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MUTUALISTIC ARCHITECTURE: IMPLICATION ON WILDLIFE SPATIAL HABITAT IN TOURISM RELATED BUILDINGS IN SIGIRIYA, DAMBULLA AREA

B.K.S.N. GOONAWARDENA[1] & S. UDALAMATTA[2]
[1, 2] Department of Architecture, University of Moratuwa, Colombo, Sri Lanka
[1]*sathya.bastian@gmail.com*, [2]*susirasen@yahoo.com*

Abstract
The research Support to comprehend the beneficial mutualistic relationship between architectural and biological systems and to investigate the mutualistic successive architecture (MSA) accommodate spatial habitat of wildlife in the tourism-related buildings within Sigiriya, Dambulla zone. The analytical study framework to analyse the local case studies critically through a wide discussion of MSA through the general "components" of architectural designs, investigating the concepts of the animal behaviour, understanding the connections of the site planning and design with ecology. The valuation of the constructed form and the natural habitats must be examined and created in order to determine how they interact in a mutually beneficial and symphonic manner. The architectural focus needs to be moved to pristine and vulnerable areas where tourism accommodation has left huge environmental impacts. Selected two cases to have extreme differentiate and similarity with two different scales. Wildlife habitat has permanent and temporal behaviour within this zone while both projects have caused the implications towards wildlife negatively and positively. Simultaneously that was the need to do the research about MS implications on wildlife within anthropogenic activities. Qualitative measures have converted to quantitative measures by using ratings and graphs. Mutualistic and resilience quality of both projects are similar to different approaches from the beginning. Hence, when considering the MSA in a project, it is essential to consider the materials and the life cycle of the materials and its performance. Considering architecture and mutual relationship in a human enclosure within wildlife habitats, the author has identified that long research has to be done to find out the MSA in a project, which engages wildlife habitats.

Keywords: *Mutualism, spatial adaptation, temporal, implication, anthropogenic activities*

1. Introduction

The inspiration to the whole investigation is moved by the way that the author's personal experience contradicts to find further exploration in mutualistic architecture and the implications of architectural components towards the non- human beings and how they adapt their personal spaces within the built environment. Early architecture was built and combined within nature and there were fewer boundaries for fauna. The temporal and spatial pattern of landscape change, human perception of landscape and affairs absent with time and incomprehension of the coexistence strategies in the landscape are the major causes of this. The areas with flawless and delicate characteristic ranges, it is important to focus in design engagement where the tourism industry was uncontrolled. Tourism-related architectural intercessions are progressively being seen as a risk to wildlife and ecosphere. By directing, reacting and getting involved in the sensorial ranges of particular species, architecture and infrastructure can become redefined as animal players in a much greater system. As a sensorial device, architecture would be accepted as a part attractor, part program container and a part animal interface. In addition, more than giving space for program and purposes, it is more effective if architecture could provide the visitor with the familiarity of engaging in a conversation with some other animal.

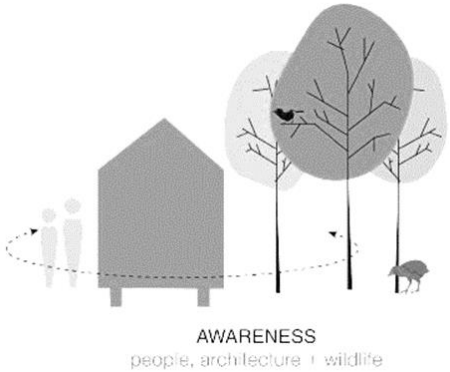

Figure 1: people, architecture, and animals
Source: Sound of silence, Hannah Smith, 2016

Impacts of anthropogenic activities are expressed at all ecological scales, from short-term and long-term changes. It is essential to have more beneficial mutualistic relationship between architectural and biological systems in such remote areas whereas design and the built environment has to improve the natural environment while supporting its human functions through spaces. Purpose of the research to investigate how built environment accommodate spatial habitat of wildlife in special reference to the tourism-related constructions in Sigiriya , Dambulla zone in Sri Lanka and their characteristic towards mutualism. The study will influence indirectly to conservational aspects of a wildlife approachable architecture to creating Mutual Succession attitude towards wildlife surrounded by the built environment. Ought to investigate the new age of designing which integrates with architecture by making superior liveable spaces for both human and animals. The challenge is to not ruin the very ecology we are attempting to save if the architectural purpose fails to attract occupants properly to the wildlife.

