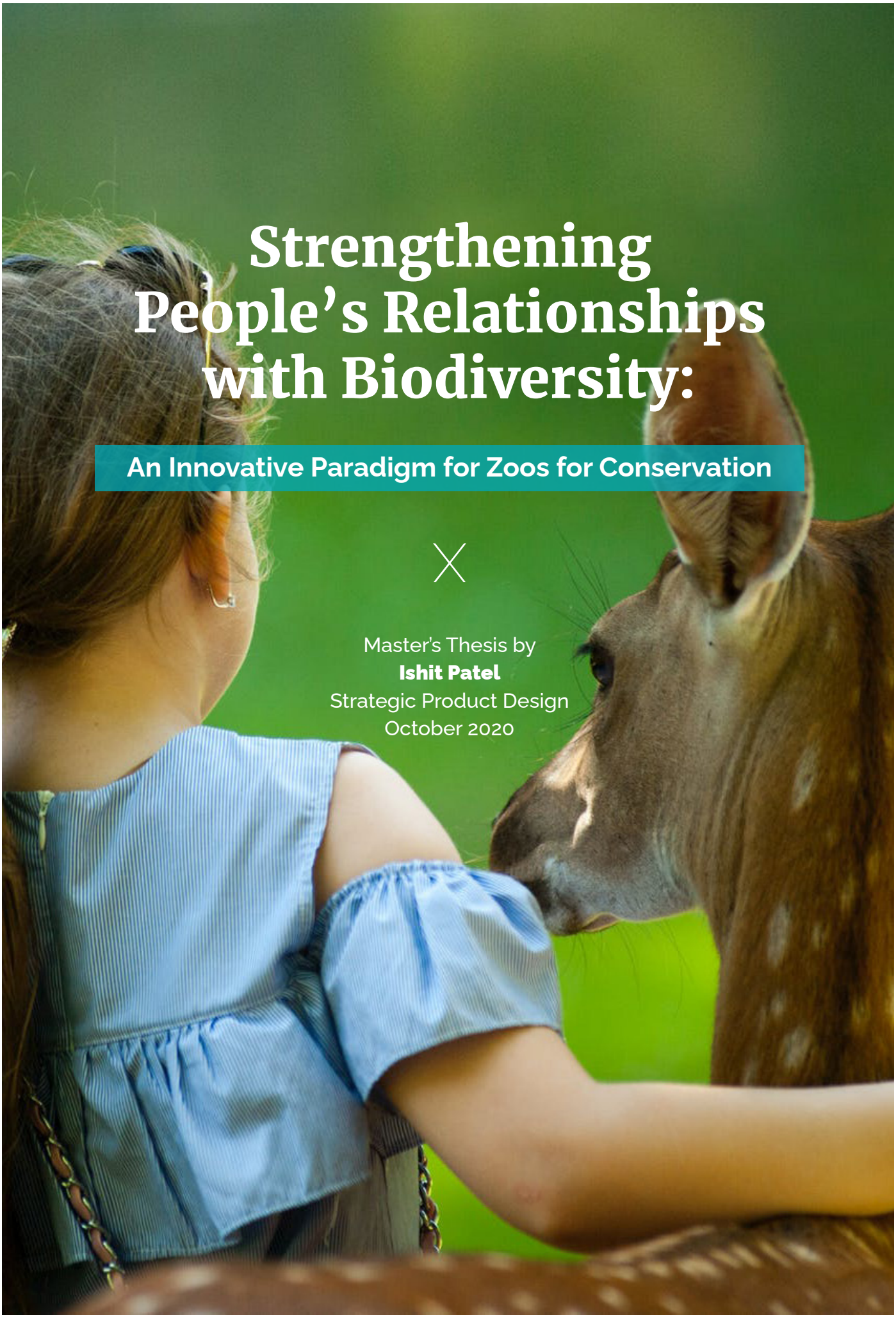

Strengthening People's Relationships with Biodiversity:

An Innovative Paradigm for Zoos for Conservation

Master's Thesis by
Ishit Patel
Strategic Product Design
October 2020

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Colophon

Master Thesis
Strengthening people's relationships with Biodiversity;
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8th October, 2020

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Gratitude

There are sunny days, and then there are rainy days. Between these two extremes, a seed becomes a flower. What we see is the flower and not the soil that held it firm, not the wind that inspired its growth, not the bee that filled it with love and not the worms that fed its tender roots.

The report may have been authored by me, but it is a result of the efforts of many, whose contributions are beyond my grasp. I thank them all. In particular, I would like to take a moment to thank **Dr. Madelon Willemsen,** whose vision and courage towards making a difference culminated in this project. A couple of months into the project, when I could understand her vision, it inspired me, challenged me, and made me a humble student and a humble person.

Dr. Jotte de Koning and **Dr. Nynke Tromp**, thank you for instigating the designer within me time and again during the project. I looked up to you for a direction, for a way, for a map to survive the storm, but rather you helped me to learn to open my eyes and find a way for myself. You taught me an important lesson and I'm glad to have you as my mentors.

Ehsan, thank you for accepting me and my ambitions and showing me the value in them, when I couldn't see it myself. Our talks and walks have always inspired me to try to become more of myself.

