Architecture for animals: the expanding challenges of sustainable development

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Abstract. In the recent years, architecture and engineering are one of the driving forces of sustainable development. Within the core of sustainability itself, continuous harmony between man and nature must occur. How can architecture and engineering contribute to sustainability in it’s entirety then? This study aims to seek the answer to that question, through methods of literature studies. Results shows that architecture and engineering also has a role in improving the lives of other species, such as animals in captivity. Captive animals are prone to develop severe stress that could decrease their welfare. Poorly designed animal enclosures are the leading cause of zoochosis; a mental illness in animals showcased by repetitive stereotypic behavior due to confinement stress. Zoochosis could affect animal health, in some cases even leads to death. Architects and engineers all over the world has started to contribute in designing and building a more appropriate built environments for captive animals, as similar as possible to their natural counterparts. In hopes to increase the welfare of captive animals while fulfilling their needs and improve their lives the same way as it is intended to fulfil ours. Expanding the scope of architecture and engineering, beyond anthropocentric ideals.

1. Introduction

1.1 The Challenge of Designing a Building for Animals
Architecture and engineering are among the driving forces of sustainable development. Through the advancement of technology and management, man made creations are designed and constructed to meet the needs of the present without jeopardizing the future generation’s ability to meet theirs. However it seem like the practice of sustainability are still targeted mainly for people, as in human beings. Everything is constructed or made surrounding the needs of human beings, with regards of the natural aspects in mind. Hoping that every human activity would have minimum negative impact to the natural aspects. The natural aspects are still considered as a side consideration, while the primary objective is to fulfil human needs.

When it comes to the Sustainable Development Goals, the third point of all the 17 points is “good health and well being”. Truly this is a noble cause, however to whom this point is made specifically? As science and technology evolves, our understanding of the environment and all of it’s inhabitants evolves as well. It is possible that the next chapter of the practice of sustainability is the realization that the natural aspects are no longer serve as a side consideration but also the main consideration, even as equal as humans to some extent. The harmony between man and nature is something we strive to achieve [1], therefore man and nature must have a balanced and equal place in sustainable
development. This raises a question: can architecture and engineering be utilized primarily towards the natural aspect aside of humans, such as animals?

Animals ideally would reside in their natural habitat, unfortunately some animals are driven out of their natural habitat due to deforestation or illegal wildlife trade. Some animals who are driven out of their natural habitat and unable to be released to the wild, would often time live in captivity; such as in a zoo. Zoos has been around for a long time, even dating back to ancient Egypt [2]. By the time of the renaissance era, zoos acts as menageries. The concept is similar to a museum, the difference is that the exhibitions are live animals. Animals are placed in a small box cage, with low regards of their well being. It’s not until in modern times, that zoos are starting to be designed in a way to resemble the animal’s natural habitat. However even at this modern day and age, the existence of zoos are still mainly targeted for the amusement of people [3].

Animals in general disliked to be stared at due to it being stressful for them, it is possible that zoo animals would hide away from visitors and a zoo where visitors aren’t able to see the animals are considered a terrible zoo [4]. This reality is still in lined with the notion that people are still the main target and animals are the side consideration. If we would practice sustainable development in it’s entirety, there must be a shift in paradigm. Instead of prioritizing the pleasure of humans, the main objective should be the pleasure of animals. The animals came first, and humans as visitors second.

This definitely raises new challenges for architects and engineers.

1.2 Animal Health as the Key Requirement of Enclosure Design

Often times we forgot that animals are not objects, they are living beings similar to us; at some degree. Just like us, animals also have needs. Perhaps it’s easier for animals living in their natural habitat to fulfil their needs, because they live exactly where they’re supposed to be. However for animals living in captivity, their ability to fulfil their needs is limited to how much the confinement of their living space provide them. In the case of zoos, animal cage environment in a zoo is often time unable to provide the optimal conditions for animals to channel their natural behavior, due to limited space and constant disruption by visitors [5]. Stripping away an animal from their needs would increase the chance of stress, jeopardizing their well being. When the stress is getting too much to bear, animals would often develop an illness called “zoochosis” showcased by a specific behavior called stereotypical behavior.