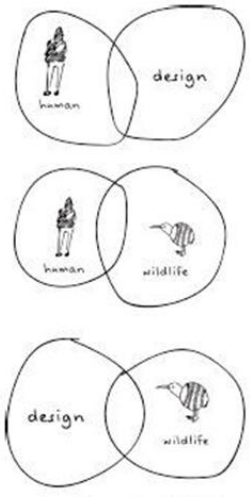

Figure 2: human-wildlife relationship towards the built environment: Silent user
Source: Sound of silence, Hannah Smith, 2016

Study combinations grant to investigate, the influence of built environment on the cooperative behaviour of animals with short term and long-term differences. This study will be undertaken through the Investigate 'by design' phase. The investigation included a study of written works about the general “components” of architectural designs (Andrea Simitch, 2014), Investigating the concepts of the animal behaviour and understanding the connections of the site planning for a mutualistic architecture. (Mehta, 1999). From the critical study of the literature review, the author creates the ideal analytical study framework to analyse the local case studies and critically observe the response to the wildlife spatial habitat through wide discussion of mutualistic successive architecture (MSA). This is an area of well-established personal interest, an expanded level of understanding was fundamental. Combined methodologies have used to establish areas of applicable preservation information.

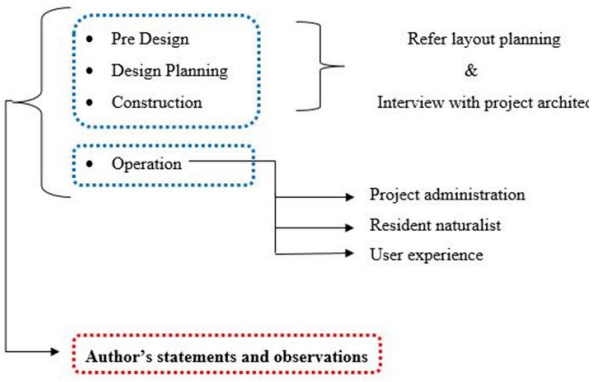

Figure 3: Flow chart for information collection process
Source: by author

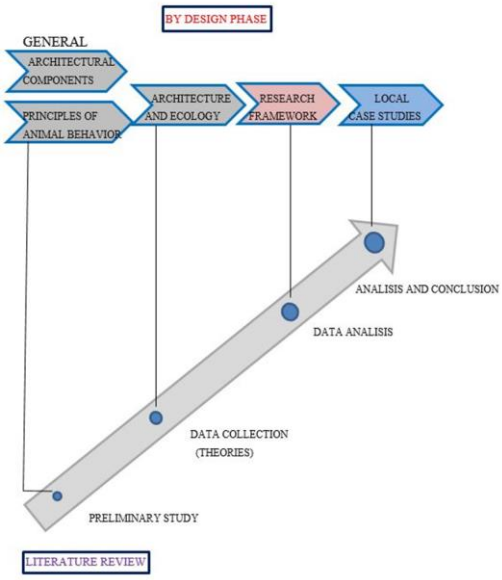

Figure 4: Chart for Methodology for the case study framework
Source: by author

2. Spatial habitat of Animals

The conditions define the behaviour of animals in a “spatial habitat “reveal their dread and desire. There is two distinct part in general bases for "territorial behaviour" in species and they are:

1. adaptive significance of the spatial habitat
2. The habitat should achieve such physiological needs

Mutualism

Ecological interaction of two or more species from which fitness benefits are gained by individuals of both species is described as Mutualism. As connected to design, the two life forms are the man-made built environment and the ecological system. The architectural design ought to be a sort of mutualism. (Vivian workman, 2004).Because of this complication that mutualistic architecture is in a special position to regenerate the regular existence and its non-artificial physical features in the building environment. The form of the mutualistic architecture ought to not be a particular “style” but reasonably a forms out that improves from a series of procedures.

