl, D. G. (1978). *Chinese architecture in the Straits Settlements and Western Malaya*. PhD Proposal. <https://doi.org/10.1017/CBO9781107415324.004>

Lip, E. (1995). *Feng shui: Environments of power: A study of Chinese architecture*. John Wiley & Son Ltd.

Munarim, U., & Ghisi, E. (2016). Environmental feasibility of heritage buildings rehabilitation. *Renewable and Sustainable Energy Reviews*, 58, 235–249. <https://doi.org/10.1016/j.rser.2015.12.334>

Osman, N. S., Rahman, K. A. A. A., Rahman, A. R. A., & Ja'afar, M. F. Z. (2018). The Effect of Design Capability Characteristic on Design Performance for Bumiputera Furniture Companies. *International Journal of Business and Management*, 2(3), 30–35. <https://doi.org/10.26666/rmp.ijbm.2018.3.5>

Said, S. Y., Aksah, H., & Ismail, E. D. (2013). Heritage Conservation and Regeneration of Historic Areas in Malaysia. *Procedia - Social and Behavioral Sciences*, 105, 418–428. <https://doi.org/10.1016/j.sbspro.2013.11.044>

Shaari, N., Aidil, K., & Abd, A. (2017). SOCIAL SCIENCES & HUMANITIES Sustaining Batik Craft Design in Malaysia using Indigenous Creative Knowledge, 25, 81–88.

Sodangi, M., Idrus, A., & Khamidi, M. F. (2013). Maintenance Management Challenges For Heritage Buildings Used As Royal Museums in Malaysia, 1(1), 54–61.

Sodangi, M., Khamdi, M. F., Idrus, A., Hammad, D. B., & Ahmedumar, A. (2014). Best practice criteria for sustainable maintenance management of heritage buildings in Malaysia. *Procedia Engineering*, 77, 11–19. <https://doi.org/10.1016/j.proeng.2014.07.017>

Sodangi, M., Khamidi, M. F., & Idrus, A. (2013). Towards Sustainable Heritage Building Conservation in Malaysia. *Sciences & Environmental Sustainability*, 1(1), 54–61.

Throsby, D. (1995). Culture, economics and sustainability. *Journal of Cultural Economics*, 19(3), 199–206.

Williams, C. A. S. (2012). *Chinese Symbolism and Art Motifs* (Four).

Yeong, Y. M., Rahman, K. A. A., Utaberta, N., & Ismail, N. A. (2016). The Assessment of Young Generation Understanding and Awareness toward Artistic Ornamental of Taoist Chinese temple from 1800-1900AD in Klang Valley, Malaysia.

Zhang, J., Chen, W., Li, J., Yu, S., & Zhao, W. (2015). VOCs and Particulate Pollution due to Incense Burning in Temples, China. *Procedia Engineering*, 121, 992–1000. <https://doi.org/http://dx.doi.org/10.1016/j.proeng.2015.09.067>

THE FRACTALITY OF A GARDEN CITY: A COMPARISON OF THE RELATIONSHIP OF ROAD NETWORK AND GREEN SPACES IN SINGAPORE AND QUEZON CITY, PHILIPPINES

Cindy P. Porneelos^{1*} and Nappy L. Navarra, D.Eng.¹

¹College of Architecture, E. Delos Santos Street, University of the Philippines, Diliman, Quezon City

* Corresponding author:
cpporneelos@up.edu.ph

ABSTRACT

This study is a comparison between a model garden city and an aspiring garden city in terms of the relationship between the spatial pattern and distribution of the road network and the structural characteristic of the surrounding green spaces using fractal analysis. ArcGIS was utilized to determine the fractal dimension of the road network and green spaces of Singapore and Quezon City. The box-counting method of measuring fractal dimension (FD) was employed to define the degree of irregularity and heterogeneity of green space fragments and road network. With the aid of correlation and covariance analyses, the research identifies the degree of relationship between the two variables in the two study areas. Results show that the FD of patches in Singapore is higher than its road network compared to the patches in Quezon City which has lower FD than its road network. But a stronger relationship between the two variables was seen in Quezon City which may suggest that the road network in Quezon City has more influence on the fractality of its patches. The obtained values, however, were not conclusive enough to determine the fractal attributes of a garden city's road network and ecological patches. Differentiating the fractal attributes of the variables in the two study areas may gather more substantial fractal description through continued research using a more refined scale, other methods of measuring FD and involvement of other factors such as landcover and characteristics of roads.

Keywords: : ecological patches, fractal dimension, garden city, green spaces, urban roads

1. INTRODUCTION

Alongside urbanization, cities are being defined by roads and due to its impact on the economy of an area, more roads are continually being built. No matter what the purpose, roads, road establishment, road maintenance, and road travel have a broad variety of effects on ecological condition and functioning at different scales (Committee on Ecological Impacts of Road Density, 2005). Despite the increasing scientific evidence pertaining to the ecological damages of roads, the governments around the world have failed to address such impacts into their policy frameworks. In the Asian tropical southeast, there has been low protection coverage in roadless areas with high ecological value index (Ibisch et al, 2016). The effect of roads is far more pervasive than what was perceived and include disparate consequences such as population and habitat fragmentation, soil erosion acceleration, compromised forest regeneration, forest habitat loss and increased invasion of exotic plants along roadways (Angelstam et al, 2017; Chen et al, 2019; Rowland et al, 2005). Roads affect wildlife and habitat by being a major contributor to habitat fragmentation. They alter large landscapes by dividing them into smaller patches and converting interior habitat into edge habitat (Noss & Cooperrider, 1994). Habitat fragmentation has numerous ways of being quantified. In addition to the rate of reduction of total habitat area and increase in the number of fragments, the measurement of the extent of isolation of habitats, area of edge, shape of fragments and degree of heterogeneity have been included. A number of literature verified that roads greatly facilitate habitat fragmentation than forest clear-cuts do, not to mention other direct impacts on biota (Spellerberg & Morrison, 1998). The permeability of roads may hinder the connectivity of ecological habitats depending on the structure of roads, structure of the landscape and characteristics of species (Assis et al, 2019). Such studies show a correlation between road network and landscape structure. In a study by Eker & Coban (2010), potential impacts of road network on the spatial structure of forest compartments were demonstrated through their shape index using fractal dimension.

In this study, both the road network and the surrounding patches would be analyzed using fractal geometry and would be later on correlated on how they influence one another with respect to their spatial characteristics. In fractal theory, the geometry of patches generated by a similar landscape transformation process should be statistically similar (Imer & Bogaert, 2004). The building of roads is the inducer of landscape transformation in this context and it is hypothesized that it has a significant geometrical impact on the surrounding patches. The distribution of patches in the study area did not occur by chance and is at least a product of road development and road impacts.

Fractal dimension measures the complexity and how an object fills the space in which it is located. It is a set with dimension strictly greater than its topological dimension (Mandelbrot, 1983). Compared to topological dimension, fractal dimension has a non-integer value because it is more sensitive to shape variation and calculates the coverage of the object's edges and curves in a finer scale. The topological dimension of a set is always an integer. It is zero (0) if the points are totally disconnected, one (1) if each point has arbitrarily small neighborhoods with boundary of dimension zero (0) (Falconer, 1990). The fractal dimension of a series of points in a line is between zero (0) and one (1) because the space it occupies is greater than that of a single point but occupies less than a line. In the same way, a wavy line's fractal dimension is between one (1) and two (2) since it covers more space than a straight line but does not cover more than a plane could. Same goes with a rough surface with a fractal dimension more than two (2) but less than three (3) since it is not a solid cube (Sreelekha, et.al, 2017). However, in this study, ecological patches and road networks does not have similar topological properties because of their shape. But it has been analyzed that despite of this difference, the spatial distribution of built-up spaces and road networks can still be compared through the use of fractal correlation analysis (Thomas & Frankhauser, 2013). Hence, similar to built-up spaces, which are topologically two-dimensional, green spaces or the ecological patches, may also be correlated to the spatial distribution of road networks. Furthermore, in characterizing road network, its network density showed the highest correlation to fractal dimension in a study by Sreelekha, et.al, (2017) indicating that fractal dimension reflects the spatial pattern of the transport network filling up a specified area.

Following Singapore's Garden City Strategy Through the Relationship of their Road Network and Green Spaces

Despite being highly urbanized, Singapore holds the title of being a garden city and in fact, is transitioning to become a city in a garden. In 2012, there are 9,081 lane-km of roads in Singapore, which is 12 percent of its total land area according to Singapore's Ministry of Transport. As of 2016, it has a land area of 719.7 square kilometers. Their green spaces occupy 45.59 percent of the total land area, with 1034 number of patches or is equivalent to 328, 107, 540 square meters.

In the Philippines, Garden City was the concept in both the 1941 Frost Plan and the 1949 Masterplan of Quezon City. Quezon City has a total land area of 161.12 square kilometers. Its 273 patches or green spaces occupy 29.74 percent or 47, 916, 678 square meters. As of 2009, the city's total road length is 2,247.75 kilometers and constructions of more minor roads and transformation of minor to major roads are currently on-going. With further establishment of roads to meet the growing demands in Quezon City, the protection and conservation of the existing ecological patches will be at stake and may even be taken for granted. Also located in the tropical region in Asia, Singapore on this matter, is able to maintain and even improve their status as a Garden City despite the density of their road network. In this research, the relationship between the spatial pattern and distribution of the road networks and the structural characteristic of patches in the two study areas will be analyzed through their fractal geometry. The resulting fractal attributes of Singapore will serve as a basis for planning and policy guide for Quezon City in its endeavor to become a Garden City. This research aims to answer the following questions:

How does the relationship between the spatial pattern and distribution of the road networks and the structural characteristic of ecological patches differ between Singapore and Quezon City?

How does the fractality of the road network and the fractality of the patches relate to each other in the two study areas?

Can a garden city be described in terms of the relationship of the fractal geometry of its road network and surrounding patches? What are the attributes?

2. MATERIAL AND METHODS

The relationship of the spatial pattern and distribution of road network and the structural characteristic of the green spaces were analyzed in Singapore and Quezon City, Philippines. The differences were identified in order to obtain distinct attributes of a garden city in terms of the fractality of its two main features being studied, the road network and the green spaces network. This was attained through the data processing methods as shown in figure 1.

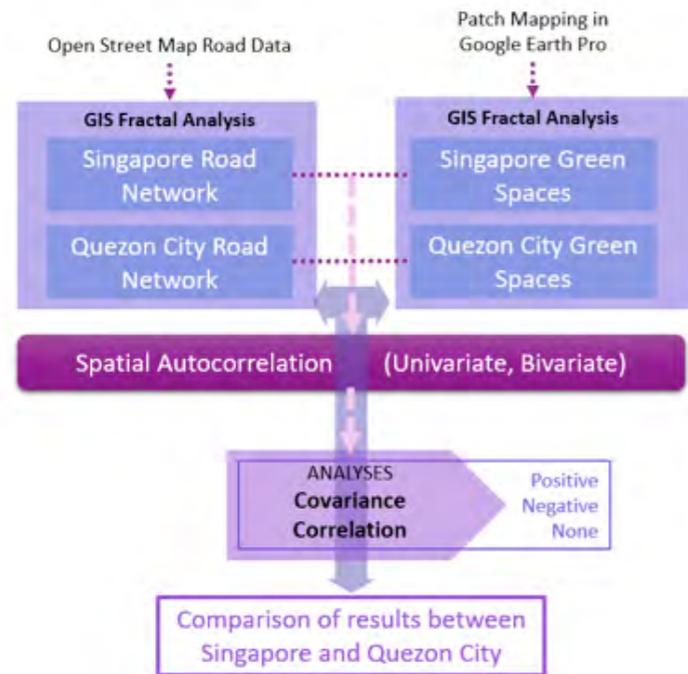


Figure 1: Research Design

To obtain the data of the existing patches in Singapore and Quezon City, Google Earth Pro was utilized for its accessibility and up-to-date satellite imagery. Commercial high-resolution maps are available at high cost and do not provide datasets for small cities like Quezon City. Data from the two study areas must originate from the same production to lessen conflicts during comparative analyses. Hence, the vector data of the patches were manually produced using Google Earth Pro. A viewing scale at eye altitude 2.50 to 2.70

km was maintained while using the polygon tool to delineate the boundaries of the patches. This is to aid in setting limit to the visible physical features and size of the patches to be included. Only green areas with a minimum size of 0.5 hectare or 5000 square metre were included. Concurrently, the network of roads in both study areas were derived from OpenStreetMap Database. The polygonised patches and road networks were digitized in ArcGIS software.

There are several methods of calculating the fractal dimension of different features. One of the most popular algorithm for computing FD in one dimensional and two dimensional data is the box-covering method (Annadhasan, 2012). In the study by S. Deng, et.al (2015), two methods for computing FD was used and revealed that box covering method gives better scaling relation for small network systems. Thus, in this study box-covering method was employed since road network, similar with metro systems, has small features and fitting difficulties while calculating the coverage will not be a problem.

Seven box sizes were used in the measurement – 1000 m, 500 m, 250 m, 125 m, 62.5 m, 31.25 m, and 15.625 m boxes. The FD of the road networks and sets of patches from the two study areas were arranged in a Scatterplot graph to investigate the linear relationship between the two variables (road network FD and patches FD) within the two study areas. The box fractal dimension was obtained through calculating the slope of this double logarithmic plot of grid size and box count.

Given the FD results, the two variables in each of the study areas were individually subjected to spatial autocorrelation using Moran Index to determine how spatially related are its parts to its network before these two variables were correlated to each other. Another round of spatial correlation was done between the road network and the patches in each of the study area. This time, it was to reveal the spatial relationship of the two variables being examined. These results were further analyzed using Covariance and Correlation matrices. Covariance was used to identify the direction of the relationship, whereas Correlation was also applied to assess both the strength and the direction of the relationship.

3. RESULTS AND DISCUSSION

The results of the spatial autocorrelation of each of the variable in the two study areas showed a very low positive Moran index, suggesting that some high FD values cluster near low FD values although most of the high FD values cluster near other high FD values and the low FD values are near other low FD values (refer to figures 2 to 5). Only the patches in Quezon City has

a p-value of 0.09 (above 0.05 which is the cut-off value to reject the null hypothesis) which suggests that there is a small possibility that the spatial processes of the observed pattern of FD values is random chance (see Figure 2). These also show that the patches or green spaces in Singapore, having less than 5 percent likelihood of being randomly clustered (see Figure 4) compared to the green spaces in Quezon City, are more connected in terms of their morphology in their urban environment.

In figures 6 & 7, when the two variables were spatially correlated in each of the study area, both resulted to a positive Moran index and statistically significant p-values. This suggests that when it comes to fractal properties, the patches and roads with the same or near FD values cluster or are more spatially related. This result do not reveal any significant difference in the relationship of the two variables in the two study areas.

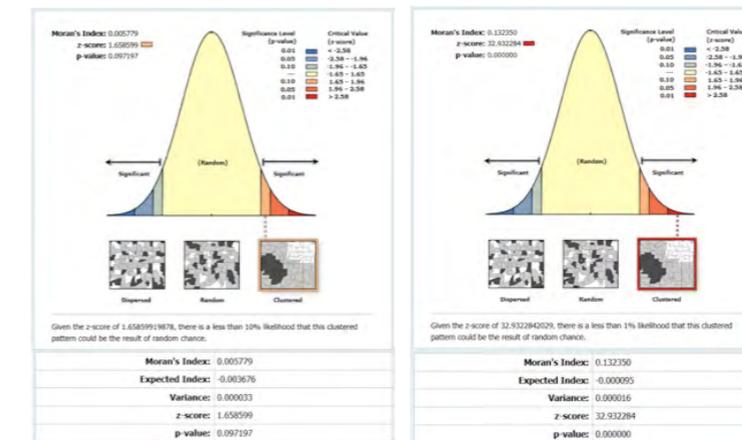


Figure 2 : Spatial autocorrelation of patches in Quezon City

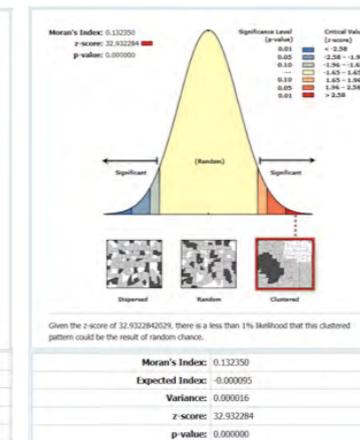


Figure 3 : Spatial autocorrelation of roads in Quezon City

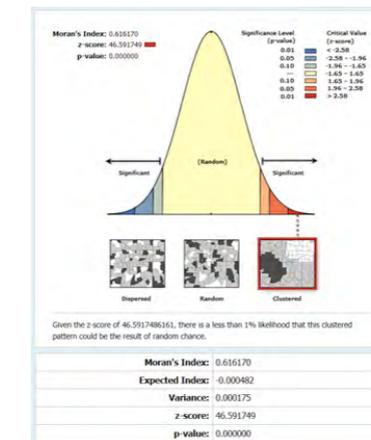


Figure 6 : Spatial correlation of roads and patches of Quezon City

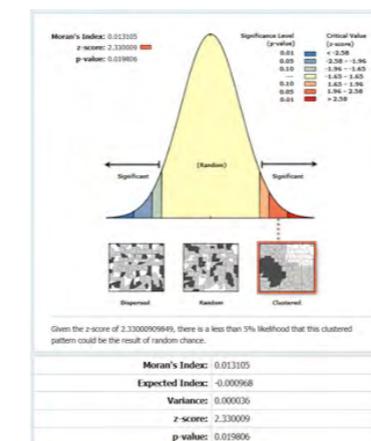


Figure 4 : Spatial autocorrelation of patches in Singapore

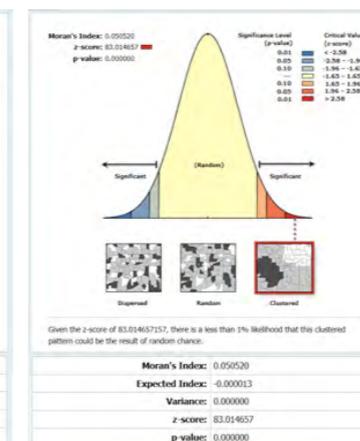


Figure 5 : Spatial autocorrelation of roads in Singapore

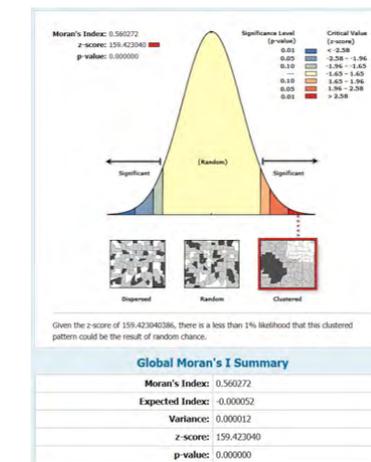


Figure 7: Spatial correlation of roads and patches in Singapore

In Figure 8, the slope of the scatterplot reveals that the fractal property of the road network in Quezon City is 1.61, which is higher than the FD 1.36 of the patches. This indicates that the roads are more spatially related than the patches. Whereas in Singapore, the FD of the patches is 1.87, slightly higher but close enough to that of the road network, 1.81 (Figure 9). These values may reflect how green spaces are being managed in the two study areas and how road construction is being planned in accordance with green space conservation and greening initiatives. It may be reflective of Singapore's efforts in the maintenance of trees and vegetation along the roads and even on the walls of many of their infrastructure.

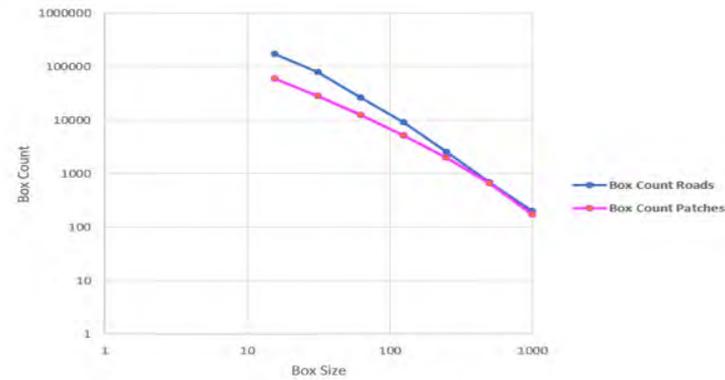


Figure 8 : Results of Box-counting for Quezon City's Road Network and Patches

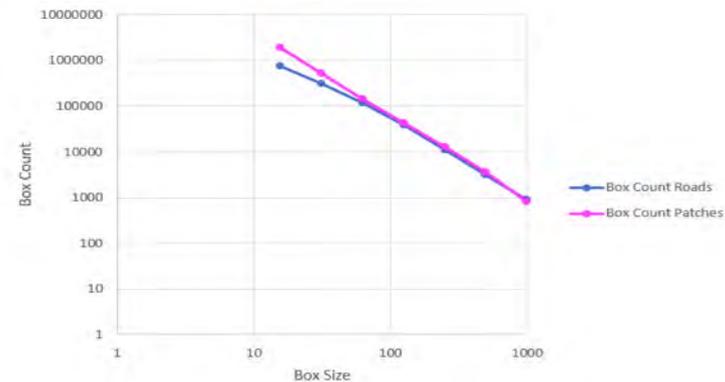


Figure 9 : Results of Box-counting for Singapore's Road Network and Patches

In correlation analyses, a stronger relationship of the two variables was found in Quezon City, with a value of 0.11 (table 1), compared to Singapore's 0.03 (table 2). This may be due to the impact of road network of Quezon City to its patches. Furthermore, the result of the covariance analyses revealed that both in the study areas, the two variables go in the same direction, such that as the FD of one variable increases, so as the other. This may denote that FD increases parallel to the disturbances which can affect the ecological patches and road networks may have far FD values from that of the patches since other extrinsic factors may also influence the structural characteristic of the patches not only the roads and the activities taking place on them.

High fractal dimension suggests low spatial difference and strong spatial correlation between urban parts (Chen, Wang, & Feng, 2017). Thus, the higher the FD value of the road network compared to the patches', the more possible that fragmentation has resulted from the establishment of roads.

Table 1 : Strength and direction of the relationship between road network and patches in Quezon City

COVARIANCE MATRIX			
Layers	Patches	Road Network	
QC Patches	1.881358e-002	6.684610e-005	
QC Road Network	6.684610e-005	1.738078e-005	
CORRELATION MATRIX			
Layers	Patches	Road Network	
QC Patches	1.00000	0.11690	
QC Road Network	0.11690	1.00000	

Table 2 : Strength and direction of the relationship between road network and patches in Singapore

COVARIANCE MATRIX			
Layers	Patches	Road Network	
SG Patches	1.853674e+004	1.881345e+004	
SG Road Network	1.881345e+004	1.801050e+007	
CORRELATION MATRIX			
Layers	Patches	Road Network	
SG Patches	1.00000	0.03256	
SG Road Network	0.03256	1.00000	

The identified relationship between the urban road network fractal properties and patches' fractal properties provides a guide for urban planning and policymaking with regards to future road developments and road construction considering the prevention of further fragmentation and conservation of ecological patches in cities to attain a garden city status.

The spatial autocorrelation showing the clustering of features with closer FD values may also reveal the extent of fragmentation in a study area (see figures 10 & 11). Very low positive or negative Moran index of the variables being studied suggests that high FD patches are surrounded by low FD patches indicating the degree of fragmentation in the study area.

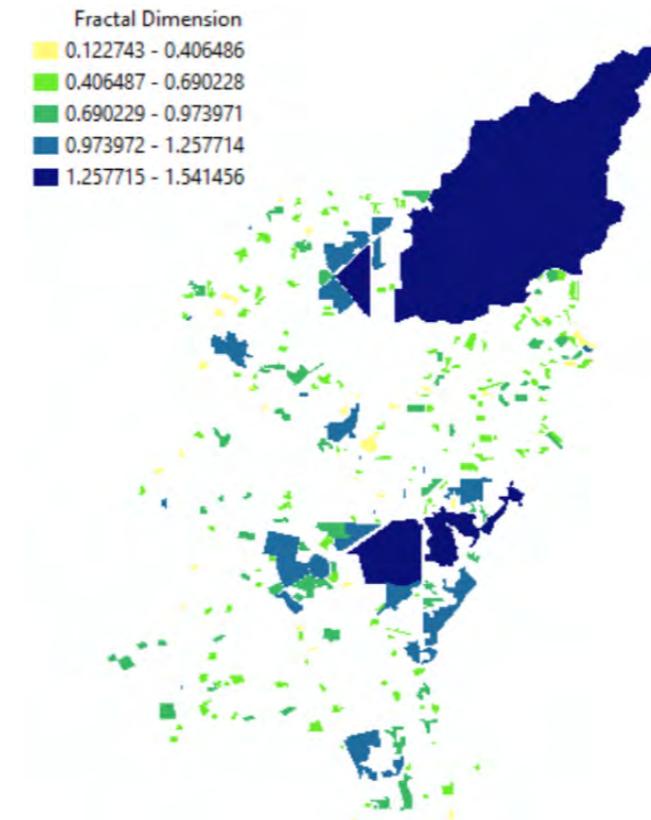


Figure 10 : The fractal dimension of individual patches in Quezon City

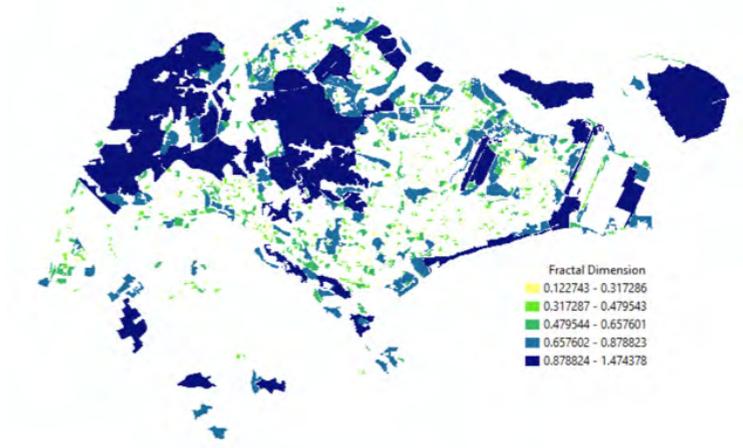


Figure 11 : The fractal dimension of individual patches in Singapore

Fractal dimension can be used to determine relationship between road network and ecological patches. However, the identified connections in this study were not strong and conclusive enough to determine the difference between the attributes of a model garden city and a city which aspires to be one. Although there were small differences and patterns which were pointed out and discussed in this study, still, other factors may have brought out those changes and influences on the fractal properties of the patches.

At this contemporary period, it is important for cities and regions, especially those that are in the periphery of highly urbanized ones and those that are considered to be rural, to secure reliable database of the physical elements of their spaces such as description of roads (e.g. road density, width, etc.) and green spaces. With the aid of modern technology, complex information may be organized and calculated to aid in minimizing negative impacts of new infrastructure developments and develop a more effective and sustainable urban plans and decisions.

4. CONCLUSION

It has been established here that fractal dimension index can be a useful assessment tool in making plans and decisions pertaining to road and other infrastructure development that may further exacerbate fragmentation. Fractal dimension can be considered as an indicator to determine areas that must be

protected against road construction and expansion. The results suggest that it may be more sustainable to build roads in areas with low FD and limit road construction in patches showing high FD, although the patches demonstrated in this study do not reflect the assurance of high ecological significance. But green spaces provide the assumption that these patches support species habitat and render certain ecological services.

This study can be further supported through research using a more refined scale to obtain more substantial findings. Also, using a variation of methods on computing FD values may reveal a clearer and more conclusive attributes of a garden city with respect to the fractal properties of its road network and ecological patches. In the study done by Jiang & Liu, (2012), they presented a detailed discussion on the issues of using the box-counting method in the case of Beijing City. They proposed improved techniques which was tested through the comparison of their FD results to an image with known FD. Their techniques were proven to provide a more reliable estimation of FD values of urban forms and may be used to gather more reliable FD values, which may provide a more conclusive description of the fractality of a Garden City. Moreover, determining the impacts of road network to patches at varying scales may also be researched further through considering the different characteristics and types of roads and patches.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the efforts of LA250 Class of the 1st semester of academic year 2017-2018, College of Architecture, University of the Philippines, Diliman, Quezon City for coming up with the vector map of ecological patches of Quezon City and Singapore.