Stereotypical behavior of animals in confinement is a common issue, there are many cases of animals showcasing symptoms of stereotypical behavior predominantly in zoos [6] [7]. A few examples of stereotypical behavior are: pacing, bar biting, vomiting and eating it, even self harm [8]. Some cases even report that captive animals would develop a certain behavior similar to suicidal behavior in humans [9] [10] which eventually leads them into committing suicide [11] [12] [13].

Stereotypical behavior are likely alter the function of the brain that responsible for controlling behavior [14]. This alteration of brain function is similar to a chronic mental illness in humans called schizophrenia [15]. Stereotypical behaviors in captive animals can be prevented with the help of enrichments, that aimed to stimulate animal behavior so that they can live in the same manner as they would in their natural habitat [16]. Enrichments has many forms, the Association of Zoos and Aquariums list them as environmental enrichment devices, habitat enrichment, sensory enrichment, food enrichment, social groupings, and behavioral conditioning. Surely, enrichments are an important aspect of animal enclosure that must be should not be neglected.

The addition of enrichments within an animal enclosure help improve their welfare, especially the psychological aspects of the animals by increasing their natural behavior and reducing abnormal behavior due to stress [17] [18]. However many animal enclosures built with the absence of enrichments, making the enclosure to be considered as an improperly designed enclosure. That being said, it is possible that improper enclosure design could turn a healthy animal ill, both physiologically and physically. Even comparable to a human with mental illness, and in some cases comparable to a suicidal man. If enclosures are designed in a way that it failed to sustain the animals housed in it, then this kind of practice isn’t sustainable.
2. Literature Study

2.1 The Role of Architects and Engineers in Improving Animal Health

What does architects and engineers have to do in dealing with animal health then? Wouldn’t it be a more suitable responsibility for veterinarians, the same way doctors are responsible to human health? To answer that question, we must first evaluate one major factor that could affect health but often neglected; the built environment. The built environment provided by architecture design, has a significant correlation with well-being and health. A proper design elements such as space, light, and materials can be utilized to create a delightful living environment that could enhance health [19] [20] [21]. Essentially, different types of animals would have different types of needs and behavior, the built environment they live in must be able to facilitate them properly. At its core, it’s the exact same principle as designing a building for humans. Different types of user and different types of purpose, requires different approach in the design process. 20th century modernist architects and industrial designers are familiar with this principle as “form follow function”, a statement that implies the importance of functionality over mere aesthetic ornamentation with no purpose whatsoever.

“Buildings and urban spaces should be designed first and foremost around their occupants,”
- Dr Sergio Altomonte

Although the statement above purely revolves around human occupants, the basic idea seems universal. Each building designed, must meet the requirements so that it could fulfill the occupants needs and ensure their welfare. Buildings must be designed and constructed to be comfortable, safe, and healthy. This is where architects and engineers came in to showcase their role, or in an indirect way, their responsibility. Due to their knowledge and skills, they are able to better understand a specific issue and solving them through design initiatives. Designing a proper animal enclosure that allows the animal to behave naturally and enhanced their health, is a challenge for both architects and engineers. Thus evolving the scope of architecture and engineering, simultaneously as the research regarding animal welfare and behavior are also growing. Architects and engineers are no longer bound to anthropocentric ideas, acting as stewards exclusively to mankind. As mentioned previously that enrichments is an important aspect of an animal enclosure that is often absent, this is a specific issue that needs to be solved by practitioners working in the design and built field such as architects and engineers. In this modern age, architects and engineers as practitioners are starting to get more involved in designing animal enclosures [22] [23]; implementing their skills to create an enclosure specific to each animals housed in it.