Dad, thank you for choosing to be my mentor. Through our conversations, I have discovered what it is to live a meaningful life and that is the only pursuit I'd like to be in.

Vino, thank you for being constant support on this journey. You have been the wind to my flower.

And lastly, **Dheebak** and **Shreyas**, thank you for always being there whenever I needed to reflect and get things done.

To the reader, I hope the report inspires you towards taking action for a better world.

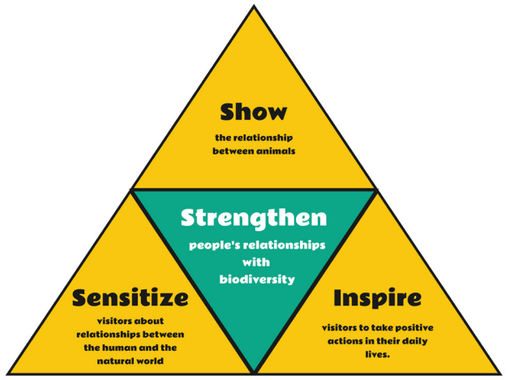
Executive Summary

The project is undertaken for the organization of British and Irish Association of Zoos and Aquariums(BIAZA). BIAZA is an association with 121 member zoos and aquariums in the UK and Ireland. It's member zoos and aquariums receive a whopping audience of about 35 million visitors every year, which is more than half of the total populations of the UK and Ireland combined. The initial brief from BIAZA was 'How can their member zoos and aquariums leverage the huge audience to drive a positive societal change?" To answer the question, the project begins to explore four main domains of research: Biodiversity, Behavioral change, The UK as a society, and Zoos and Aquariums.

From the research about Biodiversity, it is derived that Biodiversity is crucial for the maintenance of Ecosystems. Human life in many ways depend on the ecosystem services. However, biodiversity is declining globally at an alarmingly fast pace due to human activities such as intensified agricultural, overexploitation, and pollution. At the core of such systemic activities, lies an individual's everyday behaviors. This project aims to influence these individual behaviors.

The insights from the behavioral change literature suggest that many factors influence one's behaviors including environmental identity, which is the best predictor of one's pro-environmental behaviors. Through this lens of behavioral change, the UK society's engagement with the problem of loss of biodiversity is explored via interviews and literature research. It is concluded that overall a typical UK citizen loves nature and wildlife for its aesthetic value and has limited knowledge about his/her relationships with the animal world. This lack of recognition and acknowledgment of one's relationships with the animal world weakens one's environmental identity. Hence, 'development of an identity that recognizes and acknowledges one's relationships with the natural world' is defined as the 'change to aim for'.

Based on the change to aim for, the context of Zoos is explored to recognize the efforts of zoos to educate people about conservation and the effects these efforts have on the visitors. It is concluded that zoos show great potential for the development of identity because of the presence of a live animal's ability to generate an emotional connection with the animal. Based on the capacity of zoos to connect people with the animals, the role of zoos in moving forward towards the systemic direction is "To strengthen people's relationships with biodiversity".
With the goal for the zoos defined, a three phased approach of Show, Sensitize and Inspire is proposed to the zoos to move forward towards achieving this goal..



Based on the proposed approach, the concept of "Beyond the Zoo" is designed. The major part of the concept is an app supported by minor physical infrastructures at the zoo. The app can be downloaded by the visitors and is designed to work in tandem with a zoo visit. The concept is designed to motivate visitors to learn more about the interspecific relationships between animals in an engaging and exciting 'treasure hunt's fashion. The app is also designed to engage people in recognizing the contributions of biodiversity to their everyday life and subsequently inspire and support them to take positive actions in their own lives as they leave the zoo. Hence the app takes the visitors Beyond the zoo and also remains with the visitor beyond the zoo. Following the design, the concept is prototyped and tested with the users and validates by a zoo educator. The concept received extremely positive feedback from both of them establishing its desirability, feasibility, and viability.

The project ends with providing implementation guidelines and other recommendations to BIAZA for moving forward with this particular concept and towards the systemic direction defined for zoos.

Scan the code to open the prototype

Role of BIAZA in the project

The BIAZA's role was defined as to support my research and design by providing guidance and putting me in touch with relevant experts from the zoo industry

However, near the very beginning, the world was hit by Covid-19, and the normal life was brought to a halt, quite literally. BIAZA could no longer support me during most of the project having their hands full of matters that required urgent attention. Hence the project started with studying only BIAZA members, but eventually expanded to zoos all over the world. A positive side to this is that the project may be useful to all the zoos across the world.

Glossary and reading guide

Abbreviations

BIAZA	British and Irish Association of Zoos and Aquariums
BMs	BIAZA members
PEBs	Pro-environmental behaviors
TPB	Theory of Planned Behavior
EID	Environmental Identity
UI/UX	User Interface/User experience

Definitions

Some key terms for the project and what I mean by them

Pro-environmental behaviors
Behaviors that are preformed with an intention of the environmental conservation.

Interspecific relationships
The relationships between two species.

Environmental identity
The perception of one's self as a part of environment/nature. For the purpose of this report it can be understood as one's connectedness with nature.