Habitat clearance and modification

Reimbursement and change of natural surroundings are incorporated into this segment since it much of the time results in the decrease or vanishing of assets basic for key behaviours. Clearance of the habitat in sensible area is maybe the most genuine preservation risk to the world’s wildlife, and to consider with wildlife in the tourism-related buildings. Habitats might be cleared or adapted for wildlife tourism, through the development of the projects, outdoor gardens, streets, parking spots or outing regions. Territory discontinuity brings issues of edge impacts (R.J & Catterall., 1998), decreases habitats and home varieties.

3. Spatial mutualism of architecture and ecology

3.1. INTEGRATION OF ARCHITECTURE AND ECOLOGY

The homogeneous internal environment we create are detached from the nature of the site hence we become a separate entity within a selected context. We need to realize the fact that other species already inhabit a world shaped by architecture. Mutualistic architecture should always follow the natural surroundings without destroying it.

INTERDIGITATION
A spatially integrated pattern based on an intrinsic resource distribution pattern.
Example: ridges and valleys

NODE AND CORRIDOR NETWORK
A system of core areas combining the benefits of large core areas with advantages of connectivity.
Example: ecological network

Figure 5: spatial concepts for architecture and planning with landscape
Source: integration of landscape ecology and architecture, Jack Ahern, 2005

3.2 GENERAL COMPONENTS OF ARCHITECTURAL DESIGN

3.2.1. *Physical substances*

Building mass can be explained to make intrigue, concordance, and fascination inside their design. It is critical to watch the effect of structure, massing to the encompassing environments. The position of structures have changed the extent that the structure itself makes compositional space, way of life just as give a type of impact to the encompassing natural habitats. Which comprise the fundamental fascination, together With the native wildlife. The utilization of viewpoint on actual structure surface can incredibly change the spatial character and building space can be controlled evermore by utilizing surface.

3.2.2. *Ephemeral substances*

Space might be the guideline characterizing qualities of architecture. It might separate into two distinct part as inward and outside. As to wildlife, it is increasingly critical to talk about the outside spaces connected to the structure just as integration with the encompassing landscape, the building's structure can be made to blend in with and show up as an expansion of the natural habitat through sensibly planned exterior spaces. The scale identifies with the extent of an object contrasted and the space it possesses. It might be that the achievement of scale relies on the capacity to appreciate proportion and repetition in connection to some unit that is generally human-sized and close enough to the people and wildlife in a structure to allow them to quantify it against themselves. Lighting in day and night is a requirement in architecture and utility. Designers channel it through openings into their spaces and shape it on the surfaces of their masses by changes of plane, causing it to invigorate into their structures by appearing differently in relation to shadow. The presentation of artificial lighting likely spoke to the most drastic change people have made to the natural habitat.

Table 1: Analytical framework

Principles and strategies from the **Literature review** will analyze through selected case studies		Case study 01	Case study 02
1. **Analysis of the wildlife in and around the site**		-	-
2. **Principles of animal behaviors in and around the site**	• Adaptive significance • Physiological needs	-	-
3. **Negative and positive impacts of General architectural components**	• Physical Substances • Ephemeral substance	-	-
4. **Site planning and design**	• Zoning & physical structure siting	-	-

4. Comparison of implication on wildlife spatial habitat in Sigiriya, Dambulla area: Case study analysis

Project A -Kalundawa Retreat by Archt. Sanath.Liyanage
Project B- Galkadawala forest lodge by Archt. Vijitha Basnayaka

4.1. ANALYSIS OF WILDLIFE IN AND AROUND THE SITES

The core objective of the project A and B are to ensure that wildlife is not disturbed by architectural interventions. Both the projects used a different approach in the study. While Galkadawala Lodge project transformed deforested, consumed and denuded land into a vibrant ecological habitat by caretakers who worked tirelessly since 2006 till date, Kalundewa project initiated in 2005 enriched the surviving habitat ecosystem over the periods. Thus, there are favourable significant changes in the population and behaviour of the wildlife in and around the site. In Galkadawala, with the Secondary Succession, few species from the surrounding habitats exhibited the capability of thriving in the disturbed habitat whereas, in Kalundewa retreat, the entire habitat including the microhabitat was enriched and substantially improved.