2.2 Real World Implementations of Architecture for Animals

An example of a balanced collaboration between architecture and engineering for the purpose of creating a proper animal enclosure, is a project by Swiss firm Markus Schietsch Architekten [24]. Their “clients” are African elephants, at The Kaeng Krachan Elephant Park Zurich. This firm managed to design and build an enclosure, specific for the occupants; African elephants. The project is a collaboration with Walt + Galmarini engineering office and Lorenz Eugster landscape firm. The most prominent feature of their design, is the unique dome shaped skylight roof shown in Figure 1.

The roof is designed not only for aesthetic purposes, but mainly to simulate the sensation of being under the canopy of tree branches. It is designed in a way that it would create different shades and lighting throughout the day, almost exactly as the tree branches in the plains of Serengeti Africa. The enclosure itself allows up to ten elephants to roam just as they would in the wild; though not as freely but it’s the next best thing. With live vegetation, enrichments, and even a swimming pool for them to bathe in; the enclosure is designed to imitate the elephants’ natural habitat as close as it possibly can. The enclosure would facilitate, simulate, and stimulate the elephants’ needs and behavior; enabling them to live and behave as they would be in the wild. In return, it would certainly increase the elephants’ welfare; an important goal that must be achieved in taking care of animals in captivity.
Another example is the ambitious project by Danish architecture firm Bjarke Ingels Group, called the “Zootopia” in Denmark. Zootopia [25]. This project is essentially a reimagining of the concept of zoos. Instead of using cages made of steel bars, the design consists of open spaces integrating the buildings with the landscape. The architect is trying to eliminate human factors in a form of man made built environment, and instead re-creating the concept of barriers between visitors and animals in a more natural way. Barriers can be created through the separation of river streams, vegetations, and landscape, in contrast to simply using steel bars or concrete walls to separate one animal to the other. Visual barrier is also an important consideration in this project, maximizing animal visibility to visitors while minimizing visitor visibility to animals. In hopes to lower the occurrence of stress in animals, due to the sight of humans. This would result in a zoo design that are much more closer to the natural habitat of the animals.

3. Analysis and Results
As it is revealed that confinement is able to affect and alter an animal’s well being, enclosures then must be designed specifically to cater each animal’s need and behavior. Animal enclosure can no longer be identical, since one animal and the other would have different needs and behavior; hence
each enclosures would be custom made for each species. With the growing understanding of animal welfare, this affected how architects and engineers dealt with designing animal related building. We cannot go back to the times when animals are put in a concrete box cage that doesn’t match the animals’ natural habitat. This is a new era for architects and engineers.

Creating an animal enclosure as natural as possible, certainly would give benefits to both animals and humans. In terms of zoos, a properly designed enclosure would increase the welfare of the captive animals inhabiting it. Captive animals will be able to behave and live as they would in the wild. When an enclosure is able to meet such requirements, it would certainly produce a healthy and stress free animals. Of course visitors would be even more delighted to see animals that are healthy, compared to seeing a sick and stressed animals. Considering animal’s welfare in the design process of an enclosure is highly needed in this modern times. That being said, this design approach can as well be applied to other animal placement facilities other than zoos. For example, for wild animal conservation and rehabilitation.

If animals in zoos are most likely would remain in captivity for the rest of their lives, animal placement in conservation or rehabilitation is temporary. One of the main goal of conservation and rehabilitation is to care for wounded animals, and releasing them back to the wild. This kind of approach can be said to be in lined with the essence of sustainability itself. Animals that are driven out of their habitat are rehabilitated and released back to the wild where they belong. The process would ensure the existence of said animal, and prevent the act of animal extinction. Preserving and maintaining the animal’s presence in this world, for now and for future generations to come. Surely a properly designed enclosure which suits the need and behavior of each rehabilitated animal, would help increase their welfare; at the same time perhaps increase the rehabilitation success.