REFERENCES

- Angelstam, P., Khaulyak, O., Yamelynets, T., Mozgeris, G., Naumoy, V., Chmielewski, T. J., Elbakidze, M. & Manton, M. (2017). Green infrastructure development at European Union's eastern border: Effects of road infrastructure and forest habitat loss. *Journal of Environmental Management*, 193 (2017), 300-311. <http://dx.doi.org/10.1016/j.jenvman.2017.02.017>
- Annadhasan, A. (2012). Method of Fractal Dimension Computation. *International Journal of Computer Science and Information Technology and Security*. 2(1), 2249-9555.
- Assis, J. C., Giacomini, H. C. & Ribeiro, M. C. (2019). Road Permeability Index: Evaluating the heterogeneous permeability of roads for wildlife

- crossing. *Ecological Indicators*, 99 (2019), 365-374. <https://doi.org/10.1016/j.ecolind.2018.12.012>
- Chen, W., Xie, Z. & Zhou, Y. (2019) (Proximity to roads reduces acorn dispersal effectiveness by rodents: Implication for forest regeneration and management. *Forest Ecology and Management*, 433, 625-632. <https://doi.org/10.1016/j.foreco.2018.11.029>
- Chen, Y., Wang, J. & Feng, J. (2017). Understanding the Fractal Dimension of Urban Forms Through Spatial Entropy. Retrieved from <http://www.mdpi.com/1099-4300/19/11/600>
- Committee on Ecological Impacts of Road Density (2005). *Assessing and Managing the Ecological Impacts of Paved Roads*. (Board on Environmental Studies and Toxicology, Division on Earth and Life Studies, Transportation Research Board, National Research Council). Washington, D.C.: National Academy of Sciences.
- Eker, M. & Coban, H.O. (2010). Impact of Road Network on the Structure of a Multifunctional Forest Landscape Unit in Southern Turkey. *Journal of Environmental Biology*, 31 (2010), 157-168. Retrieved from http://www.jeb.co.in/journal_issues/201001_jan10/paper_21.pdf
- Deng, S., Li, W., Gu, J., Zhu, Y., Zhao, L., Han, J. (2015). Measuring fractal dimension of metro systems. *Journal of Physics: Conference Series* 604 (2015), 012005. doi:10.1088/1742-6596/604/1/012005
- Falconer, K. (1990). *Fractal Geometry: Mathematical Foundations and Applications*. Chichester, England: John Wiley and Sons, Ltd.
- Ibisch, P.L., Hoffman, M. T., Kreft, S., Pe'er, G., Kati, V., Biber-Freudenberger, L., DellaSala, D. A., Vale, M. M., Hobson, P. R. & Selva N. (2016). A global map of roadless areas and their conservation status. *Science*, 354 (6318), 1423-1427. DOI: 10.1126/science.aaf7166
- Imre, A. R. & Bogaert, J. (2004). The Fractal Dimension as a Measure of the Quality of Habitats. *Acta Biotheoretica* (2004). Retrieved from http://www.seaturtle.org/pdf/imrear_2004_actabiotheoretica.pdf
- Jiang, S. & Liu, D. (2012). Box-Counting Dimension of Fractal Urban Form: Stability Issues and Measurement Design. *International Journal of Artificial Life Research*, 3 (3), 41-63. Retrieved from <http://www.albany.edu/spatial/publications/2012.Box-Counting%20Dimension%20of%20Fractal%20Urban%20Form%20-%20Stability%20Issues%20and%20Measurement%20Design.pdf>
- Mandelbrot, B. (1983). *The Fractal Geometry of Nature*. New York : W.H. Freeman and Company.
- Noss, R.F. and Cooperrider, A.Y. (1994). *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Washington, D.C.: Defenders of Wildlife and Island Press.
- Rowland, M.M., Wisdom, M.J., Johnson, B.K., and Penninger, M.A. (2005). *Effects of Roads on Elk: Implications for Management in Forested*

- Ecosystems*. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA. pp. 42-52.
- Spellerberg, I.F. & Morrison, T. (1998). The Ecological Effects of New Roads – A Literature Review. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.553.2660&rep=rep1&type=pdf>
- Sreelekha. M.G., Krishnamurthy. K., & Anjaneyulu. M.V.L.R. (2016). Interaction Between Road Network Connectivity and Spatial Pattern. *Procedia Technology*, 24 (2016), 131-139. doi: 10.1016/j.protcy.2016.05.019
- Thomas, I. & Frankhauser, P. (2013). Fractal Dimensions of the Built-up Footprint: Buildings vs Roads. Fractal Evidence from Antwerp (Belgium). *Environment and Planning B Planning and Design*, 40 (2013), 310-329. doi:10.1068/b38218

USING MEAN PATCH SIZE AS A LANDSCAPE METRIC TO DETERMINE THE EFFECTIVENESS OF THE NATIONAL GREEN POLICY IN QUEZON CITY, MANILA

Franklin Jr. Fontanoza^{1*} and Nappy L. Navarra, D.Eng.^{1*}

¹College of Architecture, E. Delos Santos Street, University of the Philippines, Diliman, Quezon City

* Corresponding author:
fsfontanoza@up.edu.ph
nlnavarra@up.edu.ph

ABSTRACT

90 percent of the Philippines was covered by rainforest in the early 1900s (Carandang & Lasco, 1998, Lasco & Pulhin, 2009). As cities emerged and population increased over time, most of the trees were removed in exchange for houses, workspaces and national roads. In a nationwide effort to resuscitate the local environment, Executive Order No. 26 of 2011, known as the “National Greening Program” (NGP), has required 1.5 million hectares of public domain lands such as forests, mangrove and protected areas, urban areas, idle lots and other suitable lands be planted with 1.5 billion trees over a period of six years. Led by the Department of Environment and Natural Resources (DENR), all local government units were required to participate actively in this national greening endeavor. As one of the most thriving cities in Metro Manila that promote a clean and green environment for its citizens, Quezon City has been at the forefront in its participation to the mandate of the NGP. Its public parks and open spaces were planted with seedlings at the start of the program; and have been maintained and monitored to assure plant growth and overall health. Using Mean Patch Size as a landscape metric to quantify the effectiveness of the national policy, the tree covers of La Mesa Ecopark, Quezon City Memorial Circle and Ninoy Aquino Parks and Wildlife in Quezon City were measured and assessed. Pre-NGP satellite maps were overlaid on 2017 maps to determine if the green patches within these open spaces increased. After six years of NGP implementation, all three parks showed tree cover expansion proving that the National Greening Program in Quezon City is effective after all.

Keywords: : garden cities, landscape metrics, landscape urbanism, national greening program, quezon city

1. INTRODUCTION

90 percent of the Philippines was covered with rainforests when Spanish colonizers arrived (Carandang & Lasco, 1998, Lasco & Pulhin, 2009). But in just five decades, the country lost 9.8 million hectares of forests (Liu et.al, 1993) mostly due to tireless logging, forest fires and unregulated mining operations. Aggravated by the continued rise in population, the country faces food resource depletion, natural resource destruction and threats to overall biodiversity (Tacio, 2013).

Reforestation programs in an effort to revive thinning forests were implemented in local communities. These were the usual projects of elected public officials in hopes that the community becomes involved in taking environmental degradation more seriously. Tree planting activities in elementary schools and clean up drives by local offices were believed to advance environment goals; but depressingly, the scale of these efforts was not enough.

Benigno Aquino III, then president of the Philippines, signed Executive Order No. 26, series of 2011 known as the National Greening Program (NGP) on February 24, 2011 (<http://www.officialgazette.gov.ph>) to revive the presence of trees throughout the country. The mandate has appointed the Department of Environment and Natural Resources (DENR) as the lead agency to run and monitor the program nationwide. Regarded as a national priority, the NGP envisioned to plant 1.5 billion trees over a period of six years in public urban areas and in lands suitable for planting as stated in the mandate. While on the other hand, other government agencies such as the Department of Agriculture and Department of Agrarian Reform were tasked to create databases and regularly monitor NGP’s progress.

Still an estimated 7.1 million hectares of land were left idle, degraded, unproductive and unused. Thus on November 12, 2015, President Aquino signed EO No. 193, s. 2015 (<http://www.officialgazette.gov.ph>) to widen the scope of the NGP and extend its effectivity up to 2018.

As a means to verify the effectiveness of the NGP, changes in tree covers from 2011 to the final year of the NGP can be used to represent patch growth. The paper used mean patch size as a landscape metric to determine the area or size of a patch and verify if the size increased. Although the mean patch size as a metric has its sets of limitations such as the lack of identification of landscape heterogeneity and its relationship with several physical disturbances, it can still be used as a robust indicator of growth and initial basis for patch size comparisons. This robust indicator was used to compare aerial photographs of three selected open spaces in Quezon City, before and after the operationalization of the NGP.

2. PROBLEM STATEMENT

Among the major cities in the Philippines, Quezon City has been vocal to become a green city. Aside from its adherence to the NGP, the city mayor and cabinet members have continually worked on attaining international standards of compliance by attending several ecological conferences in Singapore, Washington, and Germany to name a few. Other efforts of Quezon City to achieve green city status include its compliance to the Republic Act 9003 known as the Ecological Solid Waste Management Act of 2000 (quezoncity.gov.ph/index.php), several solid waste management projects and carbon reduction programs, and passing of a Green Building Ordinance in 2009. This puts Quezon City ahead of all the other cities in the metro by looking into other ecological programs that will benefit its citizens.

Unsurprisingly, the Department of Environment and Natural Resources (DENR) is located in Quezon City. The presence of noteworthy open spaces such as the La Mesa Eco-Park, the Ninoy Aquino Parks and Wildlife and the Quezon City Memorial Circle, being the largest green spaces in the city, also add motivation to the local government to move towards achieving its green city programs. Easily enough, these open spaces were identified by DENR and designated to become NGP sites in Quezon City.

Located in the eastern side of Fairview in Quezon City, the La Mesa Eco-Park boasts of natural amenities that house several activities for nature seekers to enjoy and experience. For a time, the eco-park was neglected but private agencies took the initiative to save it. The local government picked up the eco-park’s revival by allotting 106,856 USD to rehabilitate it through road construction, inclusion of amenities for hiking, biking, fishing, bird watching, as well as a museum and organic farms to increase revenue. Since the implementation of the NGP, the eco-park received at least 17,494 seedlings of native trees such as Banaba, Ilang-ilang, Igyo, Molave and Kupang.

Formerly known as the Philippine Parks and Wildlife, the Ninoy Aquino Parks and Wildlife Center (PAWB) already showcases a wide variety of trees and shrubs species. The botanical garden also houses picnic areas, a manmade lagoon, mini-zoo and a wildlife rescue center that has become home to lost, sick and donated animals. Seedlings of Yakal, Molave, Langka, Philippine Teak and other tree species up to 230 are grown and maintained (Certificate of Development Site Code No.: 11-130000-0145-0004) in the park since 2014.

The Quezon City Memorial Circle (QCMC), known as the central park of the city, keeps the remains of former President Manuel L. Quezon and First Lady Aurora Quezon in a 66-meter high monument, right at the center of the open space. The original masterplan initially allocated 425 hectares for the park but eventually was reduced to its present size. QCMC was given 530 seedlings of Narra, Kalumpit, Banaba, Molave, and Dao, since 2011. It was confirmed that all seedlings were thriving, based on the survey DENR made in 2014 (Certificate of Development Site Code No.: 11-130000-0060-0002). 185 seedlings of African tulip, Makaasim and Talisay among other species were also planted (Certificate of Development Site Code No.: 11-130000-0078-0001).

These three sites were the main beneficiaries of the National Greening Program in Quezon City (Figure 1). But it is still yet to be known if these NGP-designated sites have improved since the NGP has been implemented in 2011. The expansion of tree covers can be used to indicate the effectiveness of the NGP in Quezon City.

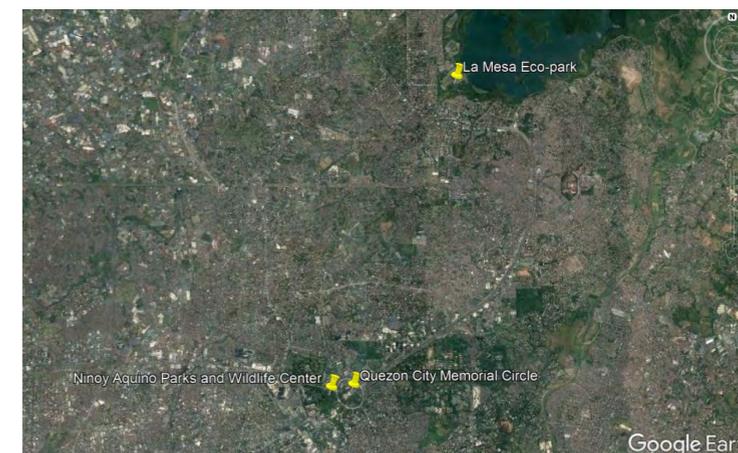


Figure 1: Locations of the three NGP-designated green spaces (2019)

This paper attempts to try to answer the following questions::

1. How well has the National Greening Program been applied in Quezon City?
2. How much change has happened in the NGP-designated sites since its implementation in 2011?
3. How can the local government of Quezon City further their goal of becoming a green city?

Aim and Objectives

The aim of this paper is to assess the effectiveness of the National Greening Program, in selected NGP-designated green open spaces in Quezon City, using the mean patch size as a metric. The objective is to quantify patch expansion to determine the extents of change that have happened since the NGP's implementation in 2011. This research contributes to the development of recommendations for the Quezon City local government on how to manage their green spaces that could hopefully motivate the locals to participate towards the national endeavor.

Scope and Delimitation

The study will look into three National Greening Program-designated green spaces in Quezon City, namely: the La Mesa Eco-park, Ninoy Aquino Parks and Wildlife Center and the Quezon City Memorial Circle. The study shall mainly use tree cover as the basis to represent patch growth, using satellite images accessed through Google Earth, taken in April 7, 2010 and April 15, 2017. The seven-year difference of the two maps could graphically show the changes in tree covers.

3. MATERIALS AND METHODS

Online journals and sections from books from the library of the College of Architecture in the University of the Philippines were reviewed for the study. Researches describing the importance of large patches to the survival of some animals and how its effects to avian migration were considered for the study.

The Wolong Nature Reserve in the province of Sichuan, China was studied to determine if its declaration of being a protected area decreased the ecological degradation that it currently faced during the period of study (Liu, et.al. 2001). The study used remote data to map out forest cover before and after the reserve was institutionalized, over three different periods. Aside from the number of

habitat patches, mean patch sizes were computed to make comparisons. After gathering quantitative information, the study concluded that even after the establishment of the reserve area into a protected land, the rates of change indicating the loss of panda habitats increased; and the number and sizes of patches decreased.

A total of 235 deciduous woodlots were studied over 22 regions spread all over Netherlands (Van Dorp & Opdam, 1987). Avian species were correlated with woodlot sizes. Sizes were somehow kept within an average and were bounded by agricultural lands, which were used as patch boundaries. Previous researches indicated that the area and habitat heterogeneity could be linked to the number of avian species. Results showed that as the patch size decreased, the variety of avian species also reduced. This implied that smaller woodlots contained fewer and smaller trees, smaller area of surface water and less diverse forest types. The existence of almost all bird species were thus influenced and better predicted by patch size.

Photo Documentation

Photos were taken using a camera phone on a weekend to document on-site conditions. This could also help in illustrating details that the researcher may have missed during the observation period.

Maps using Google Earth

Tree crown covers in the three NGP-designated green spaces in Quezon City, Philippines were traced using satellite images taken on April 7, 2010 and April 15, 2017 from Google Earth. The resulting outlines from these two images were compared to each other to indicate changes in patch sizes, as a possible indication of fragmentation. The tree crowns or forest covers were traced from a 300 meter elevation. Numerical values of areas of the patches were tabulated to show changes in perimeter and total area.

Mean Patch Size

Mean patch size is a landscape metric that can be used to determine the area or size of a patch. It can also be used as an indicator of degree of ecosystem fragmentation within a given area. The outline tree covers that represent a patch each were counted and the total area of each was tabulated and averaged. Results may confirm that the number of patches have multiplied/diminished and increased/decreased in size.

4. RESULTS AND DISCUSSION

Using Google Earth satellite images taken in April 2010 and April 2017, boundaries of the three NGP-designated green spaces were measured (Table 1). The tree covers were outlined using 1:300 scale. The two resulting images per park (2010 tree cover in blue color outline while the 2017 tree cover in orange color) were overlapped to each other to determine the changes that occurred throughout the years (Figure 2). Patches were counted and tabulated for each NGP-designated green space.

Table 1: Areas of the three NGP sites

NGP-designated green space	Area (in acres)
Quezon City Memorial Circle (QCMC)	66.11
Ninoy Aquino Parks and Wildlife Center (PAWB)	98.35
La Mesa Eco-park	5,223.52

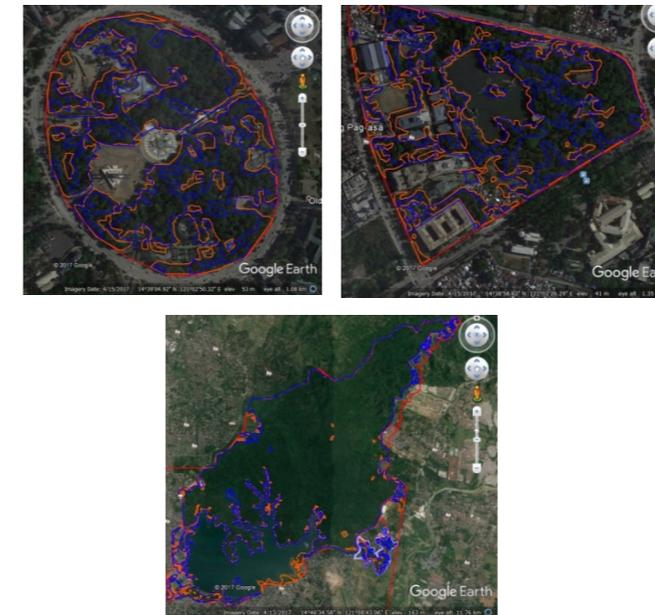


Figure 2: Maps of Quezon City Memorial Circle, Ninoy Aquino Parks and Wildlife, and La Mesa Ecopark in 2010 (outlined in blue color) and 2017 (outlined in orange color)

Maps were done using data from the Google earth to show evident changes from 2010 to 2017 (Figure 3). The tree covers were outlined and filled with red color to illustrate how it looked in 2010; while the green color was used to identify tree covers in 2017.

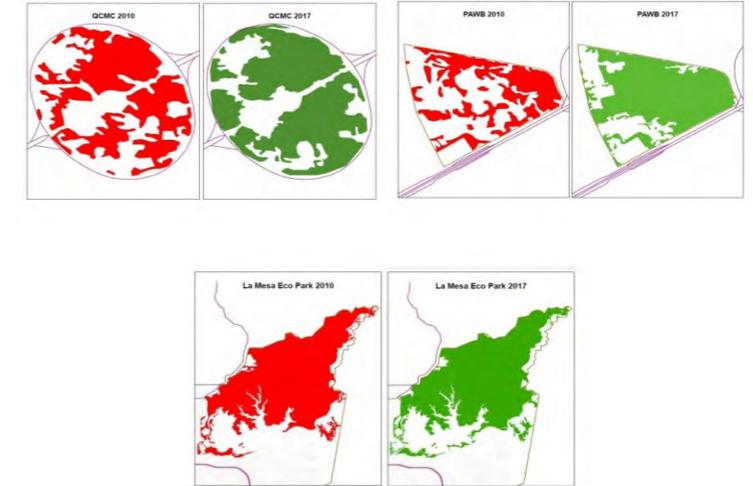


Figure 3: Maps of Quezon City Memorial Circle (QCMC), Ninoy Aquino Parks and Wildlife (PAWB), and La Mesa Ecopark in 2010 (in red) and 2017 (in green)

In some areas, tree covers were reduced due to the construction of amenities that needed more space, thus the trimming of some tree covers. While in some areas, the tree covers expanded due to the growth of newly planted and existing trees in the seven year span of the program. Several other planting areas were also developed within the sites; thus, the increase in the number of patches that represent newly-grown trees. Tree cover patches were quantified and labeled randomly. Getting the mean patch size as a landscape metric, the patches were averaged from the 2010 map and from the 2017 map for the three NGP-designated green spaces (Tables 2-7).

Table 2 : Areas of the tree cover patches for QCMC in 2010

QCMC Patch Number	2010 (in acres)
1	13.72
2	0.24
3	2.60
4	0.14
5	9.95
6	5.23
7	0.07
Total Tree Cover Patch	31.95

Table 3: Areas of the tree cover patches for QCMC in 2017

QCMC Patch Number	2017 (in acres)
1	15.89
2	0.12
3	1.15
4	3.08
5	21.50
6	0.07
Total Tree Cover Patch	41.81

Table 4: Areas of the tree cover patches for Ninoy Aquino Parks and Wildlife in 2010

PAWB Patch Number	2010 (in acres)
1	0.34
2	24.46
3	3.57
4	2.85
5	0.26
6	4.19
7	2.22
8	0.30
9	0.75
10	0.77
11	0.08
Total Tree Cover Patch	39.79

Table 5: Areas of the tree cover patches for Ninoy Aquino Parks and Wildlife in 2017

PAWB Patch Number	2017 (in acres)
1	47.07
2	0.15
3	0.12
4	0.07
5	0.75
6	0.14
7	2.87
8	0.21
9	0.22
10	0.19
11	0.04
12	0.08
13	0.07
14	0.04
15	0.02
16	0.10
17	0.02
Total Tree Cover Patch	52.16

Table 6 : Areas of the tree cover patches for La Mesa Ecopark in 2010

La Mesa Ecopark Patch Number	2010 (in acres)
1	75.62
2	0.10
3	11.11
4	2.87
5	4.21
6	14.45
7	1.82
8	0.92
9	0.84
10	0.96
11	0.45
12	2.69
13	3.29
14	0.93
15	1.25
16	0.12
17	0.43
18	4,605.38
19	6.48
20	2.84
21	19.68
22	3.22
23	15.38
24	92.37
25	1.94
26	1.32
27	0.99
Total Tree Cover Patch	4,871.66

Table 7: Areas of the tree cover patches for La Mesa Ecopark in 2017.

La Mesa Ecopark Patch Number	2017 (in acres)
1	79.18
2	0.93
3	4.99
4	2.01
5	1.95
6	0.24
7	0.29
8	22.95
9	0.28
10	12.14
11	0.09
12	0.22
13	0.07
14	0.04
15	0.18
16	0.11
17	0.05
18	0.33
19	2.66
20	2.94
21	4,638.47
22	19.46
23	58.01
24	5.70
25	0.35
26	0.35
27	1.79
28	3.05
29	20.69
30	1.60
31	0.49
32	1.97
33	1.84
34	0.96
35	3.21
36	1.01
37	24.69
38	1.71
Total Tree Cover Patch	4,917

Table 8 that summarizes the number of tree cover patches per NGP site. This may imply that there were noticeable changes within the NGP-designated green spaces. The number of tree cover patches in QCMC decreased from 2010 to 2017 but the Ninoy Aquino Parks and Wildlife and La Mesa Eco-park tree cover patches increased in number.

Table 8: Summary of the number of tree cover patch for each NGP site.

Number of Tree Cover Patches	2010	2017
QCMC	7	6
Ninoy Aquino Parks and Wildlife	11	17
La Mesa Ecopark	27	38

Table 9: Summary of the average size of tree cover patch for each NGP green space.

Average Size of Tree Cover Patch	2010 (in acres)	2017 (in acres)
QCMC	4.57	6.89
Ninoy Aquino Parks and Wildlife	3.60	3.07
La Mesa Ecopark	180.43	129.40

The average sizes of the patches using the mean patch size (Table 9) were computed to determine the average area of a patch in each NGP site. Comparing Tables 8 and 9, it was found out that the relationship between the number of tree cover patches and the average size of the tree cover patch is inversely proportional. As the number of tree cover patch decreased, as shown in QCMC, the average size of tree cover patch increased. While on the other hand, the increase in the number of tree cover patch resulted in smaller average tree cover patch size, as shown in the Ninoy Aquino Parks and Wildlife and La Mesa Ecopark sites.

The inverse relationship between the number of tree cover patch and average size of tree cover patch can be attributed to the tree planting activities in the sites. New planting areas were designated and implemented in Ninoy Aquino Parks and Wildlife and La Mesa Ecopark, thus, the increase of tree cover patch in these two green spaces. While the decrease in the number of patches in QCMC may suggest that two of its tree cover patches grew in size and merged into one larger patch. The increase in patch number which resulted to a decrease in the average size of patches primarily may be attributed to the availability of more space for trees to grow, expand and multiply. The QCMC when compared to Ninoy Aquino Parks and Wildlife Center and La Mesa Ecopark had more open space in 2010, allowing more room for the planted trees to expand. These open spaces within QCMC also enabled more areas to be planted on. It was also observed that interior road networks were constructed which possibly divided some patches.

The total tree cover patch of each NGP site was divided over the total area of each site. These percentages of tree cover patch per NGP-site were compared as well (Table 10). There was evident increase in the percentages from 2010 to 2017, depicting that tree covers grew and multiplied throughout the years.

Table 10: Percentage of growth for each NGP site.

NGP-site	2010 (in %)	2017 (in %)
QCMC	48.34	62.50
Ninoy Aquino Parks and Wildlife	40.25	53.03
La Mesa Ecopark	72.64	73.32

The biggest growth from 2010 to 2017 was most evident in the Quezon City Memorial Circle. This 14.16 percent growth can be attributed to the fact that QCMC had more open space to allow existing trees to expand and new tree samplings to be planted onsite. Since it will always be a priority project for the city government due to its location fronting the city hall, QCMC may receive local budget for its beautification and maintenance. It has to be maintained well through greening projects to attract local residents to enjoy and experience this city's main open space. Many citizens come to QCMC to enjoy the shaded activity areas and use most of its amenities that are free of charge. It is also the most accessible green space in comparison to the other two sites. There are also several public transport vehicles such as buses and jeepneys that drop off commuters easily around the QCMC.

The growth of La Mesa Ecopark, although small in terms of tree crown percentage to its total area, has still shown an increase which can be attributed to tree planting activities done by private companies. Since most parts of the La Mesa Ecopark are protected, due to the existing watershed, access to the forest is limited. It is guarded under strict management and the trees are maintained only by designated personnel. Therefore, it is also recommended that further validation be made by accessing these areas that are not open to public.

The city government and local agencies should continue monitoring the growth of the planted trees. The national program has already seen positive responses in terms of tree survival and more spaces are being identified to house these saplings. The maintenance and proper care of the trees should be sustained to ensure that the program is carried out efficiently. Private companies as well as communities within the city can be encouraged to participate more in planting activities through planting drives and nature walks to educate more people on the benefits of trees to overall human health and well-being.

Several other factors can also be considered to validate the effectiveness of the NGP. The willingness of the locals to participate, the number of tree seedlings planted versus the number of trees that survives, and the incentives that the park receives for maintaining their tree seedlings can be incorporated to future studies to strengthen the claim of the effectiveness of the greening program.

5. CONCLUSION

The National Greening Program of the Philippines since its implementation in 2011 has provided seedlings to green spaces, parks, nurseries, idle lands and forests throughout the country. Quezon City, in its goal to become a green city, received almost 20,000 seedlings since the start of the NGP. Through the Department of Environment and Natural Resources as lead government agency, the tree seedlings are maintained and monitored. Comparing pre-NGP maps with current satellite maps of the three selected green spaces, it can be said that there are encouraging evidences that showed tree crown expansion and the development of more green patches. These were positively correlated to the greening efforts of the city and the country as well.

Although the study needs more factors to strengthen the landscape metric, it still holds promise of a positive outcome for the NGP. For future studies, several other factors can also be considered to validate the research. The willingness of the locals to participate, the number of tree seedlings planted versus the number of trees that survives, even the incentives that the park receives for maintaining their tree seedlings can be looked at for future studies.

ACKNOWLEDGEMENTS

The researcher would like to thank his professor, Nappy Navarra for his guidance and his classmates for making the research process possible. Special thanks go to Monica Pujalte, Bianca Fernandez, Sir Noe, the National Parks Board in Singapore and to his family.

REFERENCES

Asian Development Bank. (2014). State of the Coral Triangle: Philippines. Mandaluyong City, Philippines: Asian Development Bank.

Calderon, W. & Lasco, R. (1998). Successful Reforestation in the Philippines. *Mega Issues in Philippine Forestry: Key Policies and Programs*. (pp. 49-59) Laguna, Philippines: Forestry Development Center. Accessed online through <https://www.nast.ph/images/pdf%20files/Publications/>

Other%20Publications%20of%20NAST/Mega%20Issues%20in%20Philippine%20Forestry%20Key/NAST%201998%20Mega%20Issues%20in%20Philippine%20Forestry%20Key%20Policies%20&%20Programs.PDF.

Department of Environment and Natural Resources. (2011). Executive Order No. 26, s. 2011. Retrieved from <https://www.officialgazette.gov.ph/2011/02/24/executive-order-no-26-s-2011/>.

Department of Environment and Natural Resources. (2011). Farmers to Benefit from National Greening Program for Improved Water Supply to Irrigate Farmlands. Retrieved online on October 2018 thru <https://www.denr.gov.ph/news-and-features/latest-news/454-farmers-to-benefit-from-national-greening-program-for-improved-water-supply-to-irrigate-farmlands.html>.

Department of Environment and Natural Resources. (2015). Executive Order No. 193, s. 2015. Retrieved from <https://www.officialgazette.gov.ph/2015/11/12/executive-order-no-193-s-2015/>.

Food and Agriculture Organization of the United Nations. (2015). Global Forest Resources Assessment 2015. Rome, Italy. Accessed online on December 2017 thru <http://www.fao.org/3/a-i4808e.pdf>.

Frayer, J., Sun, Z., Muller, D., Munroe, D., Xu, J. (2013). Analyzing the drivers of tree planting in Yunnan, China with Bayesian networks. Accessed online on November 2017 thru <http://www.sciencedirect.com/science/article/pii/S0264837713001555>.

Hall, P. & Ward, C. Sociable Cities. (1998). West Sussex, England: John Wiley & Sons Ltd.

Hester, R. (1984). Planning Neighborhood Space with People. Second Ed. New York, USA: Van Nostrand Reinhold Company Inc.

Lasco, R. & Pulhin, F. (2009). Carbon Budgets of Forest Ecosystems in the Philippines. *Journal of Environmental Science and Management*, 12(1), 1-13. Accessed online on October 2018 thru researchgate.net

Le, H. D., Smith, C., Herbohn, J. (2015). Identifying interactions among reforestation success drivers: A case study from the Philippines. Accessed online on November 2017 thru <http://www.sciencedirect.com/science/article/pii/S0304380015003531>.

Le, H. D., Smith, C., Herbohn, J. (2014). What drives the success of reforestation projects in tropical developing countries? The case of the Philippines. Accessed online on November 2017 thru <http://www.sciencedirect.com/science/article/pii/S0959378013001623>.

Le, H. D., Smith, C., Herbohn, J., Harrison, S. (2011). More than just trees: Assessing reforestation success in tropical developing countries. Accessed online on December 2017 thru <http://www.sciencedirect.com/science/article/pii/S0743016711000568>.