4.2. PRINCIPLES OF ANIMAL BEHAVIOUR

The above projects clearly identify the difference of micro changes in animal behaviour and their adaptive quality, breeding success, level of predator avoidance, food availability and awareness of human presence. Before construction, Kalundewa site was already rich in roosting sites whereas, in Galkawadala, new habitats were introduced to the site with the construction that also identified the high adaptive rates in the animals. The analysis of data collected from the Naturalist in Project Administration reveals that there is a fluctuation in nourishment, population, and locations in roosting and nesting sites. Both architects were critically considered the arboreal and other pathways below and above the structures by taking into consideration of the spaces which were occupied by the wildlife, control of artificial lighting, noise and colours at the design stage.

4.3 ROLE OF GENERAL ARCHITECTURAL COMPONENTS TOWARDS WILDLIFE

The overall architectural components have turned out to be the most refined version of the existing nature, however, it has both positive and negative impacts towards wildlife. Both the architect's intention was to let nature take over the building and dwell with it. The two projects vary in scale and with the use of technology. They had been determined by the surrounding natural context and how the buildings have been occupied within the space. While Kalundewa Retreat used local language with the use of modem and contemporary technology, Galkadawala Forest Lodge only used vermicular local technology. The appearance and output of the projects have been enhanced through techniques, colours, surfaces, textures, volumes, proportions, replications and operations by merging with their surrounding environment. This has furthermore resulted in negative and positive impacts on wildlife.

4.4. SITE PLANNING AND DESIGN

The author suggests considering the integral use of land to cater to both human and wildlife circulation when preparing the site layout (including the structures and utilities within the premises). An extremely cautious planning is fundamental that considers factors like the safe distance from the migratory routes, reproducing and perching destinations, and the zoned areas. Environmental and social cognizant site planning have resulted in establishing mutual connection between the improvements in the tourism industry and wildlife enrichments. Buildings have been constructed carefidly to define the edges when segregating the indoor-outdoor relationship. Site master planning for both the projects have perfectly merged with the dense forest, marshy land and water bodies.

4.5. ECOLOGICAL SECTIONAL TEST (LIFE CYCLE RESPONSIVENESS)

Qualitative measures converted to quantitative measures by using ratings and graphs. Final conclusion based on MSA (Mutualistic Successive Architecture) of the projects analysis through the building centred (red) and animal centred (green) life cycle of the building. By comparing the ecological sectional

test and rankings done by the project architects, the author analysed the responsiveness of the building to the natural site. Hypothetical graphical variation of mutual succession has been used in the analysis of variations in Project A & B. Due to time and mutual succession, a gradient of line Red and Green is noticeable in both the projects. Due to the different approaches of both projects, in Kalundewa : building and animal succession might rise to climax point around 30 years and there might be anticipated decrement of building responsiveness after the climax point and the animal responsiveness continues constantly. In Glakadawala both attributes increase to the climax point simultaneously due to the secondary succession, hence the building responsiveness might have been decreased after 15 years keeping the animal responsiveness constantly in the site. A faster rate of adaptation has been observed in Galkadawala over the years and is expected to change in the future. In both projects the anticipated life cycle of the MS building has and there is a significant time gap between two projects. This would develop a correlation between building and wildlife responsiveness. The buildings and its architecture proposed in Project A & B are adaptable to wildlife animal succession. The primary and secondary Meta in the responsiveness of the building are material and technology respectively. The author has identified that long term research has to be done to fad out the MSA in a project which engages wildlife habitats. Considering architecture and mutual relationship in a human enclosure within animal habitats, the reason of the MS have been identified the overall material types and the life cycle of the materials.

tms (k) — mutual succession of Kalundewa Retreat
tms (g) - mutual succession of Gikawadala Forest Lodge

tms (k) < tms (8)

Mutual Successive architecture (MSA) in selected projects –
life cycle responsiveness