4. Discussion and Recommendation
Realizing the importance of animal health in the design process of an enclosure and implementing it in real world situations (either in zoos or animal rehabilitation facility), is highly needed. Although there need to be a certain system that would ensure such practice is being correctly practiced. One might say at some point, it might be considered insufficient enough without proper laws that officially regulates the issue and made the application of such idea as mandatory. Without proper laws, the importance of animal health and how their enclosures are designed, will solely be an encouragement rather than a necessity. It’s not supposed to be something you should do, but it is something you must do. A proper law would ensure that everyone involved in the practice of animal care, would regard animal health both physical and mental as the highest priority. Failure to comply would then result in a penalty. Therefore, it is advised that policy makers must also participate in the effort of animal welfare. It shows the complexity of animal welfare, it is not only the responsibility of veterinarians or conservationist; but reaches out to a broad range from all kinds of field of study.

The idea discussed seem solid, but we need to evaluate the situation in a real world setting. Take an example of Indonesia, as one of the megadiverse country in the world. How detailed does the laws regulate the importance of animal welfare? Animal welfare in Indonesia is regulated under the Undang-Undang No. 18 Tahun 2009 Tentang Peternakan dan Kesehatan Hewan (Law Number 18 of 2009 on Husbandry and Animal Health) [26]. The law mentioned what animal health and sickness is, unfortunately it doesn’t specify them in a detailed manner. As specified in Law Number 18 of 2009 Article 1 Number 2, 34, 35, 36, 37, and 42, animal health and illness are solely viewed as being physical, there is no mention of the possibility of them being psychological or mental related illness. The law specified issues about zoonosis or diseases transmitted by animals to humans, but discussion about zoochosis or chronic stress in captive animals are nowhere to be found.

The lack of detailed definitions of animal health and illness, make way for the risk of misinterpretation of meanings and how the laws and regulations are being implemented. Disregarding psychological aspects in animal health and illness, would resulted in an incorrect practice of animal care. If we would only to measure animal welfare solely on their physical attributes, then an animal performing pacing and other stereotypic behavior would be considered healthy, while in reality they are heavily ill and tormented. When we can’t ensure the animal’s continuous welfare, then this is not
sustainability. An evaluation of the existing laws in accordance with animal welfare in its entirety, is highly recommended. At the core of scientific study, new discoveries give way to a new perspectives. As studies regarding animal welfare are rising, so does laws and regulations. In regards to Law Number 18 of 2009 Article 39 Clause 3, it specifies the role of governments in developing animal welfare policy. Therefore, it is natural for laws and regulations to evolve as well for the better.

Evaluations on current laws and regulations must be made, to include psychological aspects into animal health and illness. Because without a proper law regulating animal welfare, the practice of designing an animal enclosure in accordance to the inhabiting animal’s needs and behavior would be poorly implemented. Law Number 18 of 2009 on Husbandry and Animal Health, must include detailed definitions that animal health would include mental health and animal illness would also include mental illness such as chronic stress due to improper living surroundings. Aside the definition of zoonosis, the addition of the definition of zoochosis is also needed to highlight the broad understanding of animal illness. Lastly, it is advised that laws regarding the placement of animals would specify the need of designing the enclosure in detailed manner. Instead of just describing that an enclosure must be well made, perhaps it is better to actually specify the minimum requirements of an enclosure in terms of size, shape, vegetation, running water, enrichments, and any other relevant aspects in an operational manner.

5. Conclusion
Captive animals are prone to stress that will lead to the decline of their health; the same way as humans does. Therefore in building an enclosure for animals, it must meet certain requirements to reduce stress and ensure their well being. This surely raises new challenges for architects and engineers, since it is no longer enough to simply place an animal in a poorly made cage. This made way for the notion that the “clients” of architects and engineers are no longer bound to humans, but also animals. Architects and engineers in building an animal enclosure, have the same level of responsibility in ensuring their welfare, the same way as they are responsible for the welfare of humans inhabiting buildings they designed. In accordance to that idea, a proper laws and regulations are needed to ensure the idea is correctly implemented.

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