Lechner, A., Stein, A., Jones, S., Ferweda, J. (2009). Remote sensing of small

and linear features: Quantifying the effects of patch size and length, grid position and detectability on land cover mapping. Accessed online on September 2017 thru <https://www.sciencedirect.com/science/article/pii/S0034425709001801>.

Li, B. and Archer, S. (1997). Weighted mean patch size: a robust index for quantifying landscape structure. Accessed online on August 2017 thru <https://www.sciencedirect.com/science/article/pii/S0304380097000719>.

Liu, J., Linderman, M., Ouyang, Z., An, L., Yang, J., Zhang, H. (2001). Ecological Degradation in Protected Areas: The Case of Wolong Nature Reserve for Giant Pandas. Accessed online on August 2017 thru <http://science.sciencemag.org/>

McIntyre, N. Effects of Forest Patch Size on Avian Diversity. (1995). Accessed online on August 2017 thru <https://link.springer.com/article/10.1007/BF00153826>.

Pruetz, R. (2012). Lasting Value Open Space Planning and Preservation Successes. Washington DC, USA: American Planning Association Planners Press.

Simmonds, J. (1994). Garden Cities 21: Creating A Liveable Urban Environment. Washington DC, USA: Mc-Graw Hill, Inc.

Tan, A. Preliminary Assessment of Singapore's Environmental Law. (2007). Accessed online on September 2017 thru http://www.aecen.org/sites/default/files/singapore_eia_casestudy_prelimassessmentenvilawinsg_1997.pdf.

Tookey, D. (1998). Singapore's Environmental Management System: Strengths and Weaknesses and Recommendations for the Years Ahead. Accessed online on September 2017 thru <http://scholarship.law.wm.edu/wmelpr/vol23/iss1/5/>.

Turner, et. al., (2001). McGarigal, K. Landscape Metrics for Categorical Map Patterns. Accessed online on September 2017 thru http://www.umass.edu/landeco/teaching/landscape_ecology/schedule/chapter9_metrics.pdf.

Van Dorp, D. and Opdam, P.F.M. (1987). Effects of patch size, isolation and regional abundance on forest bird communities. Accessed on August

Ulrik Sidenius^{1*}, Patrik Karlsson Nyed¹ and Ulrika K. Stigsdotter¹

¹Nature, Health & Design Research Group, Section for Landscape Architecture and Planning, Department of Geosciences and Natural Resource Management, Faculty of Science, University of Copenhagen, Denmark

* Corresponding author:
us@ign.ku.dk

ABSTRACT

The present study examines whether participants of a nature-based therapeutic intervention in the therapy garden Nacadia® have changed their nature consumption one year after the intervention compared with one year before the intervention. The study uses exploratory pre- and post-test methods and mixed methods. Quantitative measures (questionnaires) and qualitative measures (interviews) were analysed to illuminate the changes in the informants' nature consumption. A significant change in the frequency of the informants' visits to public green spaces was found. The quantitative data were found to be insufficient with regard to achieving the goals of the current study and were therefore disregarded. The qualitative data showed that the quality of the informants' nature consumption can be organised in the four themes: 1) New approach to green spaces; 2) Awareness of self and environments; 3) New attitudes to everyday tasks; and 4) Maintaining beneficial mind-sets. After the completion of a nature-based therapy intervention, nature consumption motivated informants to remember and maintain the beneficial mind patterns they achieved during the nature-based therapy. As such, nature-based therapy seems to present an accessible health-enhancing tool that is easy to use in everyday life. The current study identifies a need for more comprehensive studies of cause and effect in relation to nature consumption as a post-therapeutic tool.

Keywords: : Absorption, Biopsychosocial, Evidence-based Health Design in Landscape Architecture, ICD-F43.0-9, Mixed Method, Nature-Assisted Therapy, Salutogenesis, Therapy Garden.

1. INTRODUCTION

Over the past twenty years an abundance of evidence supporting the presumption that natural environments can be beneficial to health has been generated (Annerstedt & Währborg, 2011; Bragg & Atkins, 2016; Hartig, Mitchell, de Vries, & Frumkin, 2014; Mitchell & Popham, 2008; Nilsson et al., 2011). Based on state-of-the-art evidence, the University of Copenhagen's Nacadia® therapy garden was designed in accordance with the model for evidence-based health design in landscape architecture (Ulrika K. Stigsdotter, 2014; Ulrika K. Stigsdotter & Randrup, 2008). The garden was opened in 2011.

The Evidence Based Health Design in Landscape Architecture (EBHDL) process is based on a model (Fig. 1) that has been developed and validated by research done by the research group 'Nature, Health & Design' and illustrates a working process based on most current evidence concerning nature-based therapeutic (NBT) interventions (Sidenius et al., 2017a; Stigsdotter, 2014). It has four parts. In part 1 the components: a) Aesthetic and practical conditions; b) The specific target group's needs and attributes; c) Evidence and experiences from relevant research and practical, must be considered in relation to the treatment and expected rehabilitation progression. In part 2, a programme is made to guide the subsequent design. Here, the collected knowledge and evidence are organized, and consensus on aims and objectives for the design and the means to achieve those are made and reported through design criteria. Part 3 is the realization of the design, and part 4 is a diagnostic post-occupancy evaluation to evaluate if the design meets the original aims of the design.

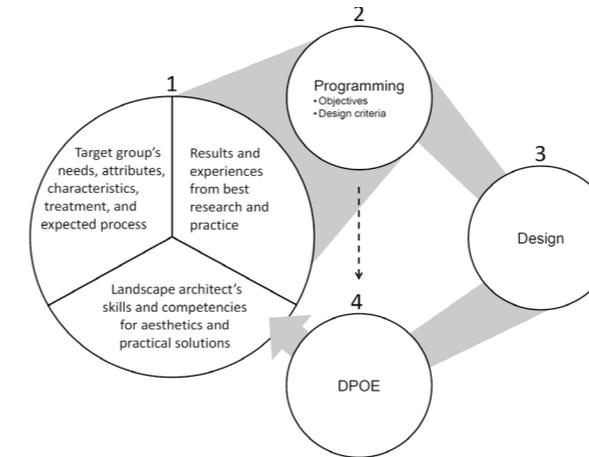


Figure 1 : The model for evidence-based health design in landscape architecture. DPOE: Diagnostic post-occupancy evaluation (Sidenius et al., 2017)

From 2013 to 2018, a randomized clinical study, 'Nacadia Effect Study' (NEST) was conducted. A 10-week NBT intervention in Nacadia was explored to shed light on how the patients use Nacadia, what their experiences are and how they develop during the intervention (Sidenius, 2017; Sidenius et al., 2017; Ulrik Sidenius et al., 2017a; Sidenius et al., 2015). Further, NEST measured the long-term efficacy of the intervention based on four health-indicating variables: 1) number of contacts with a general practitioner, 2) sick leave, 3) overall mental well-being, and 4) burnout symptoms during and after the course of NBT (Corazon et al., 2018; Stigsdotter et al., 2018). The NBT included in the NEST project contains five nature-based components: 1) individual conversational therapy, 2) mental and physical awareness exercises, 3) horticultural-based activities, 4) 'own time', and 5) homework (Corazon et al. 2018a; Corazon et al. 2010).

The intention of using homework as a part of the NBT programme was to motivate participants to practice different components and means from the NBT within their everyday life, and further to start using green spaces more beneficially for their health and well-being, outside Nacadia. This intention was inspired by findings showing associations between frequency of use of green spaces and mental health (Grahn & Stigsdotter, 2003; Ulrika K. Stigsdotter et al., 2010).

The overall hypothesis of the present study is that NBT has a positive impact on the informants' ability to find health-beneficial nature experiences. The predictions are that after participating in NBT, the participants will use nature more frequently; have gained new insights into nature consumption (NC); and be able to use NC to improve for their well-being. To examine whether these predictions hold true, the present study focuses on the changes in the informants' behavioural habits in relation to their use of green spaces prior to and one year after participating in the NBT in Nacadia.

2. MATERIALS AND METHODS

The present study is an exploratory pre-test post-test study that uses mixed methods to identify possible changes in the informants' (N=43) general NC in their everyday lives from before the NBT to one year after participating in the NBT in Nacadia. To be eligible for participation the participants had to be incapable of working and have the primary diagnosis: psychiatric diagnosis of adjustment disorder and reaction to severe stress (ICD-F43.0, 2-9) (Stigsdotter et al., 2018; World Health Organization, 1992).

Inclusion criteria: Adults aged 20-60 years. Exclusion criteria: Individuals with severe psychiatric morbidity, psychotic disorders, personality disorders, suicidal tendencies and drug or alcohol problems. Potential participants were recruited through medical doctors, social workers, psychologists and advertisements in newspapers. Clinical assessments of potential participants were conducted by one of four clinical psychologists supervised by a psychiatrist. In total 43 persons were found eligible for participation in the 10 weeks NBT programme in Nacadia. One was misdiagnosed, one did not want to receive the intervention, four did not provide baseline data, and five did not provide post-data. The informants were divided in 7 groups of 4-7 participants. The total treatment period of the study was from 05.08.2013 to 27.03.2015.

The study followed the ethical principles of the World Medical Association Declaration of Helsinki, and was approved by the Danish Data Protection Agency (J.no. 2013-54-0344) and the National Committee on Health Research Ethics (P.no. H-1-2013-038). Participants received verbal and written information about the study and signed an informed consent acknowledgement before participating.

2.1 Questionnaires

One of several questionnaires used in the NEST (detailed descriptions of the questionnaires and selected results from NEST can be found in Stigsdotter et al., 2018) was a background questionnaire (n=32) comprising questions regarding demography, educational level, employment status, health, and NC. The questionnaires were handed out to the informants on the first day of the NBT programme, and sent by mail to the participants at the end of NBT (ninth or tenth week), and 3, 6 and 12 months after completion of the NBT.

The present study uses the data from the first day of the NBT and from 12 months post NBT, and uses the part of the background questionnaire in relation to NC. The questionnaire contains measures of NC on two variables: 1) Frequency of visits to public green spaces, e.g. parks, green spaces, harbours, beaches and forests; 2) Frequency of visits to informants' own garden, balcony or common backyard where they live. The purpose of using questionnaires is to be able to conduct a statistical quantification of the possible changes in participants' NC.

2.2 Interviews

Two informants from each group (n=14) participated in semi-structured interviews (Richie et al., 2013). Due to ethical considerations, the aim was to use as few informants as possible, yet saturate the material. Participation was voluntary, and with the aim to obtaining rich and varied stories, the therapists in Nacadia aimed to ensure that the voluntary interviewees had sufficient capabilities to participate.

The interviews were conducted with the aim to gain more in-depth knowledge about the possible changes in how the informants use nature from before having participated in NBT programme to after. An interview guide for the semi-structured interviews was developed in relation to the aim of NEST. The questions in relation to NC are: Is there a particular type of environment you prefer in parks, squares and gardens? Are there any particular type of activities you prefer in parks, squares and gardens? Are there any special components you prefer in green spaces? Are there any special places, activities or components that you avoid when you are in parks, squares or gardens?

The interviews were conducted in the first week of the NBT programme, in the fifth week, and at the end of the NBT (ninth or tenth week), and 3, 6 and 12 months after completion of the NBT. The interviews were conducted in Nacadia or via telephone and lasted 25 minutes on average. They were recorded with the informants' consent and were transcribed for the further analyses.

The pre-test data consists of the interviews conducted within the NBT period (first and fifth week), and the post-data consists of the interviews conducted after the NBT. A procedure based on content analysis (Shannon, 2005) was followed during the analysis:

1. The interviews were listened to. The interviewees' style of telling about their experiences, e.g. their tone of voice, may add to an idiographic understanding of the individual informants prior to analysis and making meaning of their stories.
2. All transcripts were read and meaning units of interests in relation to the research focus were marked.
3. Meaning units from all interviews were set in a matrix in accordance with the contents of interest and were clustered in relation to recurrent themes.
4. The developed themes were elaborated based on the meaning units from the informants' stories about their experiences.

3. RESULTS

3.1 Questionnaires

A Wilcoxon Signed Ranks Test of the data from the questionnaire survey shows that there was: 1) A significant difference ($Z=-2.449$, $p<0.05$, $n=32$) in the frequency of visits to public green spaces, indicating an increased use of public green spaces; 2) No significant difference ($Z=-0.24$, $p>0.05$, $n=32$) in the frequency of visits to the informants' own gardens, balconies or common gardens where they live.

3.2 Interviews

The content analysis was conducted with the aim to qualify the possible changes in NC and provide the authors more in-depth knowledge about changes in the informants' NC. The results of the analysis are described below in relation to the content of interest and will be further discussed in the discussion section.

The content analysis of the interviews identified four recurrent themes: 1) New approach to green spaces; 2) Awareness of self and environments; 3) New attitudes to everyday tasks; and 4) Maintaining beneficial mind-sets. The themes represent the quality of how the informants use green spaces a year after having participated in NBT in the Nacadia therapy garden.

New approach to green spaces

The most noticeable recurrent theme and quality of the informants' general NC after NBT is found to be a new approach to green spaces. The informants share various stories that in different ways exemplify how they have found new insight into the potentials of green spaces, and how they have a new attitude toward using green spaces. *"Now I see nature in a whole different way. It's the first time I really notice how beautiful the spring is in Denmark. Trees are budding and are beautiful and colourful. I have never been aware of that before. It's a new way that really makes you happier. Just to be out in nature."* The quote demonstrates how an informant has become aware of new aspects of nature that she has previously not been aware of. This new awareness makes her open up to new possible human-nature interactions. Another informant, who was already aware of various aspects of nature, shares how he has learnt a new approach to how to use nature: *"I have been on many outdoor trips where I have not managed to let go of the work-related thoughts occupying my mind – at least not for long. I was caught up in all sorts of thoughts. I think that I've learned from Nacadia to be present where I am."* Similar to other stories shared by this informant, this story exemplifies an acknowledgement of how NBT has given new insight into seeing and using outdoor environments in a more beneficial way, and has thus given a new approach to something he was already familiar with.

Awareness of self and environments

The new approach was most notably found to be lived as an enhanced consciousness to exploring and experiencing the natural environments in everyday life. An informant explains: *"I have become aware of sensory nature experiences (...) There are really many different ones which I have not previously seen in that way."* Another informant adds: *"I have become more aware of how nature affects the senses (...) I experience it more in my everyday life, for example, when I'm standing by my garden pond."* The informants describe an enhanced awareness of both themselves as individuals and of themselves within the environment. The awareness of themselves seems awakened by their senses, which are roused by natural environmental factors. They describe a consciousness of how the sensory natural experiences may have an impact on them, and how they have developed an understanding of the natural environments as supportive components/factors for their well-being. This leads them to a more conscious awareness of beneficial interactions between themselves and the green environments.

New attitudes to everyday tasks

The exemplified enhanced awareness of self and environment further seems to lead to an enhanced attentiveness within the informants of their own capabilities in different everyday life situations. This can be seen in the

examples shared by several of the informants of how their new approach to NC has been converted into new attitudes to everyday life tasks and situations: *"I've obviously learned that when I begin a project in my garden, I will no longer push myself to feel completely down. I can now say: 'this is good for today, I can continue another day', without feeling bad about it."* There are also examples of how the informants' new approaches to NC have been successfully transferred into useful nature-based means in more complex and challenging environments with a higher presence of potential sociocultural stressors, e.g. working environments: *"My workplace has permitted me to go for a walk every day if I need to. I work close to a lake, so I use that area. There are three different paths I can select depending on what I need, how much time I have, and what the weather is like."* This is a good example of a supportive and collaborative employer, and it demonstrates how it is has been possible to transfer NC efficiently into a tool for actively maintaining the beneficial gains from NBT in an everyday context.

Maintaining beneficial mind-sets

Several informants tell how they use green environments more or less deliberately to maintain some of the beneficial mind-sets they have discovered and practiced during NBT. They have become more aware of exploring and discovering nature experiences that they find beneficial for their positive emotions, and they purposefully transfer and implement their new approaches to NC as a self-therapeutic mean. An informant exemplifies how she use natural environments for remembering and maintaining certain beneficial gains from the NBT in her daily life: *"When I'm in nature, I recognize some of the things I did in Nacadia. During the sessions in Nacadia there were a lot of calming nature experiences, which I recall a bit when I go out to do something in my garden, or if I'm moving around in nature. Then the calmness I know from Nacadia will come back to me again."*

The informants experience NC as a means to retaining a more beneficial state of mind, thus an enhancement of their mood and quality of life in general. An informant tells how he used a specific natural element as a way for him to recall and maintain a beneficial mind-set: *"I used the big trees in Nacadia as a way to find peace. Trees can be found everywhere – they might be seen through a window in the train, in the middle of a field or in front of 'Rundetårn', which I pass by every day. It's the trees that somehow hold such a great calmness that I take with me and use."* The quote illustrates how components from NBT are used to maintain beneficial mindsets in the informant's everyday life, thus, how NBT is transmitted from the treatment sessions to everyday life situations.

4. DISCUSSION

4.1 Enhanced Awareness

A recurrent theme of the interviews is an enhanced awareness, both of the informants' selves and of themselves within the environment. The informants' enhanced awareness seems to lead them to a higher state of being absorbed, i.e. as being "an effortless state of being fully involved and engrossed in an activity like viewing or interacting with nature" (Ballew & Omoto, 2018, p. 27), in the natural environments that they use in their everyday lives. This enhanced level of absorption is assumed based on the participants' descriptions of environmental experiences, that can be qualified as essentials of 'absorption': that is, being involved, engaging one's senses, and thus being absorbed in natural features (Ballew & Omoto, 2018). It further aligns with the quality of the psychological factor 'fascination' as elaborated by Kaplan (1995) when he explains the process of health-beneficial human-nature interactions. The process on how individuals benefit emotionally from nature experiences has been hypothesized by Ballew & Omoto (2018). Though their hypothesis is based on measures of individuals in general, their mediation model (p.31) of nature's effect on an individual's positive emotions seems to align well with the core of the qualitative findings of the present study of severely stressed informants, and with previous studies of the same case (Ulrik Sidenius, 2017). The informants' general descriptions of human-nature interactions are found to be of a quality aligning being absorbed, and their descriptions of positive effects of human-nature interactions can be closely related to the paths in the mediation model (Fig. 2).

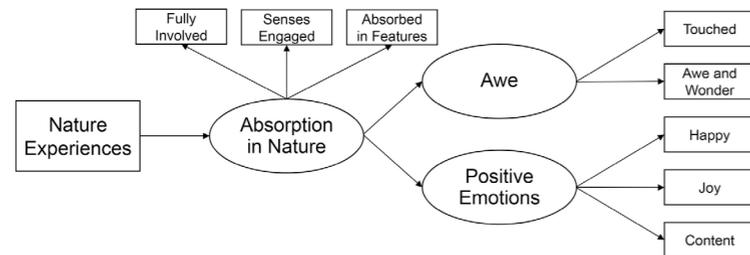


Figure 2: A simplified version of the Empirical Mediation Model of how absorption mediates the effect of nature on awe and positive emotions (Ballew & Omoto, 2018, p.31)

The mediation model hypothesizes the process of positive emotional effect of human-nature interaction on humans, which, according to Ballew and Omoto, (2018), is a process that often occurs during nature experiences. It seems that participating NBT has made the informants more aware of the general

health-beneficial potentials of natural features, and that participating NBT has led them to concrete and tangible experiences of health-beneficial human-nature interaction processes, such as those hypothesized and illustrated by the Empirical Mediation Model. It has led them to consciously seek out and engage in such processes in which natural features are used as health-supporting means.

4.2 Transferring Gains from NBT to Everyday Life

The examples under the theme 'New attitudes to everyday tasks' seem to be attempts to transfer and live such beneficial processes also in less natural environments and in everyday situations. All informants shared stories of how they benefitted differently from NBT, and of how they have implemented different individual means into their lives with regard to training and maintaining those gains. This confirms the importance of motivating 'homework' as part of NBT interventions. Through practicing 'homework', the individual participant is able to try different approaches and means from the NBT programme, and can subsequently implement the one they find to be most beneficial for them into their life. The present study and a study by Corazon et al. (2018) confirm how the informants practised and found such individual beneficial approaches and means (tools) for moving on after NBT.

From a biopsychosocial view (Timothy P. Melchert, 2015), we understand that individuals and different groups of people, e.g. groups of people with a similar diagnosis and/or symptoms, perceive and benefit differently from environments (Bucci, 2007; Grahn, Ivarsson, Stigsdotter, & Bengtsson, 2010; Ottosson & Grahn, 2008). Environmental factors can be numerous, and in the context of the present study, the main environmental factors are based on natural, cultural and social circumstances (Grahn et al., 2010; Palsdottir, 2014). The way in which environmental factors are perceived is subjective. Thus they can impact the individuals in unlimited ways, because perceptions are influenced by the individual's background, for example culture, personality, experiences, and physical and mental resources and capabilities (Grahn et al., 2010; Palsdottir, 2014).

In the present study, the informants share similar stress-related symptoms, and with the aim of developing an understanding of possible differences in this user-group's NC from prior to post participation in NBT in Nacadia, it is found that they develop an enhanced awareness of the beneficial influences of natural environmental factors on their emotions and well-being. The present study exemplifies a number of different health beneficial nature-based means that participants successfully have transferred from NBT into everyday situations. However, due to limited numbers of informants, the present study

alone is insufficient to suggest a general cause-effect pattern, making it difficult to give specific guidelines for which of the presented nature-based means would show most efficiency in the transferring and implementation to everyday context, for the participants.

4.3 Post-therapeutic Progression

In addition to developing a better understanding of the changes in NC from prior to to post NBT, it was possible to find indications of a post-therapeutic progression in relation to how informants developed an increased consciousness of how to apply NC, or essentials of NC, to everyday tasks and of how to benefit from this. Roughly speaking, the progression can be divided into two phases. During the interviews conducted three and six months after completion of the NBT, the participants describe a phase that began approximately three months after NBT during which they experienced a certain level of unhappiness. They describe a lack of motivation to perform and to maintain the beneficial means learned during NBT. However a few months later, another phase seems to begin. During the interviews conducted 12 months post NBT, the informants tend to talk more about how they, through NC, recognise, remember and resume the beneficial means and gains from NBT, and how they actively and successfully implement them in everyday contexts. This demonstrates how NC is used as a means for remembering beneficial therapeutic exercises and mind-sets practised during the NBT, as previously found by Sidenius et al. (2017) and Corazon et al. (2018). Based on the relatively limited extent of interview data from the present study, it is only possible to distinguish and describe two phases. However, the study indicates that after they move on in their everyday lives, participants experience two phases during a period of approximately 12 months after the NBT in which they adapt and find a new grounding within themselves and in their everyday environment with the new insight and approach gained from NBT.

4.4 Nature Consumption as a Post-therapeutic Tool

During that post-therapeutic progression, NC plays an important role for the informants with regard to remembering, resuming and maintaining beneficial means and gains from NBT. A good example is a participant's description of how he uses trees in an urban context to transfer means from the NBT context to his daily circumstances. Based on the four themes described above and considered within the therapeutic framework, an important conclusive aspect of NC after NBT is NC applied as a tool. In line with this, several participants describe episodes of applying NC as a tool, and describe their achievements from NBT as such: "I'm getting used to the various tools that I've learned. And they work." It is found that NC after NBT is consciously applied as a tool

with an aim of maintaining and strengthening some of the beneficial mindsets gained during NBT. The fact that several informants use the word "tool" when they describe aspects of their NC after NBT highlights an important value of the multispectral approach of the NBT in Nacadia. Namely the fact that NBT includes a broad spectrum of nature-based means with different focus and approaches to body, mind and environment: different nature-based awareness exercises and different nature-based activities, supported by conversation therapy, opportunities to try on you own, and homework (Corazon et al., 2018b). It offers the individual participants opportunities to explore and obtain the means that are most meaningful and beneficial to them during NBT, which in turn equips the participants with individual post-therapeutic tools concerning both body, mind, environment and possible synergies in between body, mind and environment.

The broad spectrum of NBT means makes the NBT more easily applicable to the individual participant's everyday life situations. The broad spectrum approach to human health from NBT in Nacadia can be said to find support in the contemporary view on stress and health in behavioural, nursing and health care in general, where a biopsychosocial view concerning both body, mind and environment is on the rise (Taylor & Francis, 2013; Melchert, 2015). It demonstrates NBT, natural features and NC as important potential tools for people to find support and maintain good health, and as such these are important factors to contemplate for landscape architects and urban planners as well as health professionals.

4.5 Mixed Methods

The statistical calculation of the data from the questionnaire survey shows that there is no difference in the frequency of visits to the informants' own gardens before and after NBT. This finding is inconsistent with the interview data, in which the informants generally stated that the frequency of their use of gardens after NBT had increased.

A reason why the statistical calculation shows no significance may be that the questionnaire was sent to the informant 12 months after participating NBT. That caused a difference of at least 14 months between pre- and post-tests. During the autumn and winter months, use of gardens on average are lower than during the summer months. Thus, for several informants who received NBT during the summer months, a constant or even reduced sequence of use of garden in the pre/post period was found. Pre- and post-tests from even seasons would probably have generated more reliable findings. For the present study, the impact of the seasonal-based factors on the frequency of NC offsets the possibility to measure the possible impact of NBT on the frequency of NC.

Despite of the insufficient quality of the questionnaire data, the use of mixed methods, which is recommended for health science (Taylor & Francis, 2013), made it possible for the authors to assess and understand the quantitative measures alongside the qualitative findings, and to develop a broader understanding of the informants' interaction with the environments.

4.6 Implications and Future Research

The present study highlights health-beneficial approaches to NC and asks for more comprehensive studies with a similar focus. Studies of the post-therapeutic period would be beneficial for a comprehensive understanding of the post-therapeutic process and to develop more knowledge of, for example, when and how NC means are applied and implemented in the participants' everyday life situations, and if some NC means are more beneficial and more easy to implement than others.

Future studies with pre- and post-tests focusing on stress- and health-related measures in association to human-nature interactions could help explain the health beneficial mechanisms and cause-effect of NC in relation to stress-related illnesses, and thus illuminate the most beneficial nature-based means applicable for everyday life situations. Future studies of NBT and the post-therapeutic period would benefit from an increased psychologically based focus on the phases of the informants' progression. Such a focus could be an advantage for finding how means from the NBT programme can be modified or added to ease the transfer and implementation of beneficial tools from NBT to everyday life, thus, supporting the participants' development efficiently during the period after NBT.

An increased understanding of different approaches to NC may inspire and motivate city planners and landscape architects to develop more health-beneficial green environments, to implement natural features in the built environments, or to let green environments remain green environments for the benefit of public health. Such nature-based landscape architectural initiatives find support from The European Union's research and innovation policy agenda on Nature-Based Solutions and Re-Naturing (*Towards an EU Research and Innovation Policy Agenda for Nature-Based Solutions & Re-Naturing Cities, 2015*), and from the World Health Organization's 'Urban green spaces: a brief for action', which is based on evidence compiled on urban green space (World Health Organization, 2017).

5. CONCLUSION

Using a mixed-method approach, the present study has presented an understanding of how informants diagnosed with stress-related symptoms

consume natural features differently after having participated in NBT compared with before such participation. A contradiction in the findings of the qualitative measures and the statistical measures was detected. The questionnaire data proved to be insufficient with regard to informing the present aim. The mixed method approach, however, helped the authors to establish, not only the changed frequency of informants' NC post NBT, but also a deeper insight into why and how they use the natural environments differently.

The content analysis showed that NBT provided informants with a new insight into NC. The quality of the changes in NC post NBT was determined and organised in four themes: 1) New approach to nature; 2) Awareness of self and environments; 3) New attitudes to everyday tasks; and 4) Maintaining beneficial mind-sets. The NBT (re-)awakened the informants' awareness of beneficial human-nature interactions. The overall new approach to NC is found to hold the essentials of 'absorption' and 'fascinations', which have used by theorists to explain nature's health-beneficial effect on peoples' positive emotions. NC post NBT helps the informants remember and motivates them to use and maintain some of the beneficial mind-sets they discovered during the course of the NBT intervention. NC post NBT can be considered as a beneficial health-promoting tool for transferring health-beneficial means from NBT into participants' everyday life. The present study suggests a comprehensive study focusing on post-therapeutic progression and studies with enhanced focus on the transmissibility of nature-based means from NBT to participants' everyday situations are needed.

ACKNOWLEDGEMENTS

The authors would like to thank the staff from Nacadia; Our former colleague: Landscape architect, PhD, Anne Dahl Refshauge for her contribution to the study; And all the informants for sharing their data for the study.