Ecological sectional test

Kalundewa Retreat

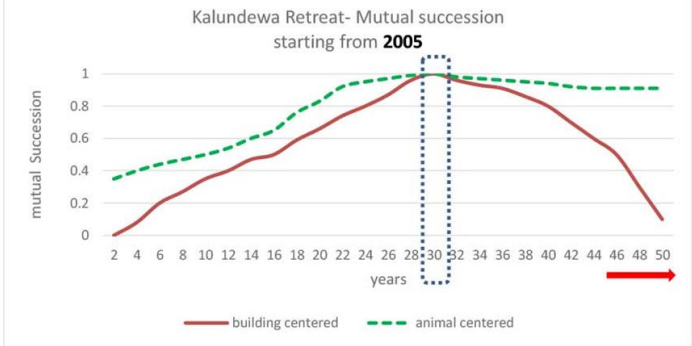

Figure 97: Chart of the expected time line of Kalundewa retreat
Source: by author developed through Findings from relevant professionals

Galkadawala Forest Lodge

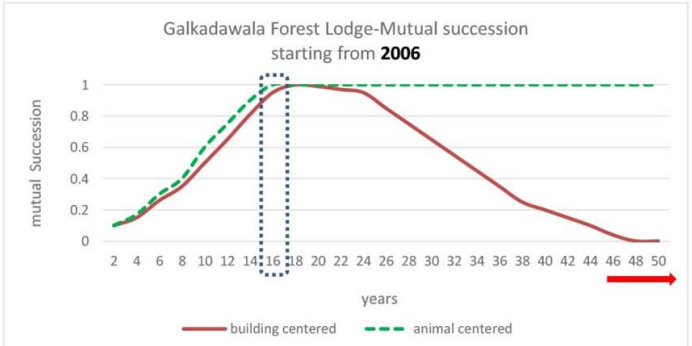

Figure 98: chart of the expected time line of Galkadawala Lodge
Source: by author developed through Findings from relevant professionals

1 – Climax of the mutual succession

0 – Initial starting

5. Conclusion

Most of all the site investigation and arranging systems in tourism-related architecture within sensitive wildlife habitats being rehearsed today are tragically objective, thus, fairly one-dimensional. Modern society tends to believe that any project can be eco-friendly with the use of various eco-friendly materials and other so-called sustainable components but to be addressed as mutualistic architecture, it is essential to have a deep understanding of the surrounding habitats which are shaped by the built environment and its performance. An abstract methodology is required to make an arrangement that is in all-out amicability with the current landscape. With regards to the environment hypothesis, comprehensive quality depends on the idea that non-living parts and living segments work together all in all as indicated by well-characterized biological laws. Everything is associated: people, plants, creatures, and non-living articles.

Both projects are surrounded by agricultural land, water bodies and dense forest in the intermediate zone with conditions of open habitats. Mutualistic and resilience quality of both projects are similar to different approaches from the beginning. The core objective of Project A and B are to ensure that wildlife is not disturbed by architectural interventions. Both the projects were initiated in 2005-06 and are in effect till date. There are visible changes in the population and behaviour of the wildlife in and around the site. Both architects critically considered wildlife spatial habitats and their performance within the designed structures. The key highlights in the projects are, decelerated construction process in Kalundewa and secondary succession approach in Galkadawala. The two approaches positively contributed to the implication of the mutualistic architecture in the concepts.

The overall architectural components have turned out to be the most refined version of the existing nature, however, it has both positive and negative impacts towards wildlife. Environmentally and socially cognizant site planning of both projects has a reasonable impact on making mutualism connection between the tourism industry improvements and wildlife enrichments. In the point of view of the architect's, both the projects let nature take over the building and demarcate relevant life cycle. After the construction period, there is a significant turning point in both the projects whereas similar results are anticipated in the final stage. In both projects the anticipated life cycle of the MS building has and there is a significant time gap between two projects. Comparing material selections and construction processes during the succession period has demonstrated a significant difference in both the projects. These are highly relevant for the ecological succession of the animal habitat. Durability in the eco-friendly building comes under the human point of view (human centred) hence when considering the MSA in a project, it is essential to consider the materials and the life cycle of the materials and overall performance of the architectural components. Considering architecture and mutual relationship in a human enclosure within wildlife habitats, the author has identified that long research has to be done to find out the MSA in a project which engages wildlife habitats.

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