REFERENCES

- Annerstedt, M., & Währborg, P. (2011). Nature-assisted therapy: Systematic review of controlled and observational studies. *Scandinavian Journal of Public Health*. <https://doi.org/10.1177/1403494810396400>
- Ballew, M. T., & Omoto, A. M. (2018). Absorption: How nature experiences promote awe and other positive emotions. *Ecopsychology, 10*(1), 26–35. <https://doi.org/10.1089/eco.2017.0044>
- Bragg, R., & Atkins, G. (2016). *A review of nature-based interventions for mental health care. Natural England Commissioned Reports*

(Vol. 204). Retrieved from <http://publications.naturalengland.org.uk/publication/4513819616346112>

- Bucci, W. (2007). Dissociation from the Perspective of Multiple Code Theory, Part I. *Contemporary Psychoanalysis, 43*(2), 165–184. <https://doi.org/10.1080/00107530.2007.10745903>
- Corazon, Sus Sola; Sidenius, Ulrik; Vammen, Katrine Skjoedt; Klinker, Sabine Elm; Stigsdotter, Ulrika K.; Poulsen, D. V. (2018). The Tree Is My Anchor: A pilot study on the treatment of BED through Nature-Based Therapy. *International Journal of Environmental Research and Public Health, 15*.
- Corazon, S., Nyed, P., Sidenius, U., Poulsen, D., & Stigsdotter, U. (2018). A Long-Term Follow-Up of the Efficacy of Nature-Based Therapy for Adults Suffering from Stress-Related Illnesses on Levels of Healthcare Consumption and Sick-Leave Absence: A Randomized Controlled Trial. *International Journal of Environmental Research and Public Health, 15*(1), 137. <https://doi.org/10.3390/ijerph15010137>
- Corazon, S., Poulsen, D., Sidenius, U., & Gramkow, M. (2018a). Konzeptmanual for Nacadias naturbaserede terapi. Retrieved from <http://www.forskningsdatabasen.dk/en/catalog/2394870903>
- Corazon, S., Poulsen, D., Sidenius, U., & Gramkow, M. (2018b). Konzeptmanual for Nacadias naturbaserede terapi, (January). Retrieved from <http://www.forskningsdatabasen.dk/en/catalog/2394870903>
- Corazon, S., Stigsdotter, U., Jensen, A. G. C., & Nilsson, K. S. B. (2010). Development of the nature-based therapy concept for patients with stress-related illness at the Danish healing forest garden Nacadia. *Journal of Therapeutic Horticulture, 20*, 33–51.
- European Union. (2015). *Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities*. Luxembourg. <https://doi.org/10.2777/765301>
- Grahn, P., Ivarsson, C. T., Stigsdotter, U. K., & Bengtsson, I.-L. (2010). Using affordances as a health-promoting tool in a therapeutic garden. In C. Ward Thompson, P. Aspinall, & S. Bell (Eds.), *Innovative approaches to researching landscape and health* (pp. 120–159). New York: Routledge. <https://doi.org/10.4324/9780203853252>
- Grahn, P., & Stigsdotter, U. A. (2003). Landscape planning and stress. *Urban Forestry & Urban Greening, 2*(1), 1–18. <https://doi.org/10.1078/1618-8667-00019>
- Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and Health. *Annual Review of Public Health, Vol 35*, 35, 207–228. <https://doi.org/10.1146/annurev-publhealth-032013-182443>
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182.
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment

on health inequalities: an observational population study. *Lancet (London, England), 372*(9650), 1655–1660. [https://doi.org/10.1016/S0140-6736\(08\)61689-X](https://doi.org/10.1016/S0140-6736(08)61689-X)

- Nilsson, K., Sangster, M., Gallis, C., Hartig, T., de Vries, S., Seeland, K., & Schipperijn, J. (Eds.). (2011). *Forests, Trees and Human Health*. Dordrecht: Springer Netherlands. <https://doi.org/10.1007/978-90-481-9806-1>
- Ottosson, J., & Grahn, P. (2008). The Role of Natural Settings in Crisis Rehabilitation: How Does the Level of Crisis Influence the Response to Experiences of Nature with Regard to Measures of Rehabilitation? *Landscape Research, 33*(1), 51–70. <https://doi.org/10.1080/01426390701773813>
- Palsdottir, A. M. (2014). *The Role of Nature in Rehabilitation for Individuals with Stress-related Mental Disorders Alnarp Rehabilitation Garden as Supportive Environment*. Dept. of Work Science, Business Economics and Environmental Psychology, Swedish University of Agricultural Sciences.
- Ritchie, J., Lewis, J., & Nichols, C. (2013). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*.
- Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research, 15*(9), 1277–1288. <https://doi.org/10.1177/1049732305276687>
- Sidenius, U. (2017). *The Therapy Garden Nacadia@ The interplay between evidence-based health design in landscape architecture, nature-based therapy and the individual*. University of Copenhagen.
- Sidenius, U., Nyed, P. K., Lygum, V. L., & Stigsdotter, U. K. (2017). A diagnostic post-occupancy evaluation of the Nacadia® therapy garden. *International Journal of Environmental Research and Public Health, 14*(8). <https://doi.org/10.3390/ijerph14080882>
- Sidenius, U., Stigsdotter, U. K., & Dahl Refshauge, A. (2015). A year in the therapy forest garden Nacadia® - participants' use and preferred locations in the garden during a nature-based treatment program. *ALAM CIPTA, International Journal of Sustainable Tropical Design Research and Practice, 8*(2), 44–53.
- Sidenius, U., Stigsdotter, U. K., Poulsen, D. V., & Bondas, T. (2017). "I look at my own forest and fields in a different way" - The lived experience of nature-based therapy in a therapy garden when suffering from stress-related illness. *International Journal of Qualitative Studies on Health and Well-Being*. <https://doi.org/10.1080/17482631.2017.1324700>
- Stigsdotter, U. K. (2014). Nacadia Healing Forest garden, Hoersholm Arboretum, Copenhagen, Denmark. In C. C. Marcus & N. A. Sachs (Eds.), *Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces* (pp. 198–205). Hoboken (N.J.): John Wiley & Sons Ltd.

- Stigsdotter, U. K., Corazon, S. S., Sidenius, U., Nyed, P. K., Larsen, H. B., & Fjorback, L. O. (2018). Efficacy of nature-based therapy for individuals with stress-related illnesses: randomised controlled trial. *British Journal of Psychiatry*, 8. <https://doi.org/10.1192/bjp.2018.2>
- Stigsdotter, U. K., Ekholm, O., Schipperijn, J., Toftager, M., Kamper-Jørgensen, F., & Randrup, T. B. (2010). Health promoting outdoor environments - Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. *Scandinavian Journal of Public Health*, 38(4), 411–417. <https://doi.org/10.1177/1403494810367468>
- Stigsdotter, U. K., & Randrup, Th. B. (2008). *Konceptmodel Terapihaven Nacadia: en model for terapihaver og haveterapi for stressramte i Danmark*. Design. Frederikberg.
- Taylor, B., & Francis, K. (2013). *Qualitative Research in the Health Sciences: Methodologies, Methods and Processes*. New York: Routledge.
- Timothy P. Melchert. (2015). *Biopsychosocial Practice: A Science-Based Framework for Behavioral Health Care*. Washington DC: American Psychological Association. Retrieved from <http://www.apa.org/pubs/books/4317346.aspx>
- World Health Organization. (1992). *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical descriptions and diagnostic guidelines*. Geneva: World Health Organization. [https://doi.org/10.1002/1520-6505\(2000\)9:5<201::AID-EVAN2>3.3.CO;2-P](https://doi.org/10.1002/1520-6505(2000)9:5<201::AID-EVAN2>3.3.CO;2-P)
- World Health Organization. (2017). *Urban green spaces: a brief for action*. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0010/342289/Urban-Green-Spaces_EN_WHO_web.pdf?ua=1

Ulrika Karlsson Stigsdotter^{1*}, Ulrik Sidenius¹ and Patrik Grahn²

¹Nature, Health & Design Research Group, Section for Landscape Architecture and Planning, Department of Geosciences and Natural Resource Management, Faculty of Science, University of Copenhagen, Denmark

²Department of Work Science, Business Economics and Environmental Psychology
The Swedish University of Agricultural Sciences, Sweden

* Corresponding author:
UKS@ign.ku.dk

ABSTRACT

Current trends in urbanisation present challenges connected to human health. In the Research and Innovation policy agenda on Nature-Based Solutions and Re-Naturing Cities, the European Union acknowledges the role nature can play in relation to these challenges. The World Health Organization (WHO) calls for green space interventions to address urban health issues such as mental health and furthermore emphasises the need for more information on designing efficient health-promoting urban green spaces. This paper considers how green spaces may be designed to promote human mental health. Previous research reports that certain nature quality types, Perceived Sensory Dimensions (PSDs), have positive impacts on mental health. This paper aims to describe operationalisation of the PSDs into an applicable design tool for practitioners, such as landscape architects and urban planners. The paper includes the application of the tool in the design of Health Forest Octovia® research and demonstration setting. This operationalisation resulted in a design tool with six steps: 1. Determine the aim of the PSD, 2. Determine the scale, 3. Identify context, 4. Identify existing rooms, 5. Identify and graduate existing PSDs, and 6. Start design phase. After establishing Health Forest Octovia®, a research study validated the health-promoting design. Further validation of the design tool, however, requires its application in other research-based design projects. The current study concludes that the 8 PSD health-promoting design tool could function as an evidence-based design tool for nature-based solutions and could enhance sustainable urbanisation by promoting the mental health of residents.

Keywords: Evidence-based design, health design, health promotion, landscape architecture, mental health, nature-based solutions, sustainable urban planning, urbanisation

1. INTRODUCTION

Today, over 70 percent of Europe’s population lives in cities, a figure that is expected to increase to over 80 per cent by 2050 (European Union, 2015). This urbanisation may present challenges related to, for example, human health, loss of natural capital, and climate change (European Union, 2015). The European Union (EU) recognises the important role nature can play relative to these challenges. The EU Research and Innovation policy agenda on Nature-Based Solutions and Re-Naturing Cities was published in 2015 with the aim of positioning the EU as a leading actor in “innovating cities with nature” (European Union, 2015, p. 28). The EU uses the term ‘nature-based solutions’ for various solutions inspired and supported by nature (European Union, 2015). ‘Enhancing sustainable urbanization’ is one area that the EU claims can be addressed by nature-based solutions, with nature-based solutions stimulating “economic growth as well as improving the environment, making cities more attractive, and enhancing human well-being” (European Union, 2015, p. 4). Admirable though the EU’s ambitions may be, challenges remain. One challenge is to understand that not all green spaces promote human health (Marcus & Sachs, 2014). This is central to the concept of ‘health design’ within landscape architecture, which is defined as “the conscious design of green spaces and gardens so that they, in a certain way, support health processes and result in improved health outcomes” (Stigsdotter, 2015, p. 90). This is also noted by the World Health Organization (WHO) regional office for Europe, which states that “understanding how to design and deliver effective urban green space interventions is critical to ensuring that urban green space delivers on its reported positive health, social and environmental outcomes” (WHO, 2017, p. 6). Various projects have sought to develop green space indicators or assessment tools for public health (e.g. van den Bosch et al., 2015). These indicators and tools frequently focus on factors such as distance to and size of green spaces but fail to address the quality of green spaces and lack applicability in the actual design process.

It is likewise crucial for designers to understand what health is and how green spaces can support health. The WHO defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948, p. 100). This is a holistic definition, though research indicates that green spaces can support health via different pathways, by indirectly encouraging physical activity (Lovell, 2016) and social activities (Maas, van Dillen, Verheij, & Groenewegen, 2009) as well as by directly improving mental health by offering mental restoration (Hartig, Evans, Jamner, Davis, & Gärling, 2003). Mental restoration refers to a process in which mental recovery is triggered by certain components of the environment (Kaplan, 1995). These components are most often found in natural environments, which are thereby referred to as ‘restorative environments’ (Kaplan, 1995).

1.1 Research Project on Nature Qualities that Support Mental Health

On the basis of a joint project, researchers from the University of Copenhagen and the Swedish University of Agricultural Sciences (SLU) argued that not all green spaces are capable of supporting human health (Grahn & Stigsdotter, 2010). The researchers claimed that quality of green spaces is crucial. The overall hypothesis was that “People perceive green spaces in terms of certain dimensions” and that “some dimensions are more important than others as regards restoring people from stress” (Grahn & Stigsdotter, 2010, p. 266). One significant research question addressed was whether people suffering from stress prefer different dimensions to people who are not stressed (Grahn & Stigsdotter, 2010). Nearly 1000 randomly selected informants in Sweden answered a questionnaire regarding their preferences for nature qualities and self-assessments of health. The data was analysed using factor analysis, and eight factors with regard to preferences for nature qualities were identified (Table 1). This was the third time these eight dimensions had been identified in research, but it was the first time it had been possible to correlate them with mental health (Grahn & Stigsdotter, 2010.). The factors were interpreted as Perceived Sensory Dimensions (PSDs). People in general prefer the PSD Serene, followed by Space, Nature, Rich in Species, Refuge, Culture, Prospect, and Social (Grahn & Stigsdotter, 2010.). The PSDs Refuge and Nature were most strongly associated with stress. However, the individual PSDs are seldom found in isolation, and the research project identified a combination of Refuge, Nature, and Rich in Species, with no presence of Social, as the most restorative environment for stressed individuals (Grahn & Stigsdotter, 2010).

Land owners, managers, and policymakers have shown considerable interest in the 8 PSDs but have complained that they are difficult to apply in practice. As a result, the University of Copenhagen initiated the Health

Forest Octovia® project, a full-scale research and demonstration setting established within Denmark’s largest arboretum. Health Forest Octovia® covers an area of approximately 2 hectares and is composed of eight different spatial settings, referred to as ‘rooms’. Each room has been redesigned to accentuate one particular PSD. A 750-meter trail connects the eight rooms in a circular walk. After Health Forest Octovia® was established, a mixed-methods research project with a crossover design was conducted. The project results confirm that informants experience Health Forest Octovia® as mentally restorative, as measured by the Perceived Restorativeness Scale (PRS) (Stigsdotter, Corazon, Sidenius, Kristensen, & Grahn, 2017a). Health Forest Octovia® also proved more physiologically restorative than an office or a bus ride, as measured by Heart Rate Variability (HRV) and pulse (Stigsdotter et al., 2017a). The Profile of Mood Scale (POMS) psychological questionnaire also supported the positive impact of Health Forest Octovia® on informants’ mood (Stigsdotter et al., 2017a). Informants furthermore ranked the rooms representing Serene, Rich in Species, Refuge, and Nature as the most restorative, thereby confirming the earlier research results (Stigsdotter, Corazon, Sidenius, Refshauge, & Grahn, 2017b). We interpret the results as a validation of Health Forest Octovia®’s design. In parallel with Health Forest Octovia®’s design process, we developed and applied a stepwise model for how the PSDs could be applied in practice. In this paper, the term ‘operationalise’ is defined as ‘put into operation or use’. The paper aims to transparently describe the operationalisation and application of this stepwise model, which we believe can serve as a tool for designing health-promoting green spaces.

2. MATERIALS AND METHODS

As mentioned above, the 8 PSDs health-promoting design tool was developed during the design process of Health Forest Octovia®. Grounded in the need for evidence-based and transparent work processes, the team of designers and researchers documented the entire design process and all design decisions in great detail. Input from both practitioners and students was also considered when developing the six steps that constitute the PSDs health-promoting design tool.

2.1 Operationalisation of the Eight Perceived Sensory Dimensions into a Design Tool

The 8 PSDs are a result and interpretation of a factor analysis (Grahn & Stigsdotter, 2010) that identified eight factors, with differing numbers of variables. Because consideration of the full range of variables is essential to the operationalisation process, these are presented in Table 1. The

interpretations of the factors, as presented by Grahn and Stigsdotter (2010), can support understanding of the special characteristics of the various factors taken together. Practitioners who attempt to design on the basis of their interpretations alone often experience that these represent too vague a basis for design decisions. Table 1 also presents the factor loadings, indicating the strength of associations between the variables and each factor. Two variables in Factor 8 (PSD Serene) have caused some confusion because they are negatively loaded. The variables are: ‘There are plenty of people and movements in the green space’ (factor loading -0.78) and ‘It is possible to watch other people being active, playing, practicing sports, etc.’ (factor loading -0.69). These should be understood as indicating the opposite, i.e. ‘There are not plenty of people and movements in the green space’ and “It is not possible to watch other people being active, playing, practicing sports, etc.’

In previous research (Grahn & Stigsdotter, 2010), the terms ‘urban park’ or ‘urban open space’ have been used to label the settings. In Table 1, the terminology has been changed to the broader term ‘green space’ because the 8 PSDs have been used in both research and practice at various scales and in various types of green spaces, not just in urban settings. For example, the PSDs have been used successfully in large-scale research projects at the regional level (Annerstedt, Östergren, Björk, Grahn, Skärbäck, & Währborg, 2012), including large forest areas; medium-scale projects at the city level (Skärbäck, Björk, Stoltz, Rydell-Andersson, & Grahn, 2014), including urban parks; and small-scale projects at the garden level (e.g. Palsdottir, Stigsdotter, Persson, Thorpert, & Grahn, 2018), including therapy gardens.

Practitioners have primarily used the 8 PSDs for three different functions: 1. To analyse which PSDs are present in different existing green spaces (Randrup, Schipperijn, Hansen, Jensen, & Stigsdotter, 2008), 2. To guide the redesign of existing green spaces (Stockholms läns landstings Regionplane- och trafikkontoret, 2004), and 3. In teaching and research, the 8 PSDs have

been used in combination: a) To analyse the preconditions for green space, b) To guide the redesign process, and c) To evaluate the redesign in a post-occupancy evaluation (Sidenius, 2017).

Because the PSDs are context dependent, it is vital to understand a green space’s context. The PSD Nature can be very strong in an urban park, though such a setting will not, of course, present this PSD at the same magnitude as in the wilderness of, for example, Yellowstone National Park. If the PSDs are used to analyse existing conditions, then the green spaces must be analysed on the basis of their contexts. This means that an urban park with a strong PSD Nature can achieve the highest graduation in strength. In order to make the work transparent and comprehensible to others, it is therefore important to describe the context in one’s own words.

It is necessary to determine where a PSD begins and ends. A research project involving four Danish municipalities prompted use of a classification system for different types of rooms in green spaces (Randrup, et al., 2008). The classification was originally developed by the Swedish researchers Gustavsson and Ingelög (1994) but was further developed by Randrup et al. (2008). In order to match Danish types of rooms in green spaces, a fourth type, Spread, was added to the original three (Randrup et al., 2008). The four types of rooms are characterised as follows: 1. Open, an open space without planting, 2. Spread, an open space with scattered planting, 3. Glade, a space formed by walls, but without a ceiling, and 4. Closed, a closed room in which tree branches form a ceiling (Figure 1). These room types may be helpful for identifying where one dominant PSD stops and the next PSD takes over. It is furthermore worth recalling that staff from both departments of nature and departments of health in four municipalities participated in the Danish study from 2008 (Randrup, et al., 2008). Exercises analysing existing PSDs in various green spaces showed consensus in results, regardless of the department at which informants were employed. This may indicate that the PSDs are relatable to people, no matter their training and educational backgrounds.

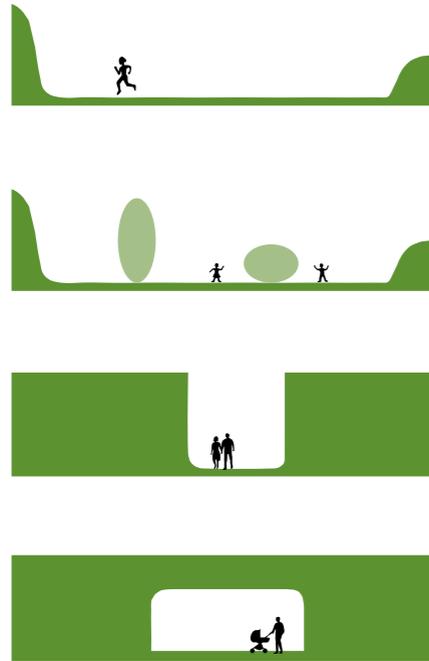


Figure 1: The four room types used in the 8 PSD health-promoting design tool. (Source: Randrup, et al., 2008)

As mention above, the PSDs are seldom found in isolation; one room can contain multiple PSDs. Nevertheless, one PSD is usually dominant or ‘stronger’ than the others. The non-dominant PSDs can support or potentially conflict with the dominant PSD. In the aforementioned example of the combination of PSDs constituting a restorative green space, the PSD Social conflicts with the combination of PSDs Refuge, Nature, and Rich in Species. The list of variables (Table 1) is useful for identifying a room’s dominant PSD. It is often which PSD is dominant, but marking which variables are present makes the process transparent. A graduation for each PSD can be undertaken on the basis of this analysis. The graduation for each room is as follows: 0. Absence, the PSD cannot be identified, 1. Weak, the PSD can be poorly identified, 2. Moderate, the PSD can be identified but is not significant, 3. Strong, the PSD is very significant or cannot be found stronger. One can identify the dominant PSD in a room and give it a grade from 0 to 3 based on the present variables. One can then identify the other PSDs that are present and give them grades from 0 to 3 as well. This process of PSD identification

and graduation in different rooms can be advantageously performed for different functions: 1. To analyse which PSDs are present in different existing green spaces, 2. To guide the redesign process, and 3. To evaluate the redesign in a post-occupancy evaluation.

Table 1: The variables and factor loadings for each factor/Perceived Sensory Dimension. The term ‘green space’ is used here (Source: Grahn & Stigsdotter, 2010)

Factor 1 – Nature	
Variables	Factor loading
The green space has a nature quality.	0.71
The green space has a wild and untouched quality.	0.63
There are free growing lawns.	0.54
It is possible to light a fire in the green space.	0.50
It feels safe spending time in the green space.	0.49
One is able to spend time in the green space without coming into contact with too many people.	0.47
The green space contains hilly areas.	0.44
Factor 2 – Culture	
Variables	Factor loading
The green space is decorated with fountains.	0.73
The green space is decorated with statues.	0.65
The green space contains a wide range of foreign plants, ornamental plants, and kitchen plants.	0.65
The green space has the characteristic of a city park.	0.57
The green space has different water features, such as ponds, canals.	0.52
The green space is ornamented with flowers.	0.50
The green space has a wooded pasture quality.	0.46
Factor 3 – Prospect	
Variables	Factor loading
The green space contains lawns and well-cut grass surfaces.	0.87
It is possible to gain an overview, with vistas over the surroundings.	0.78
The lawns are cut.	0.76
The green space has grass football pitches.	0.68
The green space has gravel football pitches.	0.50
The football pitches are lit up.	0.48
That green space has small ball grounds on asphalt.	0.47
Showers and changing rooms are available.	0.43
Factor 4 – Social	
Variables	Factor loading
It is possible to observe entertainment, like a park concert.	0.94
It is possible to observe exhibitions.	0.92
It is possible to visit a restaurant or a simple open-air restaurant in the green space.	0.89
It is possible to shop at market stalls, kiosks, etc.	0.78
There are plenty of people and movement in the green space.	0.74
The green space contains roads and gravel paths.	0.72
The green space holds special park animals, like swans, ducks and deer.	0.66
The green space has generally good lighting.	0.64
The roads are well lit.	0.63
There is access to washrooms.	0.60
There are places in the green space sheltered from the wind.	0.59

There are sunny places.	0.54
There are shady places.	0.52
The green space contains several seats and benches.	0.50
It feels safe spending time in the green space.	0.44
There are tables and benches.	0.38
The green space contains roads and paths with hard surfaces, such as asphalt, and concrete bricks.	0.33
Factor 5 – Space	
Variables	Factor loading
The green space is experienced as spacious and free.	0.89
It is possible to find areas not crossed by roads and paths.	0.87
The green space has numerous trees.	0.58
It is possible to find places where a group of several people can gather.	0.52
There are places in the green space sheltered from the wind.	0.49
There are sunny places.	0.44
There are shady places.	0.42
Factor 6 – Rich in species	
Variables	Factor loading
One can detect several animals, such as birds and insects.	0.97
The green space consists of natural plant and animal populations.	0.96
There are many native plants to study.	0.87
Factor 7 – Refuge	
Variables	Factor loading
The green space contains many bushes.	0.93
The green space holds animals that children and adults may feed and pet.	0.87
There are sand boxes.	0.77
There is play equipment, such as swings, slides, etc.	0.73
It is possible to watch other people being active, playing, engaging in sports, etc.	0.58
It feels safe spending time in the green space.	0.57
There are tables and benches.	0.36
Factor 8 – Serene	
Variables	Factor loading
The green space is silent and calm.	0.94
There are no bikes in the green space.	0.89
One is able to spend time in the green space without coming into contact with too many people.	0.84
There are plenty of people and movements in the green space.	-0.78
There are no mopeds.	0.74
It is possible to watch other people being active, playing, practicing sports, etc.	-0.69
The area is clean and well maintained.	0.60
There is no traffic noise from the surroundings.	0.57
It feels safe spending time in the green space.	0.50

2.2 Application of the 8 PSD Health-Promoting Design Tool in the Design of Health Forest Octovia®

In this study, the 8 PSD health-promoting design tool was used to guide the redesign of eight areas in an arboretum. The Hørsholm arboretum is located 30 kilometres north of Copenhagen and is regarded as Denmark’s largest botanical collection of woody plants. Planted in relation to their geographical

origins and generic affiliations, over 2000 species can be found in the arboretum (Jensen, 1994). The arboretum covers approximately 40 hectares and was established in 1936 (Jensen, 1994). Today the arboretum has the character of a majestic forest with exotic elements. There are three lakes in the arboretum, which attracts wildlife, especially birds. There were a number of advantages to establishing Health Forest Octovia® in an arboretum. The setting already possessed a natural and mature expression, and many of the 8 PSDs already existed. However, there were also some limitations. Since the arboretum is a highly valuable collection of trees and bushes, it was important not to damage the roots of the plants. This affected the placement of benches, new plantings, and paths. It was also impossible to change the expression of the planting by introducing plants that did not belong in the geographical area in question or to decorate or supply the area with sculptures, canals, or constructed shelters, washrooms, and other amenities that clashed with the arboretum’s natural expression or collection.

Based on an analysis of existing variables for the PSDs (Table 1) during all four seasons, eight areas in the arboretum were identified as already good (Rich in Species, Space, Nature, Prospect, and Serene) or fairly good (Culture, Refuge, and Social) representations of the eight PSDs. During the design process, they were all redesigned to accentuate this particular sensory dimension. The borders of each area were identified using the classification system for different types of rooms in green spaces (Gustavsson & Ingelög, 1994; Randrup, et al., 2008) and are marked with a red line in Figure 2. With the help of a surveyor, the rooms were measured and marked on a map in great detail.

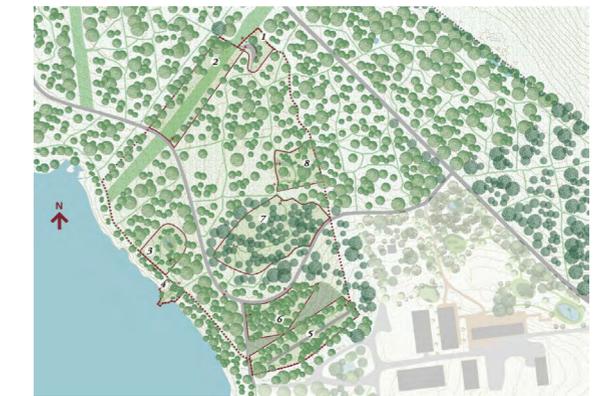


Figure 2: Site illustration of Health Forest Octovia®. Rooms are marked with a red line

The name Octovia was created specifically for the Health Forest and refers to the eight rooms connected by one path, deriving from the Latin octo (eight) and via (path/road). The rooms in Health Forest Octovia® were placed and numbered in accordance with their location along the path. The order of the PSDs thus differs from the order in the factor analysis (as presented in Table 1). Room 1 in Health Forest Octovia® represents the PSD Social, but this room also functioned as a gathering place, with information (signpost with text and QR code) about Health Forest Octovia® as a whole. All rooms had a signpost describing the current PSD and explaining how the room was designed. Entrances to all rooms were marked with a numbered granite stone placed on the ground. A similar stone marked the exit, and an arrow indicated the direction to the next room. All rooms also had seating. In Health Forest Octovia®, the rooms had the following order: 1. PSD Social, 2. PSD Prospect, 3. PSD Rich in Species, 4. PSD Serene, 5. PSD Culture, 6. PSD Space, 7. PSD Nature, and 8. PSD Refuge. In the following sections, the design of each PSD in Health Forest Octovia® will be transparently described, including site illustrations and tables describing each variable.

2.2.1 PSD Social

The room is designed to be prepared for visitors, where they could gather, eat, drink, have fun, and watch other people (Figure 3). It should be easy for visitors to get around in the room and find comfortable seating. The shape of the room is semi-circular. The walls consist of wood stacks, small trees, shrubs, and perennials. The location of the benches follows the room's semi-circular shape. The room opens up to the surroundings, and the room type is classified as Open. The floor consists of gravel and is directly connected to a gravel path. The open area enables several kinds of activities. The room has four long benches, some placed in the sun and others in the shade. The benches are placed so the visitors can watch other people in the room at the same time as they have a view of a good part of the arboretum. The wood stacks are located behind the benches, and their function is to create shelter from the wind, make the area feel safe, and define the room. Numerous birdhouses are placed in the trees and bushes behind the benches, with the aim of attracting some of the many birds that nest in the arboretum. A portable fire pit can be placed centrally in the room. The fire pit becomes a focal point but also allows for activities such as heating coffee and grilling sausages. In addition, the fire spreads heat, light, and a sense of security. Out of 17 variables, seven have been fulfilled, seven are partly fulfilled, and three are unfulfilled (Table 2). Bearing in mind the context and the limitations regarding what can be constructed, we conclude that the PSD Social dominates this room, and we grade the design as moderate (2). The PSDs Refuge and Rich in species are also present, though both are weak (1).

Table 2: Description of how the variables constituting the PSD Social were adopted in the design of Health Forest Octovia®

PSD Social – Room 1 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
It is possible to observe entertainment, like a park concert.	The larger open area in the room provides potential for various activities. The benches face the open area.		X	
It is possible to observe exhibitions.	The larger open area in the room provides potential for various activities.		X	
It is possible to visit a restaurant or a simple open-air restaurant in the green space.	It is not permitted to construct buildings in the arboretum, but a portable fire pit can be used to heat coffee or grill sausages.		X	
It is possible to shop at market stalls, kiosks, etc.	It is not permitted to build stalls or other constructions in the arboretum.			X
There are plenty of people and movement in the green space.	The arboretum has only approximately 25,000 visitors per year. The location of the room near the main road and the good overview of a large open area make it easy to discover other visitors.		X	
The green space contains roads and gravel paths.	The room is located in direct connection to a gravel path, and the main road of gravel is close by.	X		
The green space holds special park animals, like swans, ducks and deer.	The arboretum is rich in wildlife, and the birdboxes in the room are intended to attract birds.		X	
The green space has generally good lighting.	Electric lighting is not permitted in the arboretum, but it is quite a bright and open space, and the portable fire pit can contribute light.		X	
The roads are well lit.	Electric lighting is not permitted in the arboretum.			X
There is access to washrooms.	It is not permitted to build washrooms in the arboretum.			X
There are places in the green space sheltered from the wind.	The wood stacks behind the benches have the function of creating shelter from the wind.	X		
There are sunny places.	Some of the benches in the room are located in the sun.	X		
There are shady places.	Some of the benches in the room are located in the shade.	X		
The green space contains several seats and benches.	This room has the most benches of all rooms in Health Forest Octovia®.	X		
It feels safe spending time in the green space.	The benches are placed in a semicircle, so one can view other visitors. The fire pit in the middle of the room contributes to a feeling of security. From the room, visitors have a good overview, which can also contribute to security.	X		
There are tables and benches.	There are several benches in the room, but tables are not permitted in the arboretum.		X	
The green space contains roads and paths with hard surfaces, such as asphalt and concrete bricks.	It is the only room in Health Forest Octovia® that contains a solid surface of gravel, which is directly connected to a gravel path. Asphalt or similar are not permitted in the arboretum.	X		



Figure 3: Site illustration of the PSD Social in Health Forest Octovia®

2.2.2 PSD Prospect

The room is designed to have two dominant qualities, in line with the variables (Figure 4). The first quality concerns open surfaces from which the visitor has views over his or her surroundings, while the other quality relates to surfaces and facilities for ball games. The room has an elongated rectangular shape, and the floor is flat with cut grass. The sides of the long sides consist of shrubs and trees. The room type is classified as Open. Views are open at each end of the room, with one view toward a large lake and the other toward the arboretum's main path. Two benches stand far apart in the room. One is placed so the visitor gets a good view over the room, and the other one is placed so the visitor gets a view of the lake. The room's openness makes it flexible, and it can be used for many activities, such as ball games. The PSD Prospect is dominant in this space and is graded as powerful (3) due to its context of an arboretum and not a sports area. This is motivated by the fact that the four variables with the strongest factor loading have been integrated into the design. The final four variables, which all focus on ball games, have not been possible to realise in the design (Table 3). No other supporting PSDs exist in this room.

Table 3: Description of how the variables constituting the PSD Prospect were adopted in the design of Health Forest Octovia®

PSD Prospect – Room 2 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space contains lawns and well-cut grass surfaces.	The room is dominated by a large, rectangular lawn.	X		
It is possible to gain an overview, with vistas over the surroundings.	There are views from the benches into the room and toward the lake outside the room.	X		
The lawns are cut.	The lawns are cut regularly.	X		
The green space has grass football pitches.	The large lawn can be used as a football pitch.	X		
The green space has gravel football pitches.	It is not permitted to establish a gravel football pitch in the arboretum.			X
The football pitches are lit up.	Electric lighting is not permitted in the arboretum.			X
That green space has small ball grounds on asphalt.	Asphalt is not permitted in the arboretum.			X
Showers and changing rooms are available.	It is not permitted to build washrooms in the arboretum.			X

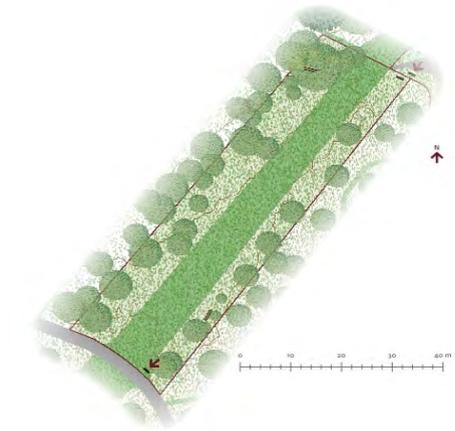


Figure 4: Site illustration of the PSD Prospect in Health Forest Octovia®

2.2.3 PSD Rich in Species

The room is designed to offer the visitor many forms of life (Figure 5). The walls of the room are made of trees and shrubs. The ground has a slight slope, rich flora, and a small pond. The room type is classified as Glade. The room is filled with greenery. The entrance and exit are between black and white

birch trunks. There is a great variety of species, with several kinds of trees, shrubs, perennials, grass, herbs, and bulbs. The plants vary in bark colour and texture as well as in leaf shape and colour, and they flourish at different times of year. They also attract different kinds of insects and small animals such as squirrels. The small pond attracts insects, frogs, salamanders, birds, rodents, and foxes. The numerous birdhouses also attract birds. Out of the three variables, the two with strongest loading have been fulfilled, and the one with the weakest loading is partly fulfilled (Table 4). Regarding the final variable, there are many different species in the room, but not all of them are native. We nevertheless grade the PSD Rich in Species as strong (3). Other PSDs present in the room are weak (1): Refuge, Space, and Serene.

Table 4. Description of how the variables constituting the PSD Rich in species were adopted in the design of Health Forest Octovia®

PSD Rich in species – Room 3 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
One can detect different animals, such as birds and insects.	The room has a great variety of plants and animals. It is easy to see the variety of plants due to characteristic textures and colours of the tree trunks and strong seasonal characteristics, such as brightly coloured flowers and fruits.	X		
The green space consists of natural plant and animal populations.	Trees, shrubs, and perennials are specifically chosen to attract animals. The small pond and birdhouses also fulfil this function.	X		
There are many native plants to study.	There are many different plants, but since we are in an arboretum, not all of them are native.		X	

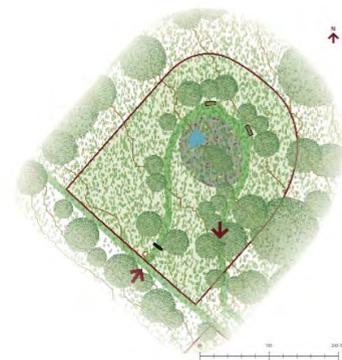


Figure 5: Site illustration of the PSD Rich in Species in Health Forest Octovia®

2.2.4 PSD Serene

The experience of being undisturbed is reinforced by the room's placement slightly away from the main path and behind a large area with rhododendron (Figure 6). The entrance and exit are the same, and a narrow path leads down to a bench overlooking a large lake. The ground cover consists of natural greenery, and the walls are made of tall trees and shrubs. Treetops form the roof. The room type is classified as Closed, but the view of the lake prevents it from feeling cramped or dark. The room is oriented toward the lake, which is rich in birdlife. Neither fishing nor motorboats are allowed. The room is smaller than the others in Health Forest Octovia®. There is only one bench, which is shorter than a traditional bench. The intention of this is to signal that if there is already a visitor here, then others should continue their walk. It is a room designed for few visitors. The room is located in the quietest part of the arboretum. The view over the quiet lake creates a soothing feeling. The room is quiet with few people – a place for reflection. Eight of the nine variables have been fulfilled in the design, and one (with the second weakest loading) is partly fulfilled (Table 5). The PSD Serene is graded as strong (3), and the supporting PSDs are Rich in Species and Prospect (due to the view over the lake), both ranked as weak (1).

Table 5: Description of how the variables constituting the PSD Serene were adopted in the design of Health Forest Octovia®. Variables 3 and 5 on the list have been rephrased in order to avoid misunderstandings due to their negative factor loading

PSD Serene – Room 4 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space is silent and calm.	The room is located some distance away from the main path, close to a big lake. There are no other roads or paths nearby. Motor boating or fishing in the lake is not permitted.	X		
There are no bikes in the green space.	It is not permitted to bike into the arboretum.	X		
One is able to spend time in the green space without coming into contact with too many people.	The room is small and private.	X		
There are not plenty of people and movements in the green space.	The room's design does not invite many people simultaneously. It is the smallest room in Health Forest Octovia® and is the only room where the visitor enters and leaves at the same place.	X		
There are no mopeds.	It is not permitted to ride a moped in the arboretum.	X		
It is not possible to watch other people being active, playing, practicing sports, etc.	The room is private and secluded.	X		
The area is clean and well maintained.	It is a small room that is being looked after.	X		
There is no traffic noise from the surroundings.	The room is located in one of the quietest parts of the arboretum, but there is sometimes sound from the remote motorway.		X	
It feels safe spending time in the green space.	The bushes behind the bench and the view of the room help make it feel safe.	X		



Figure 6: Site illustration of the PSD Serene in Health Forest Octovia®

2.2.5 PSD Culture

The room has an elongated shape, and the floor consists of grass with a gravel path (Figure 7). The walls consist of bushes and perennials and some large trees. The type of room is classified as Open. The PSD Culture consists of several variables related to the experience of artificial elements that are shaped by humans, e.g. fountains, statues, and canals. These elements are not permitted in the arboretum since they would affect the general impression of the site. We instead needed to interpret the variables more creatively in the design. The arboretum is located on former agricultural land, and traces of human activity can still be found, namely the old gravel road, where the farmers led their cattle to the market in the nearby village. It is today seen as an elevation along the path that leads through the room. The room has two benches. One is oriented toward the elevation, and the other toward an ash tree, called 'V.1'. The tree is interesting because it is the first forest tree to be selected systematically for breeding work in Denmark. Many younger ash trees in the Danish forests descend from this tree. There are also numerous cultural-historical values related to the species, and in Nordic mythology the tree of life, Yggdrasil, was an ash tree. In other words, although the room is not decorated with cultural-historical objects, historical traces from a bygone era and the unique ash tree are important values. This makes it necessary to inform visitors about the room's story if they are to understand the cultural

dimension. Out of seven variables, one (with weakest factor loading) is fulfilled, three are partly fulfilled, and three are unfulfilled in the design (Table 6). The PSD is thus graded as weak (1), though it improves to moderate (2) once the visitor has been informed about the elevation and the ash tree. The PSD Rich in Species can also be detected, though weakly (1).

Table 6: Description of how the variables constituting the PSD Culture were adopted in the design of Health Forest Octovia®

PSD Culture – Room 5 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space is decorated with fountains.	It is not permitted to install fountains in the arboretum.			X
The green space is decorated with statues.	It is not permitted to install statues in the arboretum.			X
The green space contains a wide range of foreign plants, ornamental plants, and kitchen plants.	A large number of perennials and shrubs are planted as the boundary of the room.		X	
The green space has the characteristic of a city park.	The gravel path and the large trees provide the sense of an urban park.		X	
The green space has different water features, such as ponds and canals.	It is not permitted to construct large water features in the arboretum.			X
The green space is ornamented with flowers.	The new perennials contribute flower colours are but natural-like in expression.		X	
The green space has a wooded pasture quality.	The wild grass and perennials and the large trees give the experience of a wooded grazing area.	X		

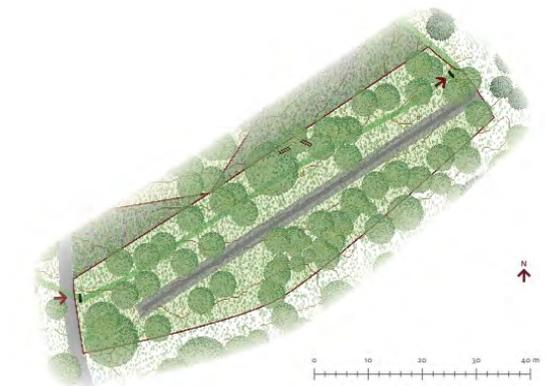


Figure 7: Site illustration of the PSD Culture in Health Forest Octovia®

2.2.6 PSD Space

The room has a rounded, coherent form (Figure 8). The floor consists of natural vegetation and the walls of shrubs. The roof is constituted by the treetops of medium-sized, multi-trunked trees and shrubs. The room type is classified as Closed. The path stays close to the edge and is made of wood chips so as to maintain the overall experience of the room. The room consists mostly of free-growing shrubs and trees. Together with the natural forest floor vegetation, they provide a coherent and undisturbed expression. The room has a distinctive character, which differs significantly from the other rooms. The visitor may experience it as entering another world. Two benches are located along the path where multiple people can gathered. Shrubs and trees allow for both shade and sun. Out of the seven variables, six have been fulfilled in the design, and one has been partly fulfilled (Table 7). The PSD Space is graded as strong (3), and the PSD Rich in Species can moderately be identified (2).

Table 7: Description of how the variables constituting the PSD Space were adopted in the design of Health Forest Octovia®

PSD Space – Room 6 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space is experienced as spacious and free.	The room feels large and free. The borders are made of bushes, and it is hard to see the end of the room.	X		
It is possible to find areas not crossed by roads and paths.	There is only a small, discrete path (made of wood chips) that guides visitors along the edge of the room.	X		
The green space has numerous trees.	The room is dominated by multi-trunked trees.	X		
It is possible to find places where a group of several people can gather.	The room is large enough for several people to gather in it.	X		
There are places in the green space sheltered from the wind.	Bushes behind the benches stop the wind.		X	
There are sunny places.	There are places where the sun comes down through the treetops.	X		
There are shady places.	There are places where the treetops stop the sun's rays.	X		

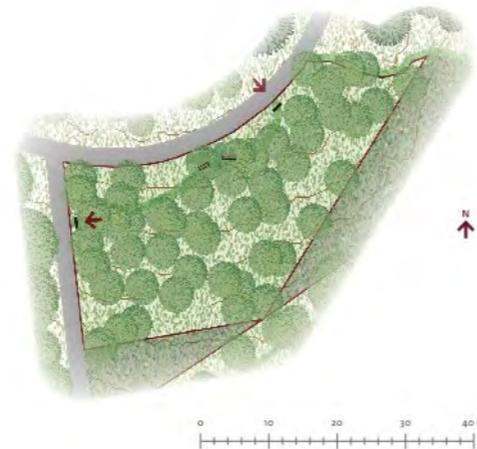


Figure 8: Site illustration of the PSD Space in Health Forest Octovia®.

2.2.7 PSD Nature

The room is distant from larger footpaths. A narrow grass trail leads up a small hill to the room, which has a natural form (Figure 9). The walls mainly consist of large, dark-green conifers. The ground vegetation layer is made of natural forest flora, such as moss and ferns. The room type is classified as Closed. Two benches are located close to tall spruce trees. The large fir trees, mossy stones, and natural forest ground cover give an impression of a naturally growing North Scandinavian spruce forest. Visitors must move deeper and deeper into the forest to reach the benches. Nature is experienced as powerful: it is the one that is in control. The route of the path and location of the benches have been formed by nature. At the same time, the trees create security due to their age and size. Out of the seven variables, five has been fulfilled in the design, and only one has not been fulfilled due to the fact that it

is not permitted to light fires close to the trees in the arboretum (Table 8). The PSD Nature is graded as strongly (3) represented in this room, and the PSDs Refuge, Rich in Species, and Space can be weakly (1) identified.

Table 8: Description of how the variables constituting the PSD Nature were adopted in the design of Health Forest Octovia®

PSD Nature – Room 7 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space has a natural quality.	The room has a North Scandinavian natural forest character.	X		
The green space has a wild and untouched quality.	It has the appearance of a free-growing pine forest.	X		
There are free-growing lawns.	The grass is uncut.	X		
It is possible to light a fire in the green space.	It is not permitted to light a fire under the trees in the arboretum.			X
It feels safe spending time in the green space.	The large, old trees create a sense of security.	X		
One is able to spend time in the green space without coming into contact with too many people.	Many small, pre-existing paths has been blocked by vegetation. The massive vegetation makes it hard to see and sense the end of the room even though the room is of limited size.	X		
The green space contains hilly areas.	The room has naturally hilly terrain.		X	

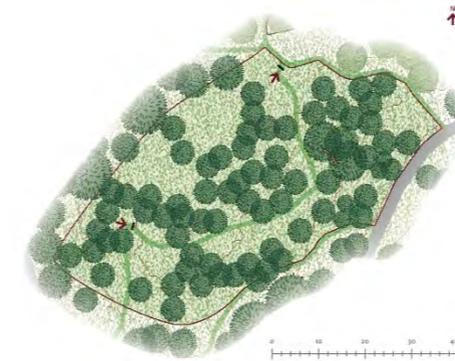


Figure 9: Site illustration of the PSD Nature in Health Forest Octovia®.

2.2.8 PSD Refuge

This PSD varies depending on whether the visitor is a child or an adult. For children, Refuge is about being able to play freely and safely. For adults, it is more about daring to let the child play freely and being able watch the child from a safe place. Alternatively, it is about the adult being able to sit and watch others who are being active. This is why the room is discreetly

divided into two parts (Figure 10). The part of the room designed for adults is furnished with two small benches, from which various bushes and perennials can be viewed. The room has clear boundaries, with numerous shrubs creating 'protection in the back'. However, there is dense beech growth behind where the children's area or territory. The adults' section of the room is classified as Open, while the children's section is classified as Closed. Since it is not permitted to build play equipment in the arboretum, a unique beech tree with long, curved branches serves 'climbing equipment'. Out of the seven variables, three have been fulfilled, two have been partly fulfilled, and two have not been fulfilled (Table 9). Both areas of the room are graded as moderate (2). In the adults' section, the PSD Rich in Species can also be weakly (1) identified, and in the children's section, the PSD Space can be weakly (1) identified.

Table 9: Description of how the variables constituting the PSD Refuge were adopted in the design of Health Forest Octovia®

PSD Refuge – Room 8 in Health Forest Octovia®				
Variables	Comments on adaptation of the variables in room design	Variables fulfilled in design		
		Yes	Partly	No
The green space contains many bushes.	The room is defined by bushes.	X		
The green space holds animals that children and adults may feed and pet.	The arboretum cannot keep domestic animals.			X
There are sand boxes.	Sand boxes are not permitted in the arboretum.			X
There is play equipment, such as swings, slides, etc.	It is not permitted to install play equipment. However, the room has a unique tree that attracts children to climb.		X	
It is possible to watch other people being active, playing, engaging in sports, etc.	From the secluded benches, it is possible to observe others who are active in the room or on the path.	X		
It feels safe spending time in the green space.	The bushes behind the benches and the view of the main path give a sense of security.	X		
There are tables and benches.	There are benches, but tables are not permitted in the arboretum.		X	



Figure 10: Site illustration of the PSD Refuge in Health Forest Octovia®.

3. RESULTS AND DISCUSSION

The operationalisation of the 8 PSDs resulted in a six-step health-promoting design tool (Figure 11) as well as in a list of variables and factor loadings for each PSD (Table 1). The guide consists of the following six steps:

- *Step 1. Determine the aim of the PSDs: analysis and/or design tool.* The 8 PSDs can be used both as an analytical (pre-design and post-design) method and a design tool. They can also be used advantageously to both analyse and design green spaces.
- *Step 2. Determine the scale at which you operate.* The 8 PSDs can be used at different scales. They have been used successfully at both larger and smaller scales. One must determine in which scale one operates: Large Scale (regional level), Medium Scale (city level), or Small Scale (garden level).
- *Step 3. Identify context.* It is crucial to understand the green space's context. The PSDs are context dependent, and it is therefore important to describe the context. Everything is analysed on the basis of the context in which it is located. As such, it is possible for a city park with a strong presence of Nature to achieve the highest grade (3).

• *Step 4. Identify existing rooms.* The four room types may be helpful when identifying where one PSD begins and where the next PSD takes over. The four types of rooms are characterised as follows: 1. Open: an open space without planting; 2. Spread: an open space with scattered planting; 3. Glade: a space formed by walls, but without a ceiling; and 4. Closed: a closed room in which tree branches form a ceiling.

• *Step 5. Identify and graduate existing PSDs.* One room can contain multiple PSDs. One PSD is usually dominant or 'stronger' than the others. Start by identifying the dominant PSD. Take the list with all the variables that constitute the different PSDs, and mark all the variables that are present in the room. The graduation for each room is as follows: 0. Absence: the PSD cannot be identified; Weak: the PSD can be poorly identified; Moderate: the PSD can be identified but is not significant; 3. Strong: the PSD is very significant or cannot be found stronger. One can identify the dominant PSD in a room and give it a grade from 0 to 3 based on the present variables. One can then identify the other PSDs that are present and give them grades from 0 to 3 as well.

- *Step 6. Start design phase.* Once one has decided which PSD one wishes to reinforce or establish, it is time to once again consider the actual natural qualities (the variables in the factor analysis) that form the PSD.

Steps	Actions	Guide to working process
1	Determine the aim of the PSDs	<ul style="list-style-type: none"> Analytical tool Design tool Combined analytical and design tool
2	Determine the scale in which you operate	<ul style="list-style-type: none"> Large Scale (region level) Medium Scale (city level) Small Scale (garden level)
3	Identify the context	Describe the context in own words
4	Identify existing rooms	<ul style="list-style-type: none"> Open  Spread  Glade  Closed 
5	Identify and graduate existing PSDs	<ul style="list-style-type: none"> Which is the dominant PSD in each room? (Use the list of all the variables that constitute the different PSDs) Graduate it from 0-3 (0=absent; 1=weak; 2=moderate; 3=strong) Are other PSDs present in the same room? Graduate each of the other PSDs.
6	Start design phase	Based on the first five steps, decide which PSDs you wish to strengthen, weaken, or remove.

Figure 11: The 8 PSDs health-promoting design tool

Both the EU and the WHO call for nature-based solutions and interventions to manage challenges (for instance, involving mental human health) associated with today's rapid urbanisation. In this context, there is a need for an easily applicable design tool for landscape architects and urban planners. The current study aims to describe the operationalisation of the PSDs into an applicable design tool for practitioners. The tool seeks to promote mental health by offering visitors nature experiences that they prefer and in which they can mentally restore themselves. The 8 PSD health-promoting design tool could thus function as an evidence-based design tool for 'nature-based solutions' and could enhance sustainable urbanisation by promoting residents' mental health. Since the establishment of Health Forest Octovia®, research has confirmed the effectiveness of the PSD health-promoting design tool (Stigsdotter, et al., 2017a; Stigsdotter, et al., 2017b). This can be seen as an initial validation by research, but the PSD health-promoting design tool also needs to be validated through application to other design projects.

The 8 PSDs have been used in research in various parts of the world, including the Nordic countries (Lindholst et al., 2015; Plambech & Konijnendijk van den Bosch, 2015); Estonia (Maikov, 2013); Russia and China (Skärbäck &

Grahn, 2016); Canada (Lockwood, 2017); Malaysia (Mansor et al., 2017); Serbia (Vujcic & Tomicevic-Dubljevic, 2017; 2018); and Iran (Memari et al., 2017). We assume that the PSDs are universal. However, it would be desirable to repeat the original questionnaire in areas outside Scandinavia and re-perform the original factor analysis (Grahn & Stigsdotter, 2010) in order to ensure that they actually are universal and to check whether any variations can be detected. It is furthermore considered a strength that the 8 PSD health-promoting design tool demonstrates respect for existing contexts and conditions. The tool focuses on existing qualities of green spaces that may be strengthened, meaning that it is often the case that no trees need to be chopped down, and no bushes need to be pulled up. The PSD health-promoting design tool guides the landscape architect or planner to work with that which already exists.

4. CONCLUSION

The current study aims to describe the operationalisation of the Perceived Sensory Dimensions (PSDs) within an applicable design tool. The PSDs are a result of previous research indicating that people perceive green spaces in terms of eight dimensions, some of which are more important than and preferred to others when it comes to promoting mental restoration. This paper argues that the 8 PSD health-promoting design tool may be useful for designing mental health-promoting green spaces. In parallel with the design process of the Health Forest Octovia® research and demonstration site, a stepwise model for applying the PSDs in practice was developed. The operationalisation of the 8 PSDs resulted in a six-step health-promoting design tool. The six steps are: 1. Determine the aim of the PSDs: analysis and/or design tool, 2. Determine the scale at which you operate, 3. Identify context, 4. Identify existing rooms, 5. Identify and graduate existing PSDs, and 6. Start design phase. Based on the results from a study in Health Forest Octovia®, the PSD health-promoting design tool seems effective. Further validation, however, requires that it be applied to other design projects.

ACKNOWLEDGEMENTS

We would like to thank our former colleague Dr. Anne Dahl Refshauge for participating in the design of Health Forest Octovia® and in developing the 8 PSDs health-promoting design tool. The Health Forest Octovia® project was funded by Realdania (2100-613), the Danish Outdoor Council (101166), the Obel Family Foundation (20122-19056 E 3), and G.B. Hartmann's Family Foundation.

REFERENCES

- Annerstedt M., Östergren, P-O., Björk, J., Grahn, P., Skärbäck, E. & Währborg, P. (2012). Green qualities in the neighbourhood and mental health: Results from a longitudinal cohort study in Southern Sweden. *BMC Public Health* 2012, 41(337), 2-12.
- European Commission. (2017). *Report from the commission to the council on the Urban Agenda for the EU*. Retrieved from https://ec.europa.eu/regional_policy/sources/policy/themes/urban/report_urban_agenda2017_en.pdf
- European Union. (2015). *Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities*. Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities', Directorate-General for Research and Innovation, 2015 Climate Action, Environment, Resource Efficiency and Raw Materials EN (full version), ISBN 978-92-79-46051-7, doi: 10.2777/765301
- Grahn, P. & Stigsdotter, U.K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning*, 94, 264-275.
- Gustavsson, R. & Ingelög, T. (1994). *Det nya landskapet*. [In English: The new landscape] Skogsstyrelsen, Jönköping, Sverige (in Swedish).
- Hartig, T., Evans, G.W., Jamner, L.D., Davis, D.S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23, 109-123.
- Jensen, N. (1994). *Guide til Arboretet i Hørsholm*. [In English: Guide to the arboretum in Hoersholm], Copenhagen, Denmark: The Royal Veterinary and Agricultural University.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169-182.
- Lindholst, A.C., Caspersen, O.H. & Konijnendijk van den Bosch, C. (2015). Methods for mapping recreational and social values in urban green spaces in the Nordic countries and their comparative merits for urban planning. *Journal of Outdoor Recreation and Tourism*, 12, 71-81.
- Lockwood, A. (2017). *Balancing Perceived Sensory Dimensions and Biotopes in Urban Green Space Design*. Guelph, Ontario, Canada: The University of Guelph.
- Lovell, R. (2016). *Links Between Natural Environments and Physical Activity: Evidence Briefing*. Natural England, Exeter.
- Maas, J., van Dillen, S., Verheij, R.A., & Groenewegen, P.P. (2009). Social contacts as a possible mechanism behind the relation between green space and health. *Health & Place*, 15, 586-595.
- Maikov, K. (2013). *Landscape Characteristics In Tartu City Parks*: User

Omar Hussein Ali¹, Nor Haslina Ja'afar^{1*} and Mohd Khairul Azhar Mat Sulaiman¹

¹Centre of Innovative Architecture & Built Environment (SErAMBI),
Architecture Programme, Faculty of Engineering and Built Environment,
Universiti Kebangsaan Malaysia

* Corresponding author:

mell_ina@ukm.edu.my

ABSTRACT

Urban squares, also known as public open spaces, are places where everyone with any social status can visit. Such spaces are recognised and identified as the heart of the cities. In Iraq, the square is not as dominant as a street such as 'souq', maybe because of the geographical factors such as weather and the design aspect. This shows the need for a study to examine the square function and try to understand its compatibility and suitability in the Iraqi context. Thus, this research aims to determine the influence of critical design attributes pertaining to the geographical and physical aspects of urban square design on user activities in Erbil Square. The study site, Erbil Square, is in the heart of Erbil City, north of Iraq. The study adopted a quantitative method of questionnaire survey as the primary tool. The pilot survey used a sample size of 34 square users as respondents. Quantitative analysis employed the descriptive statistics to interpret the important aspects influencing the user activity index. The results revealed a positive relationship between geographical and physical as design factors and user activities. Moreover, the literature review and pilot study have exposed the need to focus on design policies and strategies in the Iraqi urban context. Thus, designers should take note of the square element designs that generate activity in the Iraqi context for designing a new square.

Keywords: : User activity, urban square, erbil, physical attributes, public space, geographical attributes.

1. INTRODUCTION

Urban space has contrasting definitions based on considerations such as title, management, entry, and usage. Some authors define it as 'space that is not controlled by private individuals or organisations and hence is open to the general public' (Madanipour, 1996). The presence of an urban square is essential to public lives, especially in high-density metropolises such as Erbil. However, urban square design is reported as mostly unsuccessful in serving the users' needs. Carr et al. (1992), for example, stated that urban squares are often created for commercial and recreational reasons and are thus used for promotional purposes. However, Cherulnik (1993) showed that designers and urban planners make excessive changes when considering the physical attributes of urban space design that daily users need. The present study is thus valuable in motivating urban designers to create successful urban spaces. Recently, we have witnessed how this balance has been deeply disturbed in numerous cities by factors such as increasing vehicle traffic (Gehl, 2007). The characteristics that affect people's needs in public places were discussed by Lang (2017), Madanipour (2007), and Maslow (1970), while the effect of environmental elements on losing the function of urban spaces as social interaction and recreational areas was discussed by Carmona et al. (2003) and Madanipour (2007). Numerous studies were carried out to investigate the lack of public space's redevelopment, the principle of efficient use, and the value of urban squares. However, a few scholars had integrated these concerns into one study. Moreover, most of the previous studies related to this research were based on situations in the western countries (Klingemann et al., 2018; Mehta, 2014; Van Hecke et al., 2016; Wang, Brown, & Liu, 2015). Thus, the objective of this study is to identify the essential design attributes for the geographical and physical aspects that influence urban square design on user activities in Erbil Square, Iraq.

Influences Through Design. *WIT Transactions on Ecology and the Environment*, 179, 353–364.

Mansor, M., Ghani, N., Harun, N.Z. & Zakariya, K. (2017). Conceptual Models of Greenspace and Health. *Advanced Science Letters*, 23, 6326-6330.

Marcus, C.C. & Sachs, N.A. (2014). *Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces*. Hoboken, New Jersey, John Wiley & Sons.

Memari, S., Pazhouhanfar, M. & Nourtaghani, A. (2017). Relationship between perceived sensory dimensions and stress restoration in care settings. *Urban Forestry & Urban Greening*, 26, 104–113.

Palsdottir, A.-M., Stigsdotter, U.K., Persson, D., Thorpert, P. & Grahn, P. (2018). The qualities of natural environments that support the rehabilitation process of individuals with stress-related mental disorder in nature-based rehabilitation. *Urban Forestry & Urban Greening*, 29, 312-321.

Plambech, T. & Konijnendijk van den Bosch, C. (2015). The impact of nature on creativity – A study among Danish creative professionals. *Urban Forestry & Urban Greening*, 14, 255-263.

Randrup, B.T., Schipperijn, J., Hansen, B.I., Jensen, F.S. & Stigsdotter, U.K. (2008). *Natur og sundhed: Sammenhæng mellem grønne områders udtryk og brug set i forhold til befolkningens sundhed*. [In English: Nature and Health: Associations between green spaces' characteristics, use and public health], Park- og Landskabsserien, 40/2008. (in Danish)

Sidenius, U. (2017). *The Therapy Garden Nacadia® - The interplay between evidence-based health design in landscape architecture, nature-based therapy and the individual*. PhD thesis. Faculty of Science, University of Copenhagen.

Skärbäck, E., Björk, J., Stoltz, J., Rydell-Andersson, K., & Grahn, P. (2014). Green Perception For Well-Being In Dense Urban Areas – A Tool For Socioeconomic Integration. *Nordic Journal of Architectural Research*, 26(2), 179-200.

Skärbäck, E. & Grahn, P. (2016). People's Preferences for Outdoor Affordances are Relatively Similar Irrespective of Cultural Background. In P. Bauer, M. Collender, M. Jakob, L.B. Ketterer, P. Petschek, D. Siegrist & C. Tschumi (Eds.) *Bridging the Gap* (pp. 36-370). ECLAS, Rapperswil, Switzerland.

Stigsdotter, U.K. (2015). Nature, Health & Design. *Alam Cipta, International journal of sustainable tropical design research and practice*, 8(2), 89-96.

Stigsdotter, U.K., Corazon, S.S., Sidenius, U., Kristensen, J. & Grahn, P. (2017a). It is not all bad for the grey city: A crossover study on physiological and psychological restoration in a forest and an urban environment. *Health & Place*, 46, 145–154.

Stigsdotter, U.K., Corazon, S.S., Sidenius, U., Refshauge, A. & Grahn, P.

(2017b). Forest design for mental health promotion: Using perceived sensory dimensions to elicit restorative responses. *Landscape and Urban Planning*, 160, 1-15.

Stockholms läns landstings Regionplane- och trafikkontoret. (2004). B. Malmros (Ed.) *Hanvedenkilen, Upplevelsevärden i Stockholmsregionens gröna kilar*. [In English: Hanvedenkilen: Experience values in the Stockholm region] (pp. 1652-3741). (in Swedish).

van den Bosch, M.A., Mudu, P., Uscila, V., Barrdahl, M., Kulinkina, A., Staatsen, B., Swart, W. Kruize, H., Zurlyte, I. & Egorov, A.I. (2015). Development of an urban green space indicator and the public health rationale. *Scandinavian Journal of Public Health*, 44(2), 159-167.

Vujcic, M. & Tomicevic-Dubljevic, J. (2017). Urban nature as a response to stress of urban population. *Lesson of Forestry Faculty*, 115, 185-198.

Vujcic, M. & Tomicevic-Dubljevic, J. (2018). Urban forest benefits to the younger population: The case study of the city of Belgrade, Serbia. *Forest Policy and Economics*, 96, 54-62.

World Health Organization. (1948). *Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference*, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

World Health Organization. (2005). *Mental Health, Facing the Challenges, Building Solutions*. Report from the WHO Ministerial Conference. WHO Regional Office for Europe.

World Health Organization, Regional office for Europe. (2017). *Urban Green Space and Health: Intervention Impacts and Effectiveness*. Meeting report, Bonn Germany, 20-21 September 2016.

2. Urban Square Attributes

2.1 Physical Attributes of the Urban Square

The physical aspects of urban squares involve the implementation and services offered to serve the daily needs of people. This aspect initially covers the form of the square, its size, and its visual complexity (Carmona, 2019; Moughtin, 2003). Kim (2017) in her study divided the urban space size into three types according to the ratio of depth to height D/H with regard to the influence of the size of urban squares, perceptions of the quality, and enclosure in urban spaces. These categories included three D/H ratios—2:1, 5:1, and 10:1. Form, like the size of the public space, should be in proportion to the dominant structures. Physical space as an expression is relevant to physical forms, cityscape, urban furniture, approachability, and landscape. Krier (1979) detailed the many options and variations in the shape of public space.

Activity denotes land use, patterns, pedestrian flow behaviour, and vehicle flow (Balsas, 2007). Urban squares are traditional places for individuals to meet and synopsis most kinds of public open spaces with differences in dimensions, shapes, and capabilities. These places can also be in parallel with pedestrian paths or with traffic routes (Jacobs, 1993; Krier, 1979). More importantly, urbaneness needs to be concerned about the pedestrians and offers the possibility for lingering activities. Among all types of urban squares, the most active spaces are those with many areas connected by short pedestrian paths that enable users to hang around or stroll (Shaftoe, 2008). People can also affect the shape of the urban square by doing these activities. Crowds on special occasions likewise shape the major gatherings in urban spaces (Askari & Soltani, 2018). The important feature of open spaces is openness and complete access. The openness must contain social and physical access via entry to the place and activities inside the urban square. An urban space devoid of complete and open access is not completely a public space (A Madanipour, 2004). Empirical studies (Hass-Klau, 1999; Mehta, 2014; Rapoport, 1990) indicated that a well-designed physical urban space for users, with enough seats and other space furniture, becomes valuable and meaningful for users when there are places for community events, a range of stores supporting activities, and other land uses. Public seating areas should be comfortable, visually pleasing, suitably located, and incorporate well-designed urban furniture (Pressman, 1994). Even for users who have seats and are not engaged in physical activities, public spaces should provide a sociable atmosphere and a simple feeling of security for those passing by, playing, as well as private seats from businesses like cafes that offer attractive destinations or rest stops for walkers (Chacón-Borrego, Corral-Pernía, Martínez-Martínez, & Castañeda-Vázquez, 2018; Hjort et al., 2018; Thompson, 2013). Seating

can also be part of the hard landscape in public spaces. Particular attention can be given to places with benches along with informal seating and leaning options, such as ledges, steps, and low walls (Shaftoe, 2008). However, these are not continuously available places to achieve at human scale through texture, patterns of the components, and elements with a size that makes up the floors, edges of urban space, and any of the above features as well as any fixed or portable components. The study by Douglas et al. (2017) proposed that providing sheltered places areas with interesting views will assist social interaction. Shade and protections can be shaped by tree canopies, awnings, overhangs, canopies, and other shading devices (Mehta & Bosson, 2018). A paved floor with a different material than its surroundings gives the place a very enclosed feeling and the look and feel of a corporate space (Mehta, 2014). Differences in the materials of the floorscape can also define the crossing and sitting areas of the urban space. Features of the urban space include the street, the sidewalk material and planting, space lighting, furniture, and public art (Yeang, 2000).

2.2 Geographical Attributes of Urban Square

The geographical aspects have a considerable impact on the shaping and physical growth of a city. A few studies have included the design and social characteristics and shown the improvement of criteria such as community access, aesthetic and attractiveness, and location of the urban space (Herbst & Herbst, 2006). Conventional accessibility studies were founded on location theory to reduce operational costs of service distribution and make substantial distance or nearness to the service as a critical variable in functional accessibility (Gregory, Johnston, Pratt, Watts, & Whatmore, 2011; Hass-Klau, 1999; Nicholls, 2001). Generally, urban squares serve their ideal purpose when they are reasonably in the centre of a neighbourhood or city and at the intersection of routes that people use for other functions. The Project for Public Spaces (PPS) (2008) found that urban squares are the most successful when they are located near the ‘action’, that is, where people can sit and watch other people. Geographers consider urban space access as a scale of the spatial distribution of facilities adjusted for the need and capability of users to overcome the distance or travel time to access the urban space (Giles-Corti et al., 2005). The accessibility and permeability of public spaces permit the interactions between workers, occasional visitors, and city residents, thus contributing to the liveability of the urban community (Pancholi, Yigitcanlar, & Guaralda, 2015). Alternatively, location accessibility and distance to transit are related to a more active journey (Cervero & Kockelman, 1997; Ewing & Handy, 2009). Urban connectivity between the neighbourhood and the urban square refers to the physical paths linking the open space with the surrounding parts of the neighbourhood. These paths are necessary for human activity.

Urban connectivity is easy and has direct physical connections between two or more urban spaces; it is related to the integration of urban spaces (Walker & Hiller, 2007). Spatial connectivity is the integration between urban spaces and between urban factors in the urban setting (Hillier, Burdett, Peponis, & Penn, 1987).

2.3 User Activities in Urban Square

Urban squares carry several and varied meanings depending on people’s daily activities. What are the attributes that indicate a thriving urban space? Carr et al. (1992) suggested that an ideal urban space is reactive, substantial, and democratic. By contrast, the PPS describes a successful or high-quality space as one that addresses the issues of accessibility, activity and use, design element, and sociability. Such spaces are also easy to access, connected to the surrounding community, contain multiple activities for a variety of users, have adequate seating and, most importantly, act as venues for people to interact socially (PPS, 2008). Public spaces are destinations where activities take place and are connected with user activities. The aim of such a ‘place’ is for users to spend time in the public space and generate various activities such as observing. The physical aspects are essential because they determine the intangible aspects of people’s behaviour or activity (Ja’afar, 2018).

The enjoyment of time in public spaces was mentioned in Worpole and Knox’s (2007), who examined young people’s perceptions on social variation. They found that young people could make friends and learn some of the rules of communal life and play in public spaces. The essential sub-categories that encourage visits to public spaces and performance of physical activities are accessibility by foot and public transport, location of the urban square that is close to home/work, the attendance of lively family and friends, and public space facilities (Van Hecke et al., 2016).

3. METHODOLOGY

The literature determined the selected variables of the physical and geographical attributes that impact user activities on urban space. The study captured and measured seven main aspects: location, accessibility, and connectivity of urban square as geographical attributes, as well as form, soft and hard landscape features, shelter and protection, and seating elements as physical attributes. This study implemented a quantitative methodology using data from the pilot study. The specific survey technique employed in this research was the cross-sectional survey using a questionnaire form supported by field observation. This study addressed the logical and constructed validity of the instrument. Some drafts were evaluated to increase the content

validity of the research instrument. Pilot research fulfils a variety of essential functions and can provide useful information for other researchers. Social science literature has unusually few sample size recommendations for pilot studies, given the popularity of the pilot. However, some relevant articles bring attention to the matter (Johanson & Brooks, 2010). The studies by Isaac & Michael (1995) and Hill (1998) suggest that sample size of respondents between 10 and 30 is suitable for pilot study with several concrete advantages, including simplicity, easy calculation, and the ability to test hypotheses, yet “overlook weak treatment effects” for pilots in survey research. Treece & Treece (1977) in their most recent and experimental research suggested that 10% of the project sample size is recommended. For this reason, empirical studies suggesting 30 typical participants from the population of interest are the reasonable minimum reference for a pilot study where the purpose is an initial survey or scale development (Hill, 1998; Johanson & Brooks, 2010). In addition, N = 30–36 is recognised as a reasonable sample size for bootstrapped confidence intervals for the pilot survey (Johanson & Brooks, 2010).

According to the explanation above, this study chose a sample size of 34 for pilot study, which fulfilled both samples as suggested by Treece and Treece (1977) and also Johanson and Brooks (2010). Besides, there are several papers that were published according to the pilot study (Guilbert et al., 2019; Nakau et al., 2013). This shows that the pilot data could be used for writing a journal. The 34 pilot sample size consists of questionnaire surveys on urban square users in Erbil, Iraq. The questionnaires used items with a five-point scale (“agree” and “disagree” statements). When researchers want to collect many attitudes in a short time, five-point agree-disagree items are typically the chosen method (Johns, 2005). The answers of the respondents are basically dispersed in a five-point scale (1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree). A panel of urban design and social science experts was selected to examine the instrument’s logical validity. All items were translated into Arabic and Kurdish to enable the panel of experts to verify the format, organisation, suitability of information, language, and the content used in the tool. Cronbach’s alpha coefficient was utilised to evaluate the reliability of the survey items. The data were analysed using mean and the essential variables in the range of 3 to 5 were determined for the mean score, where 3 represents the midpoint of the scale

4. STUDY AREA (THE LOCATION AND SELECTION)

The data shown in this research were collected at Erbil Square in Erbil City (population 932,800), northern Iraq. Erbil is the capital of the Erbil governorate and the Kurdistan Regional Government KRG. The location of

Erbil City impacts the city's urban development and economic growth, and it assists the city in enduring and maintaining its name throughout history (Houtsma, 1993, p. 521). The size and stability of the city make it a popular base for humanitarian organisations. Erbil Square is located in front of the Erbil Citadel (the landmark of Erbil City and a World Heritage Site) (see <https://whc.unesco.org/en/list/1437>). The current location of Erbil Square is at the same place with a traditional maidan (Public Square) from the 12th century (Figure 1). It is located in the south side of the Erbil Citadel, lower than its south gate, and reaches out towards the valley where the old cemetery is placed (Al-hashimi, 2016). Based on its location and the observations of the study area, Erbil Square was selected as the study area owing to several factors. Firstly, this urban space is a substantial public space in the city and is viewed as a safe place. Secondly, this square is easily accessed by main forms of transport and is an ideal place for people to meet, socialise, sit around and, if they so wish, walk around the city. The area also has commercial shops and other small individually owned or local stores which are part of the square. Therefore, Erbil Square is an urban space that is safe where people can congregate, sit, interact with other visitors, or walk around (Mehta, 2014).



Figure 1: Location maps of Erbil Square shows: (A) the location of square in the center of Erbil City. (B) Map of the square with the surrounding.

5. RESULTS

Data from the pilot survey were used to calculate the descriptive statistics using SPSS version 25. Table 1 shows that the two main user activity indexes were the number of visits to the urban square, with mean = 3.176 for responding to the four question items (1 = 1st time visiting the urban space, 2

= 2nd time visiting the urban space, 3 = 3rd time visiting the urban space, 4 = more than 3 times; see Figure 1). The standard deviation score was 1.028 for measuring the amount of variation in statistical conclusions, and the measures of skewness = 0.907 and kurtosis = 0.469 for checking the normal distribution of the data set. The second variable of the main user activity index was the ability to start communication and create friendship in the urban space, with mean = 0.558 as the average (with 0 = I don't have friends inside the urban square, and 1 = I have friends inside the urban square), the standard deviation score = 0.503 and the measures of skewness = -0.248 and kurtosis = 1.064 (Figure 2).

Table 1: The descriptive for a total mean score for the user activities

		Frequency Times for Visiting the Place	Have friends inside the Place
N	Valid	34	34
	Missing	0	0
Mean		3.176	0.558
Minimum		1.00	0.00
Maximum		4.00	1.00
Std. Deviation		1.028	0.503
Skewness		-0.907	-0.248
Kurtosis		-0.469	-1.064

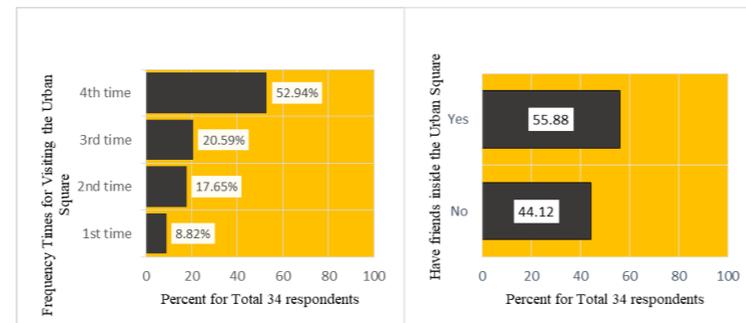


Figure 2 : For respondent Frequencies- Times for Visiting the Place (left). Have friends inside the Place (right)

(i) Physical Aspects

The measurements of the four selected physical aspects (form, hard and soft landscape, seating, shade and protection) are listed in Figure 3. Table 2 shows that form (mean = 3.75, std. deviation= 0.751) was rated the highest among the physical aspects and at more than mid-point, and hard and soft landscape (mean = 3.18, std. deviation= 0.650) was also at more than mid-point. These aspects were followed by seating elements (mean = 2.23, std. deviation= 0.975) at less than mid-point, while shade and protection (mean = 2.18, std. deviation= 1.281) was last with the least value among all the physical aspects.

(ii) Geographical Aspects

Table 2 shows the mean results of geographical aspects (mean = 3.98). The rating scale was five points (from strongly disagree to strongly agree). As shown in the table below, the location (mean = 4.84, std. deviation = 0.410) of the urban space was rated the highest among all the design aspects that affect social activities in the urban space, with many of the respondents indicating "strongly agree" (Figure 4). This item was followed by connectivity (mean = 4.05, std. deviation = 0.781), which was also a highly rated variable at more than mid-point. The finding showed that accessibility (mean = 3.76, std. deviation = 0.407) had the lowest mean in the geographical attributes but still at more than mid-point.

Table 2 : Total Mean Score for selected Design Attributes Based on a Pilot Survey

	N	Minimum	Maximum	Mean	Std. Deviation
Geographical Attributes	34	3.00	4.50	3.98	0.424
Location of urban square	34	2.00	5.00	4.84	0.410
Connectivity of urban square	34	1.50	5.00	4.05	0.781
Accessibility of urban square	34	1.00	4.33	3.76	0.407
Physical Attributes	34	2.33	4.00	2.98	0.560
Form of Urban Square	34	1.00	5.00	3.75	0.751
Soft & hard landscape	34	1.00	4.75	3.18	0.650
Seating elements	34	1.00	5.00	2.23	0.975
Shelter & Protection	34	1.00	5.00	2.18	1.281
Valid N (list-wise)	34				

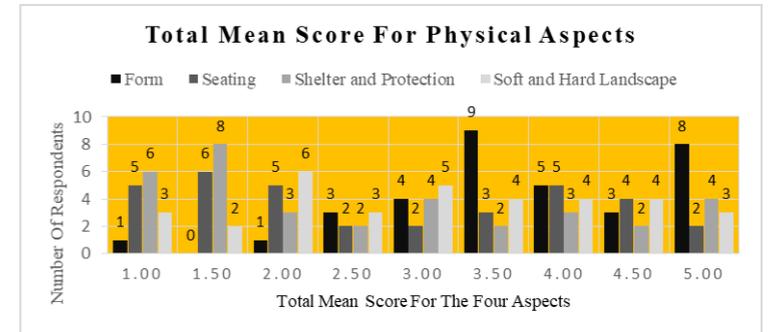


Figure 3: Total Score for the Respondent Answers on Physical Attributes

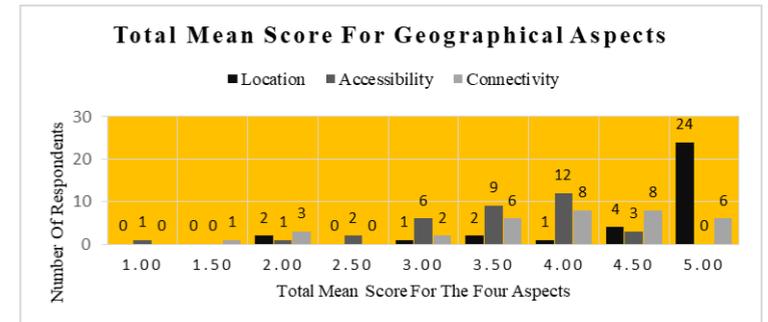


Figure 4: Total score for the respondent answers on Geographical attributes

6. DISCUSSION

The purpose of this study is to identify the essential design attributes for geographical and physical aspects that influence urban square design on user activities in Erbil Square, Iraq.

6.1 Physical Aspects

This study shows the importance of the form of the urban square which most of the respondents agreed that 'the place is open' (mean = 3.75). From the section, the study found that the ratio is 1:8 by which the square size could be categorized under a big size (Kim, 2017; Lynch & Hack, 1984). However, when the study compared shelter and protection attributes (mean = 2.18), it showed the lowest significant attributes with mean less than the midpoint. What is the relationship? This reveals that the size or square ratio is important to create a comfortable environment for users from the

weather. In other words, the form of the square itself is one of the important attributes which functions like shelter and protection via its shading. This comfortable environment is important because it will generate user activity. Another type of element that creates shades and increases user activity is tree canopy (Shaftoe, 2008). However, the weather of Erbil is not suitable for planting big canopy trees (Al-hashimi, 2016; Rasul, Balzter, & Smith, 2017). As mentioned by the researcher, the nature of public space is exposed to the weather (Rasul et al., 2017). This means that the appropriate type of public open space design should be considered. Thus, many scholars suggest referring back to the typology of urban form which encompasses its public open space (Lang, 2017). Therefore, if we reveal the typology of traditional public open urban spaces in Iraq, they are synonym with street concept such as 'souq' and small size of square (small ratio) (Almohannadi, Zaina, Zaina, & Furlan, 2015; Habibi, Farahmandian, & Mojdehi, 2016). The finding also supports that many urban square users go to the restaurants and coffee shops around the urban space when the weather is rainy or sunny. This means that the size of the square is too big; in addition, there is no big canopy plantation that could be planted in the Erbil climate. In other words, the big size of square through its ratio is not suitable in designing a square in Iraq. This is the reason why these 2 attributes revealed a contrasting result and how they relate to each other. To conclude, the form of the square via its appropriate size of ratio with the climate condition is a significant feature that will influence urban square design on user activities in Erbil Square, Iraq. This design element (form of the square via its appropriate ratio size) will create the main element of shelter and protection. This is an important contribution of the study where not all design elements from other countries with different weather and culture is suitable in Iraq. An appropriate ratio size will create a square with comfortable environment through the shading of its form. Thus, it will generate user activity during sunny day because being exposed to weather is a natural characteristic of a square as a public space. However, how we design to respond to climate in order to create shading via its ratio is important.

Another important study includes hard and soft landscape elements (mean = 3.18) like the materials of space floors and also various natural green areas and plants. This could be seen in study area; the big size of square is divided into multiple spaces for variety of user activities via different kinds of (i) vegetation such as a shrub and (ii) floor material design such as interlocking concrete, timber, glass, water, and grass (see Figure 6.). The design of these

elements create a variety of spaces and human activities such as a place for people to walk, sit, observe, chat, and conduct businesses. With respect to the big spaces, Moughtin (2003) also found that a surface with big spaces and material with decorative designs is able to create a human scale environment via the segmentation of the space, thus creating a human ratio. As added by Kim (2017), the same goes for plantation design which creates physical and visual barriers. This shows that a variety of hard and soft landscape design features will influence urban square design on user activities in Erbil Square, Iraq. The variety of types of vegetation and floor materials design will create a space, thus generating a diversity of user activities. This is because the space segments can create a human scale environment.

The explanation above also shows the important relationship between the form and also hard and soft landscape design attributes that influence urban square design on user activity, and they are the main physical aspects in urban space which influence people's needs (Carmona, Tiesdell, & Heath, 2003; Krier, 1979; Shaftoe, 2008; Whyte, 1980). As added by Lynch (1984), urban squares should provide places where users can do something of their own. That is why this study revealed the highest mean between form and also hard and soft landscape attributes. This portrays that the relation between the form of the square via its ratio size and the types of hard and soft landscape element will influence urban square design on user activities in Erbil Square, Iraq.

One of the strengths in this study is the similarity of results with the previous researches that used different approaches of different types of public space. Mehta (2014) used different measures for evaluating the 'liveliness' of the street in Boston. This study found that seating (types and design flexibility) score was not so significant (mean = 2.24) and did not have high effects on user attraction in the square. However, the study revealed that users can find additional seating from the private business inside and around the urban square. This kind of business can support the public organisation responsible for the facilities managed inside the public space. This result is parallel with Mehta's (2014) study. This shows another important contribution in a sense that different methods will yield the same result. As a result, seating attributes should consider that seating from the business inside and outside the building that faces the square will influence urban square design on user activities in Erbil Square, Iraq.



Figure 6. Picture of some Physical Aspect elements on Erbil square such as seating, hard & soft landscape features, and floorscape materials

6.2 Geographical Aspects

One of the important elements in any successful urban spaces in the city is strategic location (Askari & Soltani, 2018). For this reason, we understand why geographical aspects, especially location (mean = 4.84), has a greater impact on user activities in Erbil square. As mentioned in Figure 1, the section of the study area shows that the location of Erbil square is in the centre of the city of Erbil, in front of a historic citadel, and beside the traditional market. This shows that these nearby locations of important buildings function to provide an advantage to Erbil square which enhances its function as a node; a square as a public urban space through attracting people to meet and gather as assembly point. According to Askari and Sotani (2018), this will create a liveable square. In short, the great strategic location will influence urban square design on user activities in Erbil Square, Iraq. This location factor is important because it will enhance the function square as a public open space by considering the nearby important building functions, such as the market, where it will attract people to the square and gather as an assembly point. Thus, it will create a successful and liveable square and also enhance the square function as a node in the urban area.

The result showed that connectivity (mean = 4.05) also portrays a good impact along with the geographical aspects on user activities in the urban square through the direct movement between the buildings and the urban square and the level of all areas in the place. The direct connection between the building level and the urban space level will create a visual and physical linking between these places. The direct connection between any places will create a feeling of continuity through the absence of interrupted physical obstacle like steps; this inadequacy will create a sense of safety for the public. Dobbins (2009) highlighted the importance of the type of connection between civic spaces and their mixed-use activities, all of which should be clearly outlined.

Furthermore, this kind of connectivity will allow users to observe all parts of the urban space, reduce the sense of fairness from any negative activity inside the space, and improve the social interaction among people on the urban space areas. Hence, keeping the urban space in the same level with the surrounding as well as between the urban space parts can improve user activities through reducing the obstacle that affects the elderly and children who visit any public space or strolling around from the surrounding place to the urban space. In short, the connectivity will influence urban space design on user activities in Erbil Square, Iraq.

A good connectivity of the square design should be achieved by integrating visual and physical linking on urban space. An urban space with a permeating direct network can reduce the distance between the users. A clear path can provide a feeling of safety, improve the connectivity notably, and hence the usage.

The result portrayed that the accessibility (mean = 3.76) factor is the lowest part of the geographical aspects on user activities in the urban square. The types of accessibility could be divided into 3 main access which are by foot, public transportation, and private vehicles (Van Hecke et al., 2016). The location of the Erbil square makes the accessibility to reach it more easily for the public, especially for those on foot and those strolling from the surrounding building like the historic place and the markets. The entrance access positions are connected with the nearby axes like the traditional market, citadel entrance, and transportation and parking zones. The observation showed that the south and the east entrances are the most used paths; the reason behind this comes from the fact that these two entrances have a direct connection with the pedestrian paths around the urban space. These are the pedestrian streets and this direct connection develops into a new shape as commercial areas for street vendors and improves the space activity (see Figure 7.). This access is active with people's activities such as walking and talking, and it allows users to move between the urban space and the traditional market as well as the Erbil citadel safely. This environment causes the vehicle movement to slow down the speed during most of the daytime.

However, the west and north entrances are separated from the surrounding by automobile roads where the vehicle movement is fast; thus, it is difficult for pedestrians to cross the street. The observation exposed that the width of the street is wide and the access points within this axis do not have "pedestrian cross areas", and this can affect user safety, attendance, as well as the activity on the urban space, thus creating unfriendly pedestrian environment. According to Ja'afar et al. (2017), these environments occur because cars are given priority in terms of design where the high speed (60km/p) is not

parallel with the pedestrians' which is low, 5km/p. Such speed difference without connectivity by "pedestrian cross areas" will make it unsafe for the pedestrians to cross the street; thus, it would reduce the number of people coming to the place (Ja'afar et al., 2017).

In addition, Erbil square is not accessible for public transportation because there is no nearby stop. Thus, people depend on cars to go to Erbil square. This will increase the volume of private vehicles and the space of facilities. Chen and Chang (2015) coined that public transportation accessibility is essential because it would increase more volume of pedestrians to visit the place.

The findings also disclosed that the car park is not sufficient and people are forced to park their vehicles far from the urban square. Most of the people who visit the Erbil square are depending on their private transportation and public transportation is not enough to cover the whole area around the urban square. Moreover, many users come over to Erbil square from all around the city and from other cities of Iraq. The observation also found that there is lack of pedestrian facilities such as continuity sidewalk and shades surrounding the square. Thus, this has increasingly caused users to depend on private vehicles. The effect of this finding on people's attendance is similar to the pattern observed by Chen and Chang (2015), hence supporting the goal of increasing public transportation for improved accessibility. Heavily depending on car or private vehicles with a reduced service of public transportation is the reason why the accessibility attributes showed a lower result. As a result, accessibility attributes, especially by foot and good public transportation service will influence urban square design on user activities in Erbil Square, through increasing the facilities and space for the pedestrians and public transportation. They have an added advantage through providing a facility for private vehicles as the last hierarchy of accessibility. This type of accessibility design will increase the number of pedestrians coming to the square.



Figure 7. Shows vender areas on the east (left) and south (right) side supports commercial and social activities on urban square.

7. CONCLUSION

This study investigates the most critical design attributes affecting people's needs for urban square in Erbil, Iraq. The results from the study may be used as a foundation for urban square design in Iraq. The findings have revealed features of design attributes that affect people's requirements in urban squares. The literature review and pilot survey have uncovered a weakness in the focus on strategies and plans in urban design. Consequently, guidelines must be established based on the design attributes that are associated with fulfilling people's needs. The findings lead to the recommendation that the increased focus be directed to specific design attributes of urban squares when designing urban open public spaces. These attributes include a place of accessible path, location and connectivity, proportion, and materials for visual elements like seating and paving, and the distribution of green area inside the urban square. This study has put a decent understanding of how the geographical and physical factors can influence the effective use of user activities in urban spaces and has also detected the importance of these aspects. However, at the same time, the pilot study is still limited in terms of statistical power by the limitation of sample size and this may affect the accuracy of the results. For this reason, the investigation will be continued in the future study with a bigger sample size to outline a guide for the urbanists on how the design attributes can impact users of urban space through daily activity in Iraqi squares with the critical aspects conducted in this study.

REFERENCES

- Al-Hashimi, F. W. (2016). *The hidden face of Erbil: change and persistence in the urban core* (Doctoral dissertation, Nottingham Trent University).
- Almohannadi, M., Zaina, S., Zaina, S., & Furlan, R. (2015). Integrated Approach for the Improvement of Human Comfort in the Public Realm: The Case of the Corniche, the Linear Urban Link of Doha. *American Journal of Sociological Research*, 5(4), 89–100. <https://doi.org/10.5923/j.sociology.20150504.01>
- Askari, A. H., & Soltani, S. (2018). Determinants of a successful public open space: the case of Dataran Merdeka in the city centre of Kuala Lumpur, Malaysia. *Landscape Research*, 6397, 1–12. <https://doi.org/10.1080/01426397.2018.1427221>
- Balsas, C. J. L. (2007). City centre revitalization in Portugal: A study of Lisbon and Porto. *Journal of Urban Design*, 12(2), 231–259. <https://doi.org/10.1080/13574800701306328>
- Carmona, M. (2019). Principles for public space design, planning to do better. *Urban Design International*, 24(1), 47–59. <https://doi.org/10.1057/s41289-018-0070-3>

- Carmona, M., Tiesdell, S., & Heath, T. (2003). *Public Places - Urban Spaces*. London: Architectural Press.
- Carr, S., Francis, M., Rivlin, L. G., & Stone, A. M. (1992). *Public Space*. Cambridge: Cambridge University Press.
- Cervero, R., & Kockelman, K. (1997). travel demand density, diversit aand design Cervero 1997.pdf, 2(3), 199–219. [https://doi.org/10.1016/S1361-9209\(97\)00009-6](https://doi.org/10.1016/S1361-9209(97)00009-6)
- Chacón-Borrego, F., Corral-Pernía, J., Martínez-Martínez, A., & Castañeda-Vázquez, C. (2018). Usage Behaviour of Public Spaces Associated with Sport and Recreational Activities. *Sustainability*, 10(7), 2377. <https://doi.org/10.3390/su10072377>
- Chen, J., & Chang, Z. (2015). Rethinking urban green space accessibility: Evaluating and optimizing public transportation system through social network analysis in megacities. *Landscape and Urban Planning*, 143, 150–159. <https://doi.org/10.1016/j.landurbplan.2015.07.007>
- Cherulnik, P. D. (1993). *Applications of Environment-behavior Research: Case Studies and Analysis*. Cambridge: Cambridge University Press.
- Dobbins, M. (2009). *Urban Design And People*. John Wiley & Sons, Inc. <https://doi.org/10.1017/CBO9781107415324.004>
- Douglas, O., Lennon, M., & Scott, M. (2017). Green space benefits for health and well-being: A life-course approach for urban planning , design and management. *Cities*, 66, 53–62. <https://doi.org/10.1016/j.cities.2017.03.011>
- Ewing, R., & Handy, S. (2009). Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. *Journal of Urban Design*, 14(1), 65–84. <https://doi.org/10.1080/13574800802451155>
- Gehl, J. (2007). Public spaces for a changing public life. In C. W. Thompson & P. Travlou (Eds.), *Open Space: People Space* (1st Ed. p. 8). Oxon & New York: Taylor & Francis.
- Giles-Corti, B., Broomhall, M. H., Knuiiman, M., Collins, C., Douglas, K., Ng, K., ... Donovan, R. J. (2005). Increasing walking: How important is distance to, attractiveness, and size of public open space? *American Journal of Preventive Medicine*, 28(2 Suppl. 2), 169–176. <https://doi.org/10.1016/j.amepre.2004.10.018>
- Gregory, D., Johnston, R., Pratt, G., Watts, M., & Whatmore, S. (2011). *The Dictionary of Human Geography*. West Sussex: John Wiley & Sons.
- Guilbert, A., De Cremer, K., Heene, B., Demoury, C., Aerts, R., Declerck, P., ... Van Nieuwenhuysse, A. (2019). Personal exposure to traffic-related air pollutants and relationships with respiratory symptoms and oxidative stress: A pilot cross-sectional study among urban green space workers. *Science of The Total Environment*, 649, 620–628. <https://doi.org/10.1016/j.scitotenv.2018.08.338>
- Habibi, M., Farahmandian, H., & Mojdehi, R. B. (2016). Reflection of urban

- space in Iranian cinema. A review of the last two decades. *Cities*, 50, 228–238. <https://doi.org/10.1016/j.cities.2015.07.005>
- Hass-Klau, C. (1999). *Streets as living space*. London: Landor Publishing.
- Herbst, H., & Herbst, V. (2006). The development of an evaluation method using a geographic information system to determine the importance of wasteland sites as urban wildlife areas. *Landscape and Urban Planning*, 77(1–2), 178–195. <https://doi.org/10.1016/j.landurbplan.2005.02.005>
- Hill, R. (1998). What Sample Size is "Enough" in Internet Survey Research? *Interpersonal Computing and Technology: An Electronic Journal for the 21st Century*, 6(3–4), 1–10. Retrieved from <http://www.reconstrue.co.nz/IPCT-J Vol 6 Robin hill SampleSize.pdf>
- Hillier, B., Burdett, R., Peponis, J., & Penn, A. (1987). Creating life: or, does architecture determine anything? In *Architecture et Comportement/ Architecture and Behaviour* (pp. 233–250).
- Hjort, M., Martin, W., Stewart, T., Troelsen, J., Hjort, M., Martin, W. M., ... Troelsen, J. (2018). Design of Urban Public Spaces: Intent vs. Reality. *International Journal of Environmental Research and Public Health*, 15(4), 816. <https://doi.org/10.3390/ijerph15040816>
- Houtsma, M. T. (1993). E. J. Brill's *First Encyclopaedia of Islam*, 1913-1936. Brill. <https://doi.org/10.1057/s41289-018-0069-9>
- Isaac, S., & Michael, W. B. (1995). *Handbook in research and evaluation: a collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in education and the behavioral sciences*. EdITS. Retrieved from
- Ja'afar, N. H. (2018). Landscape Features and Traditional Streets Character in Malaysia. *Asian Journal of Environment-Behaviour Studies*, 3(8), 121. <https://doi.org/10.21834/aje-bs.v3i8.285>
- Ja'afar, N.H., Asiah A.R., Nur Amirah A.S., Che Raiskandar C. R. (2017). Sidewalk Accessibility at Melakas Traditional Streets for People with Disabilities (PwDs). *Planning Malaysia Journal*, 15(1).
- Jacobs, A. B. (1993). *Great Streets*. Cambridge: MIT Press.
- Johanson, G. A., & Brooks, G. P. (2010). Initial scale development: Sample size for pilot studies. *Educational and Psychological Measurement*, 70(3), 394–400. <https://doi.org/10.1177/0013164409355692>
- Johns, R. (2005). One Size Doesn't Fit All: Selecting Response Scales For Attitude Items. *Journal of Elections, Public Opinion & Parties*, 15(2), 237–264. <https://doi.org/10.1080/13689880500178849>
- Kim, J. (2017). Comparing the Influences of the D/H Ratio, Size, and Facade Design of an Enclosed Square on Its Perceptual Qualities as a Sustainable Urban Space in South Korea. *Sustainability*, 9(4), 675. <https://doi.org/10.3390/su9040675>
- Klingemann, H., Scheuermann, A., Laederach, K., Krueger, B., Schmutz, E., Stähli, S., ... Kern, V. (2018). Public art and public space – Waiting

Pibool Waijittragum^{1*}

¹Department of Graphic and Multimedia Design, Faculty of Industrial Technology,
Suan Sunandha Rajabhat University,
1 U-Thong Nok Road, Dusit, Bangkok 10300, Thailand

* Corresponding author:
pibool.wa@ssru.ac.th

ABSTRACT

An outstanding quality of graphic design for food packaging acts as a powerful communicative channel to attract consumers. Generally, a proper graphic design involves the use of photos and calligraphy. This research focused on the functional application of graphic design in Thai food packaging developed for elderly Japanese consumers. Data were collected through surveys involving 351 Japanese elderly residing in Thailand and 300 Japanese food packaging samples.

By applying the practical use of graphic design on food packaging, the elderly Japanese consumers were able to have a better understanding on ideas conveyed by food manufacturers. The graphic designs consist of photos showing the food inside the packaging, Japanese motifs, calligraphy, and floral motifs, indicating the meticulous lifestyle of the Japanese. Japanese consumers over the age of 70 usually pay attention to the functional attributes of products rather than their aesthetic attributes. Therefore, the use of symbols, explicit photos, readable texts, easy to understand product explanations, and saturated colors plays a significant role in the functional application of graphic designs. In addition, the products should be clearly seen from a distance, are portable, and made from natural material.

Keywords: : Visual communication, packaging design, elderly person

1. INTRODUCTION

Japan is considered as a huge market with high-potential customers of around 127 million people. The size of the Gross Domestic Product (GDP) is ranked ninth in the world with a value of ¥479.2 million (US\$4.57 million). Its economic size is regarded as the word third largest after the United States and China. In Japan, various types of products are available for consumers including goods for the senior citizens who make up 32% (more than 30 million people) of the total populations (International Monetary Fund 2013).

Japan National Institute of Population and Social Security Research (2012) reported an increase in the number of Japanese senior citizens beginning 2002. The report showed that people over the age of 65 made up 19% of the total population. The number rose to 20% in 2006 and 30% in 2014. It is estimated that the number of senior populations will be over 30% by 2033. In other words, one-third of the Japanese citizens will be made up of senior citizens aged 65 and above. Senior citizens are associated with certain criteria such as slower physical movement and mental ability that affect brain function and decision making. They can easily become irritable and suffer from eyesight and health problems which may lead to changes in their lifestyle and their amount of food intake. Although many aging hindrances are unavoidable, they can be solved by functional application of graphic designs that can improve their lifestyle (Hongrapas, 2008).

stress and waiting pleasure. *Time and Society*, 27(1), 69–91. <https://doi.org/10.1177/0961463X15596701>

Krier, R. (1979). Urban Space. https://doi.org/umkc_nichols_na9053_s6K74131979b

L.Oxford, R., & A.Burry-Stock, J. (1995). Assessing The Use Of Language Learning Strategies Worldwide With The Esl/Efl Version Of The Strategy Inventory For Language Learning (SILL). *Neuroepidemiology*, 23. <https://doi.org/10.1159/000104095>

Lang, J. (2017). *Urban Design: A Typology of Procedures and Products*. Oxon & New York : Taylor & Francis.

Lynch, K., & Hack, G. (1984). Site planning. Cambridge : MIT Press.

Lynch, K. (1984). *Good City Form*. Cambridge : MIT Press.

Madanipour, A. (1996). *Design of Urban Space: an inquiry into a socio-spatial process*. John Wiley & Sons.

Madanipour, A. (2004). Marginal public spaces in European cities. *Journal of Urban Design*, 9(3), 267–286. <https://doi.org/10.1080/1357480042000283869>

Madanipour, A. (2007). Designing the City of Reason. Routledge. <https://doi.org/10.4324/9780203962138>

Maslow, A. H. (1970). *Motivation and personality*. Harper & Row, Publishers.

Mehta, V. (2014). Evaluating Public Space. *Journal of Urban Design*, 19(1), 53–88. <https://doi.org/10.1080/13574809.2013.854698>

Mehta, V. (2018). Streets and social life in cities: a taxonomy of sociability. *Urban Design International, Volume 24, 16-37 (2019)*

Moughtin, C. (2003). *Urban Design: Street And Square* (Third, Vol. 1). <https://doi.org/10.1017/CBO9781107415324.004>

Nakau, M., Imanishi, J., Imanishi, J., Watanabe, S., Imanishi, A., Baba, T., ... Morimoto, Y. (2013). Spiritual care of cancer patients by integrated medicine in urban green space: A pilot study. *Explore: The Journal of Science and Healing*, 9(2), 87–90. <https://doi.org/10.1016/j.explore.2012.12.002>

Nicholls, S. (2001). Measuring the accessibility and equity of public parks: a case study using GIS. *Managing Leisure*, 219, 201–219. <https://doi.org/10.1080/13606710110084651>

Pancholi, S., Yigitcanlar, T., & Guaralda, M. (2015). Public space design of knowledge and innovation spaces: learnings from Kelvin Grove Urban Village, Brisbane. *Journal of Open Innovation: Technology, Market, and Complexity*, 1(1), 13. <https://doi.org/10.1186/s40852-015-0015-7>

Pressman, N. (1994). Climatic factors in play areas and public space. *Architecture et Comportement*, 10(4), 83–93.

Project for Public Spaces. (2008). *Streets as spaces. Pace Pacing And Clinical Electrophysiology*. Retrieved from http://www.pps.org/pdf/bookstore/Using_Streets_to_Rebuild_Communities.pdf

Rapoport, A. (1990). *The Meaning of the Built Environment*. Tucson: University of Arizona Press.

Rasul, A., Balzter, H., & Smith, C. (2017). Applying a normalized ratio scale technique to assess influences of urban expansion on land surface temperature of the semi-arid city of Erbil. *International Journal of Remote Sensing*, 38(13), 3960–3980. <https://doi.org/10.1080/01431161.2017.1312030>

Shaftoe, H. (2008). *Convivial Urban Spaces, Creating Effective Public Places*. <https://doi.org/10.1007/s13398-014-0173-7.2>

Thompson, C. W. (2013). Activity, exercise and the planning and design of outdoor spaces. *Journal of Environmental Psychology*, Volume 34, Pages 79-96. Retrieved from <https://doi.org/10.1016/j.jenvp.2013.01.003>

Treecce, E. M. W., & Treecce, J. W. (1977). *Elements of research in nursing*. Mosby.

Van Hecke, L., Deforche, B., Van Dyck, D., De Bourdeaudhuij, I., Veitch, J., & Van Cauwenberg, J. (2016). Social and physical environmental factors influencing adolescents' physical activity in urban public open spaces: A qualitative study using walk-along interviews. *PLoS ONE*, 11(5), 1–24. <https://doi.org/10.1371/journal.pone.0155686>

Walker, R. B., & Hiller, J. E. (2007). Places and health: A qualitative study to explore how older women living alone perceive the social and physical dimensions of their neighbourhoods. *Social Science and Medicine*, 65(6), 1154–1165. <https://doi.org/10.1016/j.socscimed.2007.04.031>

Wang, D., Brown, G., & Liu, Y. (2015). The physical and non-physical factors that influence perceived access to urban parks. *Landscape and Urban Planning*, 133, 53–66. <https://doi.org/10.1016/j.landurbplan.2014.09.007>

Whyte, W. H. (1980). *The Social Life Of Small Urban Spaces*. The Conservation Foundation Washington, DC.

Worpole, K., & Knox, K. (2007). *The Social Value of Public Spaces*. Joseph Rowntree Foundation.

Yeang, Llewelyn Davies. (2000). *Urban Design Compendium. Homes and Communities Agency*.

A healthy living condition prolongs the average lifespan of Japanese people. This provides opportunities for them to access the promising market and to empower the senior citizens (Office of Lifestyle Trade Promotion, 2018). Since most senior citizens still continue to work, they are involved in economic activities which contributes to the Japanese economic system. Research show that those aged 50 and above possess high purchasing power as a result of a decrease of financial commitments towards their children, and in average, their savings would reach ¥6 million (over \$50,000). In addition, those who retire between the age of 60 and 75 would have accumulated pension worth up to ¥14 million (\$120,000), which allows them to maintain their wealthy lifestyle and to have more free time.

There are two elements influencing Japanese consumers' buying decisions: product design and quality. Generally, Japanese consumers will first look at the design of the packaging, followed by the quality of the products that suits their lifestyles. Therefore, it is essential for marketing specialists to add elements of simplicity and ease of use of products. The examples are as listed below.

- The products have to be designed based on essential needs: product portability and label legibility; for example, mobile phones or certain home appliances.
- The products should capture the attention of the younger consumers such as music, recreation and tourism.
- There is a high demand for healthy lifestyle products. Thus, product designs should focus both on customers who need medical treatment and those of the older population. Some products could also be fashionable although research have shown that the elderly Japanese are more likely to buy products with a simple design than the fashionable ones.
- Food products for elderly consumers should be easily digested and made of low-calorie ingredients such as chicken and fish.

The Japanese value a healthy lifestyle and are meticulous about everything. This makes them unique in many ways such as in their thinking style, perseverance, accountability, punctuality, and their acceptance of technological development which are intertwined with cultural preservation. Regardless of where they are in the world, they will examine products in the market carefully and select the ones with Japanese designs they are familiar with. Consumer behaviors among the Japanese are reflected in the grocery and food they buy. Therefore, to attract the customers, Thai food products would have to adjust their flavors and package products with interesting designs.

1.1 The Objectives

1. To study visual communication elements on food packaging among elderly Japanese.
2. To study consumer behaviors, reasons, attitudes, motivations, and tastes in elderly Japanese deriving from visual perception and the functional approach which could impact the purchasing decision based on graphic designs of food packaging.

George and Michael (2008) described the concept of 'Brand Identity Creation' which portrays the creation of a unique identity of products that can impress consumers' sensory perception. The brand identity creation processes include the following:

1. Attributes of the products such as branding, calligraphy, logo design, color tones, packaging; distributors and public relation.
2. Benefits derived from the products such as flavors, odor, textures, ingredients, practicality; also included are the manufacturing process, the origin of the products and manufacturers.
3. Values of the products experienced by the consumers, such as confidence from owning the products, product reliability, and values.
4. The personality of the products such as their fashionable look.

1.2 Variables of the Research

1. Independent variables include basic details of Japanese consumers such as gender and age.
2. Dependent variables include consumer behaviors, reasons, attitudes, motivations, and tastes (Kotler & Armstrong 2006).

2. MATERIALS AND METHODS

This research was both quantitative and qualitative involving the following steps:

1. The patterns of visual communication on 300 pieces of Japanese food packaging were studied;
2. A survey on the satisfaction from 351 Japanese elderly consumers towards the packaging prototypes was carried out. The samples were randomized through the non-probability sampling method. The samples, subject to the survey, were selected through purposive sampling.

3. The packaging designs were evaluated by seven specialists of graphic designs.

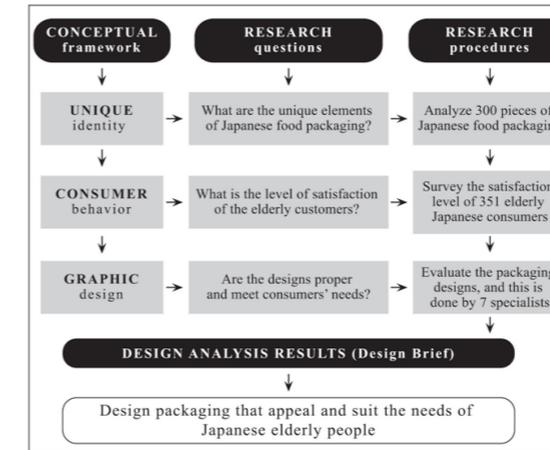


Figure 1: The research framework

2.1 Research Tools

1. Questionnaires to collect data on preference, attitude, purchasing reason, motivation, and taste from the consumers.
2. Checklists to collect data on Japanese food packaging features: picture, calligraphic, color, symbols/ graphics, and motifs.
3. Evaluation forms to collect information from the graphics and packaging specialists.

2.2 Statistical Evaluation

1. Descriptive statistics were used to analyze data from the consumers and evaluation forms from the specialists.
2. Inference statistics was used to test the hypothesis and to analyze the relationship between independent and dependent variables.

The scale responses in the questionnaires were created according to the Likert Scale. Respondents identified their level of agreements which were classified into five levels: "5" strongly agree, "4" agree, "3" moderately agree, "2" slightly agree, and "1" least agree. The acceptable responses calculated from the questionnaires should be well over "3.41" of the average value set as a criterion. The validity of the content relationship was tested against the index of item objective congruence (IOC) (Stufflebeam, 1997). The context was evaluated by CIPP Model, and the validity was evaluated by three research specialists.

After the questionnaires were adjusted according to recommendations given by the specialists, a pre-test involving 30 samples with similar qualification criteria as the research samples was conducted to test the reliability of the questionnaires. The reliability was analyzed through Cronbach's Alpha Coefficient Method as it is a suitable method for creating questionnaires with a rating scale. Data derived from the questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows Version 17. Descriptive statistics were utilized to obtain frequency result. Percentage calculation was used to measure the level of consumers' agreement. Mean score and standard deviation were used to determine the consumer preference and motivation. Inferential statistics was used to test the hypothesis and analyze the relationship between independent and dependent variables. The methods involved the following:

- T-Test was calculated to determine the differences between the average values of the two variables: males and females.
- A variance was tested using F-test to compare the average values of more than two variables: age, educational level, and occupation. One-way ANOVA was used to analyze the differences among the variable groups. If differences among the variable groups were found, a comparative analysis between a pair of variables would take place. The pair of variables would then be continuously paired using a multiple comparison test with Fisher's Least Significant Difference (LSD) at 0.05.
- The Pearson Product Moment Correlation Coefficient was used to analyze the correlation between the independent and dependent variables using the criteria shown in Table 1.

Table 1: The correlation between independent and dependent variables

Correlation Coefficient ®	Level of relationship
Below 0.20	Low correlation
0.20 – 0.39	Relatively low correlation
0.40 – 0.59	Medium correlation
0.60 – 0.79	Relatively high correlation
Over 0.80	High correlation
Over 1.00	Perfect correlation

3. RESULTS AND DISCUSSION

This research analyzed the findings of a survey carried out on graphic designs of 300 Japanese food packaging which focused on the functional applications of visual communication elements: pictures, calligraphic, symbolic/ graphics, colors, and motifs. The results of the analysis are listed as follows.

1. According to the functional applications of the pictures, it is found that the most optimum function is a bright photo followed by a bright Japanese printing art and a bright Japanese comic art. However, as seen in Table 2, bright pictographs and illustrations are rarely applied on the food packaging. The results indicated that most Japanese food packaging involved designs with bright and colorful photos.

Table 2: The Frequency of the functional application of picture

Types of Pictures	The frequency of use from a total of 300 food packaging
Colorful Photo	210
Colorful Japanese Printing Art	122
Colorful Japanese Comic art	117
Colorful Pictograph	96
Colorful Illustration	55
Monochrome Printing Art	0
Black and White Photo	0
Monochrome Japanese Comic art	0
Black and White Illustration	0
Monochrome Pictograph	0

2. According to the functional application of calligraphy, the most optimum function is the Japanese Kanji written language followed by Hiragana, Katakana, and Romanji. However, Thai language is not found on the Japanese food packaging at all as can be seen in Table 3. The result indicated that most Japanese food packaging were designed with Japanese traditional calligraphy.

Table 3: The Frequency of the functional application of calligraphy

Alphabet types	The frequency of use from a total of 300 food packaging
Kanji	250
Hiragana	205
Katakana	150
Romaji	75
Thai alphabets	0

3. According to the functional application of symbols or graphics, the most optimum function is the symbol of food preparation instructions, followed by the symbol of food texture identification. However, symbols indicating the product type was hardly found on the packaging as can be seen in Table 4. This indicated that the designs of most Japanese food packaging were mostly based on functional approaches using symbols or graphics.

Table 4: The Frequency of the functional application of symbolic or graphic

Symbols or Graphics	The frequency of use from a total of 300 food packaging
Food Preparation Instructions	280
Food Texture	150
Food Category	60
Food Quality	0
Storing of Food Instructions	0
Warnings	0
INS for Food Additives	0

4. According to the functional application of colors, it is found that the most optimum function is the realistic and bright tones of colors, followed by duotones, monotone, soft-tone, and vivid tone as shown in Table 5. The result indicated that the designs of Japanese food packaging mostly involved realistic shades and bright tone colors.

Table 5: The Frequency of the functional application of color

Types of color tones	The frequency of use from a total of 300 food packaging
Realistic Shade	280
Bright Tone	270
Duotones / Two Tones	220
Monotone	85
Soft Tone	70
Vivid Tone	65
Pale Tone	0
Subdued Tones	0
Dark Tones	0

5. According to the functional design of motifs, designs that are most effective and are highly used are designs with motifs that reflect Japanese identity, calligraphic motifs, and plant and floral motifs. Secondary designs are designs with organic, geometric, scenery, seasonal, and free-form motifs. Abstract and heritage motifs are found occasionally. The least frequently used motifs are art period and regional motifs. Finally, tribal and Thai motifs are also found on the food packaging as shown in Table 6. The result indicated that the designs of most Japanese food packaging involved traditional motifs, floral motifs, organic motifs, and calligraphy.

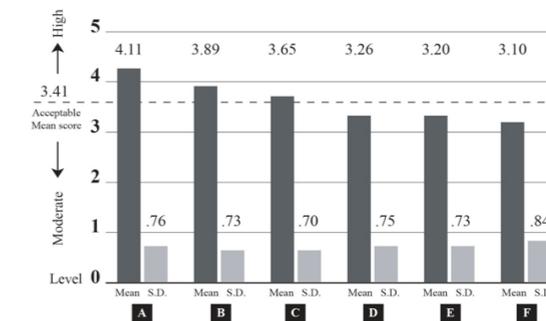
Table 6: The Frequency of the functional application of motif

Types of Motifs	The frequency of use from a total of 300 food packaging
Japanese Identity Motif	285
Calligraphic Motif	270
Floral Motif	265
Organic Motif	250
Geometric Motif	210
Scenery Motif	150
Seasonal Motif	140
Freeform Motif	125
Abstract Motif	80
Heritage Motif	75
Art period Motif	50
Regional Motif	25
Tribal Motif	0
Thai Identity Motif	0

Based on the results, it can be concluded that Japanese graphic designers have utilized their designs mainly to ease communication between food manufacturers and consumers through the use of photos, Kanji alphabets, and symbols that instruct food preparations, and realistic and bright color tones with Japanese motifs, calligraphy, and organic and floral motifs.

After the results were concluded, packaging protocols were designed, and a survey involving 351 elderly Japanese residing in Thailand were carried out. Contents analyzed involved the optimum use of the pictures, picture features, logo position, product explanation position, product texture identification, product texture symbol position, product type identification, product type identification position, color tones, and motifs. The optimum use of graphic designs on food packaging is listed as follows.

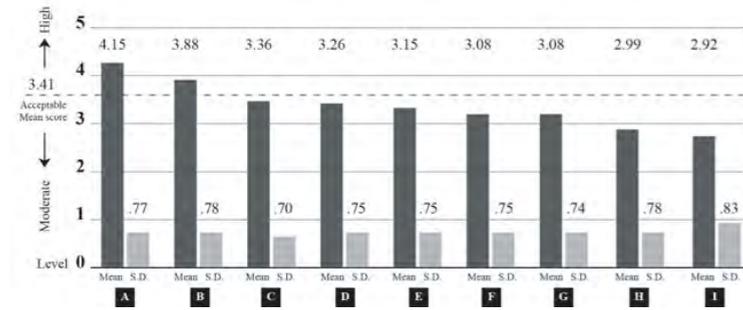
1. The highest frequency of functional use of the picture is the use of a large picture at the bottom of the packaging, followed by the use of a full-frame picture, and the use of a large picture on the upper part of the packaging as shown in Figure 2. The result indicated that most elderly Japanese were satisfied with food packaging with a large picture at the bottom of the packaging that covers 70% of the total area.



- A = A large picture at the bottom of the packaging contributing to 70% of the total area
- B = Full - frame picture (100%)
- C = A large picture on the upper part of the packaging contributing to 70% of total area
- D = A small picture in the middle of the packaging contributing to 30% of total area
- E = A small picture on the upper part of the packaging contributing to 30% of total area
- F = A small picture at the bottom of the packaging contributing to 30% of total area

Figure 2: Consumers' Satisfaction level of picture size and positioning

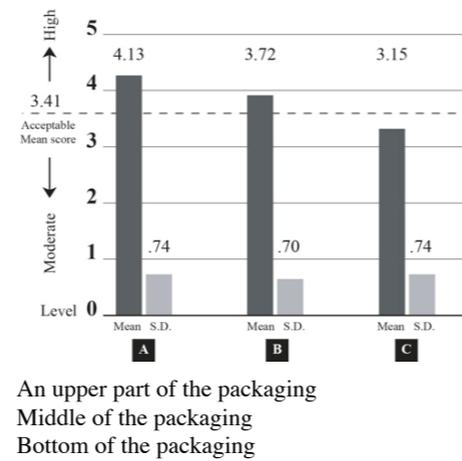
2. The highest frequency of functional use on picture features is the use of a large clear picture followed by a full-frame clear picture as shown in Figure 3. The result indicated that most older Japanese adults were satisfied with large and clear pictures on food packaging.



- A = A large clear picture
- B = Full - frame clear picture
- C = A large pale picture
- D = Full - frame pale picture
- E = A small pale picture
- F = A large subdued - tone picture
- G = Full - frame subdued - tone picture
- H = A small clear picture
- I = A small subdued - tone picture

Figure 3: Consumers' satisfaction level of picture features

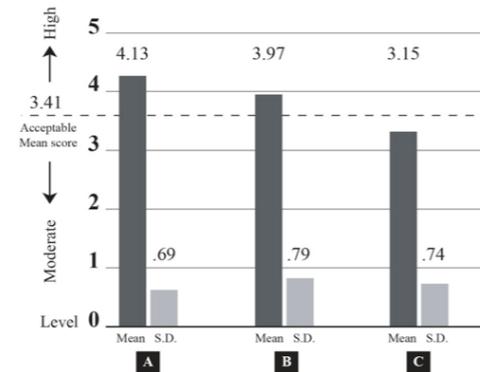
3. The highest frequency of functional use on a logo position is the position found on the upper part of the packaging, followed by the position in the middle of the packaging as shown in Figure 4. The result indicated that most of the Japanese older adults in the study were satisfied with logos being positioned on the upper part of the packaging.



- A = An upper part of the packaging
- B = Middle of the packaging
- C = Bottom of the packaging

Figure 4: Consumers' satisfaction level of the positioning of logos on the packaging

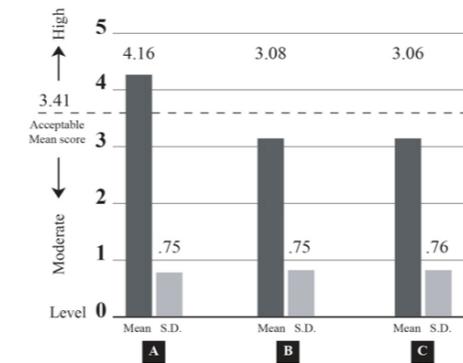
4. The highest frequency of the functional use of the position of the product explanation was found to be on the upper part of the packaging followed by in the middle of packaging as shown in Figure 5. The result indicated that most of the Japanese older adults were satisfied in product explanation of food packaging placed on the upper part of the packaging.



- A = An upper part of the packaging
- B = Middle of the packaging
- C = Bottom of the packaging

Figure 5: Consumer's satisfied levels of the positions of the product explanations on the packaging

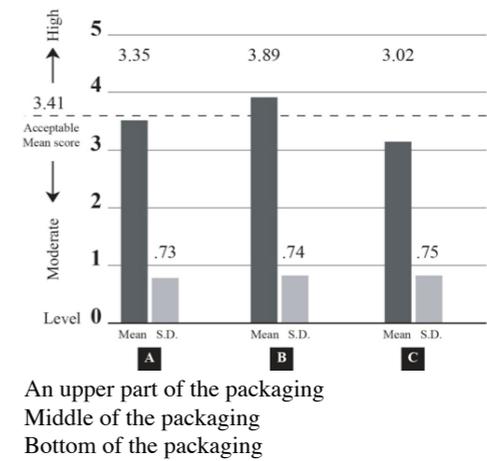
5. The highest frequency of functional use on product texture identification position is the position on the upper part of the packaging as shown in Figure 6. The result indicated that most of the Japanese older adults were satisfied in product texture identification on food packaging placed on the upper part of the packaging.



- A = An upper part of the packaging
- B = Middle of the packaging
- C = Bottom of the packaging

Figure 6: Consumer's satisfied levels of the position of product texture identification

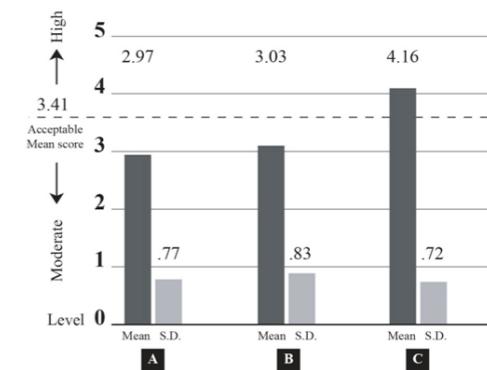
6. The highest frequency of functional use on the position of symbols to instruct food preparation is in the middle of the package as seen in Figure 7. The result indicated that most of the Japanese older adults were satisfied with symbols to instruct food preparation on food packaging placed in the middle of the packaging.



- A = An upper part of the packaging
- B = Middle of the packaging
- C = Bottom of the packaging

Figure 7: Consumer's satisfied levels of the position of food preparation instruction

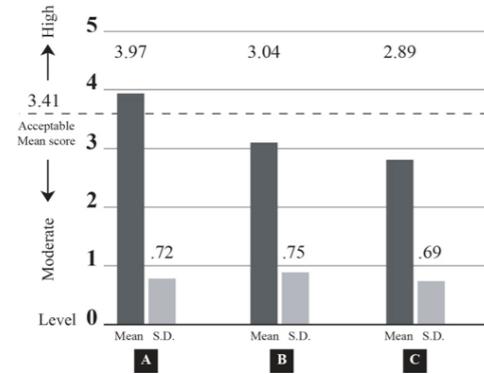
7. The highest frequency of functional use on the position of ingredient symbols is the position found at the bottom of the package as can be seen in figure 8. The result indicated that most of the Japanese older adults were satisfied with ingredient symbols on food packaging positioned at the bottom of the packaging.



- A = Upper part of the packaging
- B = Middle of the packaging
- C = Bottom of the packaging

Figure 8: Consumers' satisfaction level on the positions of food ingredient identification

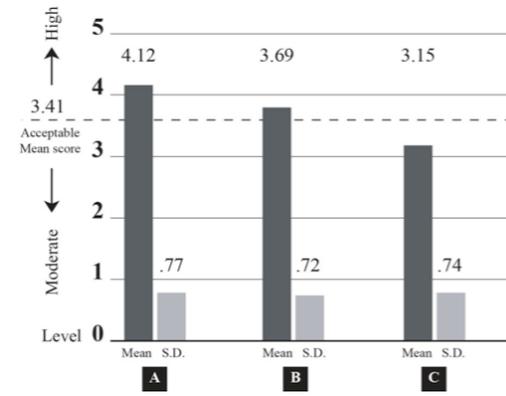
8. The highest frequency of functional use on a color scheme is the bright tone while the pale and subdued tones are unfavorable as can be seen in Figure 9. The result indicated that most of the Japanese older adults were satisfied with the bright color tones covering the food packaging.



- A = Bright Tone
- B = Pale Tone
- C = Subdued Tone

Figure 9: Consumers' satisfaction level on the color scheme on the packaging

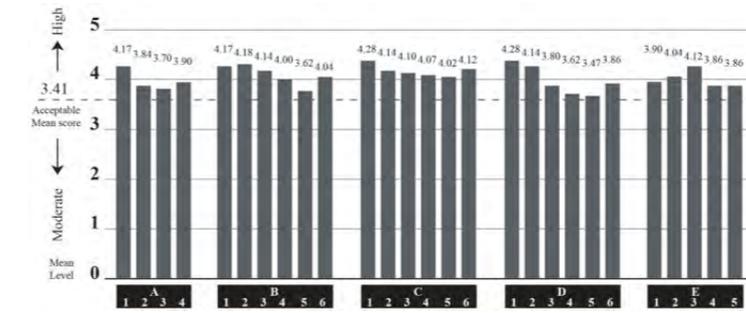
9. The highest frequency of functional use of motif is the Japanese motifs followed by international motifs. Thai motifs, however, are unfavorable as seen in Figure 10. The result indicated that most of the Japanese older adults were satisfied with Japanese style motifs covering the food packaging.



- A = Japanese Style
- B = International Style
- C = Thai Style

Figure 10: Consumers' satisfaction level on the styles of motifs on the packaging

After an evaluation of the functional use of graphic designs on the food packaging was completed, seven marketing specialists and graphic designers assessed the appropriateness of the ideas on the graphic design, marketing strategies, and consumer behavior. The assessment was presented in the form of a five-level rating scale as shown in Figure 11. The results indicate that most of the Japanese older adults are satisfied with the food packaging design elements i.e. Brand name and logo, Pictures, Motifs, Calligraphy, and Symbols. Most of the Japanese older adults are satisfied with the picture size that covers 30% of the area of the packaging.



A: Elements of design

- A 1 = Brand name and logo
- A 2 = Symbols showing the ingredients on the packaging
- A 3 = Symbols showing the food preparation instructions
- A 4 = Overall design elements

B: Graphic design with picture covering 70% of the total area of the packaging

- B 1 = Pictures
- B 2 = Motifs
- B 3 = Calligraphy
- B 4 = Color Tones
- B 5 = Symbols
- B 6 = Overall graphic design with the picture

C: Graphic design with picture covering 30% of the total area of the packaging

- C 1 = Pictures
- C 2 = Motifs
- C 3 = Calligraphy
- C 4 = Color Tones
- C 5 = Symbols
- C 6 = Overall graphic design with the picture

D: Graphic design with picture covering 100% of the total area of the packaging

- D 1 = Pictures
- D 2 = Motifs
- D 3 = Calligraphy
- D 4 = Color Tones
- D 5 = Symbols
- D 6 = Overall graphic design with the picture

E: Overall design elements

- E 1 = Overall design elements
- E 2 = Overall graphic design with the picture covering 70% of the packaging
- E 3 = Overall graphic design with the picture covering 30% of the packaging
- E 4 = Overall graphic design with the picture covering 100% of the packaging
- E 5 = Overall results

Figure 11: Evaluation of functional uses

After all the results were gathered, a briefing on the design was delivered based on the marketing strategies, consumer behaviors and graphic elements. Graphic design for Thai convenience food was generated into three patterns: Graphic design with a full-frame picture as in Figure 12; Graphic design with a picture covering 70% of the total area of the packaging as shown in Figure 13; and Graphic design with a picture covering 30% of the total area of the packaging as shown in Figure 14.



Figure 13: Graphic design with the picture covering 70% of the total area



Figure 14: Graphic design with the picture contributing 30% of the total area

4. CONCLUSION

This research has emphasized the functional use from graphic design appearing on the food packaging for the elderly market. Typograph, and pictograph/symbol designs can be described as examples of visual communication approach. The main objective of the graphic design is to create a just simple picture with universal design and boundless language, this is correlated to Tracada (2008). The details of the picture need to be removed in order to better understanding. As well as this, the secondary objective is to create the aesthetic perception which will eventually become a taste or a trend of the time.

The independent variable is the elderly group of people who are physical deteriorated causing vision problems. Therefore, the graphic design for the elderly customers on the food packaging has to be fully functional enhanced rather than the other age groups. The visual communication on food packaging needs to focus substantially more on functional application than an aesthetic approach. Nonetheless, the basic needs are still necessary for those elderly consumers, too. This can be found on Boonke (2002) who stated that the basic needs of senior citizens included mental needs together with social and economic requirements.

The well-crafted design on the food package needs to convey the message to convince target consumers to buy the products. Moreover, this finest design is an element to increase the product value relating to Waijitragum (2014) who affirmed that the principle of visual communicative design is to create the product recognition by applying numerous design elements: photos, illustrations, typograph, text, color schemes, color hues/tones, scales/proportions, motifs, and space/ground. These can be discussed as follows.

1. In order to gain the optimum use of graphic design on food packaging in Japan, the bright tone photo and illustration were highly-frequently applied as they were suitable methods to grab consumers' attention. Bright tone comic art, Japanese printing art, and pictograph were secondarily applied to the food package. Nevertheless, the artistic work can be found on the Japanese package, in general, owing to Japanese nationalism, and strong cultural background. Therefore, it is relatively easy to perceive and to feel the real Japanese uniqueness and identity through the packaging design.

One more Japanese identity which can be commonly found is the skillful calligraphy. This Japanese calligraphy can be classified as a partial area of fine art because the letter pattern looks similar to the graceful drawing. There is no need to take time to comprehend through alphabet reading. Thus, the Kanji, Hiragana, and Katakana alphabet types are widely used on the Japanese packaging while Romanji can be easily found on the products with international look and can be used to describe the product details.

The functional application of Japanese pictograph is unique among the packaging from the other countries as the Japanese is pretty meticulous. Their well-designed pictograph helps the consumers from wasting time-consumption on reading the package details which are long and printed in small font size. This can cause problems for elderly consumers. Most pictographs portray the ingredients, flavors, and instructions of food preparation. As the hurried lifestyle of Japanese, they are unlikely to waste their precious time on unnecessary details. The understandable pictograph or drawing has to be utilized to describe the process, and food texture which can be a great help for the elderly to make the suitable purchasing decision upon the ready-cooked food products available in the market.

The Japanese idea of minimalism can be influential in shaping the use of color tones to express the Japanese identity. Most acceptable color tones for Japanese are bright but not vivid tones. It is usually found that most gentle and bright tones are used harmoniously with tastefulness on the packaging. This is correlated to Oka (1975) who presented the functional use of Japanese color tones to express the product personality and uniqueness. Hence, to successfully market the products in Japan, the design needs to be adapted in according to the

consumer's taste leading to permanent product recognition and repurchasing.

Japanese motifs and ornaments on the food packaging can also be found but not noticeable. Most motifs include organic, floral, geometric forms. Scenery or seasonal motif can be found on souvenir goods or gift boxes. This can be evidence for their highly careful consideration.

2. It is unavoidable to take the geriatric conditions into an account of the graphic design on packaging as the elderly citizens are mental and physical impaired. These conditions can cause the abruptly social change in lifestyle, so the graphic design should be functioned as a solution for the troublesome issues which can alleviate the seriousness of the vision problems. This can be supported by Chong and Shureen (2016) who optimized their graphic design function to reduce the intensity of the problems and to create the mental peacefulness.

The Japanese citizens aged lower than 60 have counted themselves as middle-aged workers who can pursue their work and demand products with aesthetic elements. Unlike the people aged over 70, they have considered and admitted themselves as senior citizens who need more time to conduct any activities in their daily lives. Moreover, due to their weakened sensory systems, this group of people prefers the product with functional quality to products with aesthetic elements. This is correlated to Chandhasa (2017) who primarily focused on the functional use from the products rather than the product attractiveness. Sometimes, it is important to initiate the practically-oriented structure of the product before applying the graphic design approach.

In order to gain the high yield result from sustainable design, the designers and the manufacturers should utilize the reduction of the unnecessary process, materials and laboring together with taking an energy saving campaign into their consideration. An elderly friendly design and universal design for handicapped people are important as well because they need visual communication aid through pictures or symbols. For example, the use of symbols presenting food texture can help the elderly to figure out the toughness of the meat that

matches their ability of food consumption. The structure of the product should be portable and consumer friendly. Some containers with lids should be easy to reopen. It is advisable to use the environmentally friendly containers derived from the local material such as coconut husk paper which was researched by Bussaban and Chumee (2019).

ACKNOWLEDGEMENTS

This research would not have been possible without the contribution, support, kindness helpful and encouragement of; Associate Professor Dr. Suppakorn Disatapundhu, Chulalongkorn University and Suan Sunandha Rajabhat University for all supports.

REFERENCES

- Boonke, P. 2012. *Communities Trade Fare and Activities for elderly person*. Thailand: Chiang Mai University.
- Bussaban K., Chumee J. 2019. *From Coconut Husk Waste to Community Business*.
- In: Kantola J., Nazir S., Barath T. (eds) *Advances in Human Factors, Business Management and Society*. AHFE 2018. *Advances in Intelligent Systems and Computing*, vol 783. Springer, Cham.
- Chandhasa, R., 2017. The Development of Home Decorative Vetivers Seat Cushion. *Asian Social Science*; Volume 13, No. 7; 2017
- Chong, Y. E. and Shureen, F. A. S. 2016. *Healing gardens for the elderly: a review* of design guidelines and the comparisons with the existing senior outdoor survey (SOS) tool. *ALAM CIPTA: International Journal of Sustainable Tropical Design Research and Practice* (Volume 9, No. 2, December 2016, Pages 19 to 25)
- George, E. B. & Michael, A. B. 2008. *Advertising & Promotion*. New York: McGraw-Hill/Irwin.
- Hongprapas, P. 2008. *Nutrition for elderly person*. Thailand: Khon kaen University.
- Japanese National Institute of Population and Social Security Research. 2012. Total population in Japan. Available on: <https://www.statista.com/statistics/263746/total-population-in-japan/> Retrieved June 26, 2013.
- International Monetary Fund. 2013. Available on: <http://www.ipss.go.jp/p-info/e/psj2012/PSJ2012.asp>. Retrieved June 26, 2013.
- Kotler, P. & Armstrong, G. 2006. *Principles of Marketing.USA.: Pearson*

Prentice Hall.
Office of Lifestyle Trade Promotion. 2018. The Conference on Japanese elderly person. *Bangkok: Department of International Trade Promotion, Ministry of Commerce.*
Oka, H. 1975. How to Wrap Five Eggs. *Massachusetts: Shambhala Publications, Inc.*
Stufflebeam, D. L. 1997. Strategies for institutionalizing evaluation: revisited. *Occasional Paper Series #18*. Kalamazoo: Western Michigan University Evaluation Center.
Tracada, E. 2008. *Design Codes and Design Language*. Design Pedagogy Research: Leeds.
Wajjitratum, P. 2014. Visual Communication for Thai Halal Print Media. *The International Journal of Design in Society. USA: Common Ground Publishing*. Volume 7, Issue 4; 2014.

INSTRUCTIONS TO AUTHORS

MANUSCRIPT PREPARATION

Manuscript Types

Alam Cipta accepts submission of mainly **five** types of manuscripts for peer-review.

1.REGULAR ARTICLE

Regular articles are full-length original empirical investigations, consisting of introduction, materials and methods, results and discussion, conclusions. Original work must provide references and an explanation on research findings that contain new and significant findings.

Size: Generally, these are expected to be between 6 and 12 journal pages (excluding the abstract, references, tables and/or figures), a maximum of 80 references, and an abstract of 150–200 words.

2.REVIEW ARTICLE

These report critical evaluation of materials about current research that has already been published by organizing, integrating, and evaluating previously published materials. It summarizes the status of knowledge and outline future directions of research within the journal scope. Review articles should aim to provide systemic overviews, evaluations and interpretations of research in a given field. Re-analyses as meta-analysis and systemic reviews are encouraged. The manuscript title must start with "Review Article:"

Size: These articles do not have an expected page limit or maximum number of references, should include appropriate figures and/or tables, and an abstract of 100–200 words. Ideally, a review article should be of 7 to 8 printed pages.

3.SHORT COMMUNICATIONS/PROJECT REVIEW AND CRITIQUES

They are timely, peer-reviewed and brief. These are suitable for the publication of significant technical advances and may be used to:

- (a) provide systematic design review or critiques on the

architectural and design projects which are relevant with journal scope;

- (b) report new developments, significant advances and novel aspects of experimental and theoretical methods and techniques which are relevant for scientific investigations within the journal scope;
- (c) report/discuss on significant matters of policy and perspective related to the science of the journal, including 'personal' commentary;
- (d) Disseminate information and data on topical events of significant scientific and/or social interest within the scope of the journal. The manuscript title must start with "Brief Communication:"

Size: These are usually between 2 and 4 journal pages and have a maximum of five figures and/or tables, from 8 to 20 references, and an abstract length not exceeding 100 words. Information must be in short but complete form and it is not intended to publish preliminary results or to be a reduced version of Regular or Rapid Papers.

4.BOOK REVIEW

A book review paper offers a description and an evaluation of a book within the journal scope. The author must furnish the book information or bibliographic citation in full includes author(s), place, publisher, date of publication, edition statement, pages, special features (maps, colour plates, etc.), price and ISBN. A snapshot of the book cover is necessary. The manuscript title must start with "Book Review"

Size: Generally, book review article is usually between 2 and 3 journal pages. The paper does not necessarily have an abstract and references.

5.OTHERS

Brief reports, case studies, comments, concept papers, Letters to the Editor, and replies on previously published articles may be considered

PLEASE NOTE: NO EXCEPTIONS WILL BE MADE FOR PAGE LENGTH.

Language Accuracy

Alam Cipta emphasizes on the linguistic accuracy of every manuscript published. Articles must be in **English** and they must be competently written and argued in clear and concise grammatical English. Contributors are strongly advised to have the manuscript checked by a colleague with ample experience in writing English manuscripts or a competent English language editor.

Author(s) **should provide a certificate** confirming that their manuscripts have been adequately edited. A proof from a recognized editing service should be submitted together with the cover letter at the time of submitting a manuscript to Alam Cipta. **All editing costs must be borne by the author(s)**. This step, taken by authors before submission, will greatly facilitate reviewing, and thus publication if the content is acceptable.

Linguistically hopeless manuscripts will be rejected straightaway (e.g., when the language is so poor that one cannot be sure of what the authors really mean). This process, taken by authors before submission, will greatly facilitate reviewing, and thus publication if the content is acceptable.

MANUSCRIPT FORMAT

The paper should be submitted in one column format with at least 4cm margins and 1.5 line spacing throughout. Authors are advised to use Times New Roman 12-point font and MS Word format.

1. Manuscript Structure

Manuscripts in general should be organized in the following order:

Page 1: Running title

This page should **only** contain the running title of your paper. The running title is an abbreviated title used as the running head on every page of the manuscript. The running title should not exceed 60 characters, counting letters and spaces.

Page 2: Author(s) and Corresponding author information.

This page should contain the full title of your paper not exceeding 25 words, with name(s) of all the authors, institutions and corresponding author's name, institution and full address (Street address, telephone number (including extension), hand phone number, and e-mail address) for editorial correspondence. First and corresponding authors must be clearly indicated.

The names of the authors may be abbreviated following the international naming convention. e.g. Salleh, A.B.1, Tan, S.G2*, and Sapuan, S.M3.

Authors' addresses. Multiple authors with different addresses must indicate their respective addresses separately by superscript numbers:

George Swan¹ and Nayan Kanwal²

¹Department of Biology, Faculty of Science, Duke University, Durham, North Carolina, USA., ²Office of the Deputy Vice Chancellor (R&I), Universiti Putra Malaysia, Serdang, Malaysia.

A **list** of number of **black and white / colour figures and tables** should also be indicated on this page. Figures submitted in colour will be printed in colour. See "5. Figures & Photographs" for details

Page 3: Abstract

This page should repeat the full title of your paper with only the Abstract (the abstract should be less than 250 words for a Regular Paper and up to 100 words for a Short Communication), and Keywords.

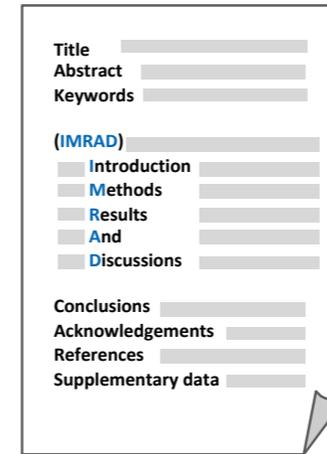
Keywords: Not more than eight keywords in alphabetical order must be provided to describe the contents of the manuscript.

Page 4: Introduction

This page should begin with the Introduction of your article and followed by the rest of your paper.

2. Text

Regular Papers should be prepared with the headings *Introduction, Materials and Methods, Results and Discussion, Conclusions, Acknowledgements, References, and Supplementary data* (if available) in this order.



MAKE YOUR ARTICLES AS CONCISE AS POSSIBLE

Most scientific papers are prepared according to a format called IMRAD. The term represents the first letters of the words Introduction, Materials and Methods, Results, And, Discussion. It indicates a pattern or format rather than a complete list of headings or components of research papers; the missing parts of a paper are: Title, Authors, Keywords, Abstract, Conclusions, and References. Additionally, some papers include Acknowledgments and Appendices.

The Introduction explains the scope and objective of the study in the light of current knowledge on the subject; the Materials and Methods describes how the study was conducted; the Results section reports what was found in the study; and the Discussion section explains meaning and significance of the results and provides suggestions for future directions of research. The manuscript must be prepared according to the Journal's instructions to authors.

3. Equations and Formulae

These must be set up clearly and should be typed double spaced. Numbers identifying equations should be in square brackets and placed on the right margin of the text.

4. Tables

All tables should be prepared in a form consistent with recent issues of Alam Cipta and should be numbered consecutively with Roman numerals. Explanatory material should be given in the table legends and footnotes. Each table should be prepared on a new page, embedded in the manuscript.

When a manuscript is submitted for publication, tables must also be submitted separately as data - .doc, .rtf, Excel or PowerPoint files- because tables submitted as image data cannot be edited for publication and are usually in low-resolution.

5. Figures & Photographs

Submit an original figure or photograph. Line drawings must be clear, with high black and white contrast. Each figure or photograph should be prepared on a new page, embedded in the manuscript for reviewing to keep the file of the manuscript under 5 MB. These should be numbered consecutively with Roman numerals.

Figures or photographs must also be submitted separately as TIFF, JPEG, or Excel files- because figures or photographs submitted in low-resolution embedded in the manuscript cannot be accepted for publication. For electronic figures, create your figures using applications that are capable of preparing high resolution TIFF files. In general, we require **300 dpi** or higher resolution for **colored and half-tone artwork**, and 1200 dpi or higher for line drawings are required. Failure to comply with these specifications will require new figures and delay in publication.

NOTE: Illustrations may be produced in colour at no extra cost at the discretion of the Publisher; the author could be charged Malaysian Ringgit 50 for each colour page.

6. References

References begin on their own page and are listed in alphabetical order by the first author's last name. Only references cited within the text should be included. All references should be in 12-point font and double-spaced.

NOTE: When formatting your references, please follow the APA reference style (6th Edition). Ensure that the references are strictly in the journal's prescribed style, failing which your article will not be accepted for peer-review. You may refer to the Publication Manual of the American Psychological Association for further details (<http://www.apastyle.org/>).

7. General Guidelines

Abbreviations: Define alphabetically, other than abbreviations that can be used without definition. Words or phrases that are abbreviated in the introduction and following text should be written out in full the first time that they appear in the text, with each abbreviated form in parenthesis. Include the common name or scientific name, or both, of animal and plant materials.

Acknowledgements: Individuals and entities that have provided essential support such as research grants and fellowships and other sources of funding should be acknowledged. Contributions that do not involve researching (clerical assistance or personal acknowledgements) should not appear in acknowledgements.

Authors' Affiliation: The primary affiliation for each author should be the institution where the majority of their work was done. If an author has subsequently moved to another institution, the current address may also be stated in the footer.

Co-Authors: The commonly accepted guideline for authorship is that one must have substantially contributed to the development of the paper and share accountability for the results. Researchers should decide who will be an author and what order they will be listed depending upon their order of importance to the study. Other contributions should be cited in the manuscript's Acknowledgements.

Copyright Permissions: Authors should seek necessary permissions for quotations, artwork, boxes or tables taken from other publications or from other freely available sources on the Internet before submission to Alam Cipta. Acknowledgement must be given to the original source in the illustration legend, in a table footnote, or at the end of the quotation.

Footnotes: Current addresses of authors if different from heading may be inserted here.

Page Numbering: Every page of the manuscript, including the title page, references, tables, etc. should be numbered.

Spelling: The journal uses American or British spelling and authors may follow the latest edition of the Oxford Advanced Learner's Dictionary for British spellings.

SUBMISSION OF MANUSCRIPTS

Owing to the volume of manuscripts we receive, we must insist that all submissions be made electronically using the **online submission system ScholarOne™**, a web-based portal by Thomson Reuters. For more information, please click "**Online Submission**" on our website.

Submission Checklist

1. **MANUSCRIPT:** Ensure your MS has followed the Alam Cipta style particularly the first four pages as explained earlier. The article should be written in a good academic style and provide an accurate and succinct description of the contents ensuring that grammar and spelling errors have been corrected before submission. It should also not exceed the suggested length.
2. **COVER LETTER:** All submissions must be accompanied by a cover letter detailing what you are submitting. Papers are accepted for publication in the journal on the understanding that the article is original and the content has not been published or submitted for publication elsewhere. This must be stated in the cover letter. Submission of your manuscript will not be accepted until a signed cover letter (original pen-to-paper signature) has been received.

The cover letter must also contain an acknowledgement that all authors have contributed significantly, and that all authors are in agreement with the content of the manuscript.

The cover letter of the paper should contain (i) the title; (ii) the full names of the authors; (iii) the addresses of the institutions at which the work was carried out together with (iv) the full postal and email address, plus telephone numbers and emails of all the authors. The current address of any author, if different from that where the work was carried out, should be supplied in a footnote.

3. **COPYRIGHT:** Authors publishing the Journal will be asked to sign a copyright form. In signing the form, it is assumed that authors have obtained permission to use any copyrighted or previously published material. All authors must read and agree to the conditions outlined in the form, and must sign the form or agree that the corresponding author can sign on their behalf. Articles cannot be published until a signed form (*original pen-to-paper signature*) has been received.

Please do **not** submit manuscripts to the editor-in-chief or to any other office directly. Any queries must be directed to the **Editor in Chief** office via email to alamciptaeditor@upm.edu.my.

Visit our Journal's website for more details at <http://alamcipta.upm.edu.my/>

HARDCOPIES OF THE JOURNALS AND OFF PRINTS

Under the Journal's open access initiative, authors can choose to download free material (via PDF link) from any of the journal issues from Alam Cipta website. Under "**Issue**" you will see a link, "Current Issues" or "Past Issue". Here you will get access to all current and back-issues from 2000 onwards.

The **corresponding author and authors** for all articles will receive one complimentary softcopy (digital print) of the journal in which his/her articles is published. Additional copies of the journals may be purchased by writing to the Chief Executive Editor.

Contact us:

Editor In Chief
International Journal of Sustainable Tropical Design Research and Practice
Faculty of Design and Architecture
Universiti Putra Malaysia
43400 UPM Serdang
Selangor
Malaysia
Tel : 03-97694064/03-97694079
Email : alamciptaeditor@upm.edu.my
Website : <http://alamcipta.upm.edu.my/>

**Copyright © Special Issue 1, May 2020 by Faculty of Design and Architecture,
Universiti Putra Malaysia**
Published by UPM Press
Serdang

Design Direction :
Mohd Nasir Baharuddin

Design Cover:
Arizy Valentino Ramli

Layout and Computer Graphics:
Nur Fatiha Sapran

Secretariat:
Siti Noriza Samad
Norasyidah Mohd Noor
Zetty Fazleen Anuar