Nature/Wild/Environment
These terms are repeatedly used in the report and they are all interchangeable. By any of these terms, I refer to the natural elements .

Wild communities
Wild communities are a group of species that live together and share interspecific relationships. It includes all varieties of life forms.

Highlights

The important information and useful derivations from the text distinguished as shown below.

Important information and useful derivations

Quotes

The quotes extracted from the interviews and literature are highlighted as shown below.

"We love wildlife, but we love bits of it."

Interviewee 1

Contents

Chapter 1

INTRODUCTION

Let us begin!
We will start with discussing the global event of mass extinction (1.1) , why does it matter (1.2), important role of zoos as bridging people and the wild (1.3) and BIAZA (the organization this project is based in)(1.4). Lastly we will discuss the project brief (Section 1.5),

1.1 Holocene Extinction

The world we live in today is debated to be amidst the sixth mass extinction event called as 'Holocene Extinction.' Mass extinction events are understood as the loss of the majority of species in a relatively short geological time, caused by a catastrophic natural event. The rate at which species have gone extinct in recent times, is a hundred times greater than all the previous extinction events. We have already lost 52% of the species in the small time frame of 50 years. According to the research of biodiversity and ecology department, United Nations, we are **expected to lose about one million species of plants and animals** within the time frame of decades because of human activities. (IPBES, 2020)

1.2 Why does it matter?

The diversity in ecosystems; between species and within species is referred as Biodiversity. Diversity in the species is the result of evolutionary processes which took millions of years, based on natural selection. All the species have mutual interdependence for their survival and thus all species live in a state of a collective co-existence. Extinction or change in the population of one species disrupts not only the food chain, but also alters the ecological state of nature which can make it impossible for other species to survive, including humans.

For example, with the decline in population of vultures in India, a rise in impact of rabies on human health was observed (Markandya, 2008). How? Vultures eat dead bodies hence they are the cleaners of the natural world. In their absence, the dead bodies of animals and birds become a host for infectious diseases which could be passed on to the human world through the abundance of dogs, as they are in close contact with humans. So if we don't have rabies today, it is these vultures who are to thank, at least partially.

Therefore, Loss of biodiversity is more than just a loss of certain species from the planet. It is a potential threat to the survival of life on the planet.

1.3 Zoos : a bridge between 'an urban individual' and the 'world of wildlife'

Amongst such a loss of species, the places a common man can visit to see the partial arena of biodiversity are zoos and aquariums. And these are the places which has potential to bring the visitors close to nature and thus transform them into concerned citizens who would care for the sustenance of the species and biodiversity. This viewpoint is the most critical idea in the project.

In modern society, zoos and aquariums are a significant link that connects the public with nature. Urbanization and industrialization have led us to live in a surrounding that is largely built with a priority of flourishing humans only. So humans are being born, survive, grow old and die in these surroundings, far away from nature and wild. In this context, it is the zoos and aquariums that bring nature and wild close to the people living in the cities. For some people, zoos are the only places that offer a nature like experience amongst the hustle and bustle of an urban city. It gives them a feeling of breaking free from the monotony of daily routines. And for parents, zoos are the most sought places to expose their children to the natural world, a much necessary exposure for the overall growth of the child in early stages. (Fraser 2009)

Figure 01: A first hand experience of wild made possible at the zoo

1.4 British and Irish Association of Zoos and Aquariums (BIAZA)

In the Emerging emotions of empathy , animal well being is a cornerstone for the zoos and aquariums. To care for species' physical and emotional well being, one requires serving attitude, species-specific knowledge and multiple skills, (what we can call specific expertise). And to find them, all zoos & aquariums need to network with other zoos & aquariums and regularly communicate and learn from each other . There are many organizations worldwide who play this role of networking, associating, connecting and subsequently advocating for the cause of zoos & aquariums. In other words such organizations play a very vital role in representing the zoos & aquariums. One such organization is British and Irish Association of Zoos and Aquariums, UK (BIAZA) for English and Irish zoos.

BIAZA is a professional body that represents the Zoos and Aquariums in the UK and Ireland and promotes the good values of Zoos and Aquariums. It was founded as a charity organization in1966 with representatives from nine zoos and bird gardens, under the chairmanship of the Earl of Cranbrook. Then it was called the Federation of Zoological Gardens of Great Britain and Ireland. The federation aimed to spread good practices in the domain of animal welfare among its members and ensured that its members achieved high standards of maintenance of animals through regular monitoring. Over the years, the federation grew bigger, strengthened its support for the zoo industry and changed its name to BIAZA in 2005.

Today, BIAZA has a total of 121 member (as of July 2020) zoos and aquariums across the UK and Ireland. Its members extends to a diverse set of members that include zoos and aquariums, educational institutes such as colleges and universities, corporate companies and individual professionals.

1.4.1 Importance of BIAZA

The importance of BIAZA stems from the need for collaboration between zoos and aquariums for expertise and support to grow as independent organizations. BIAZA can be looked at as a central organization that connects its members and caters to the overall needs of all the members. For example, in the ongoing pandemic, the zoos and aquariums across the UK faced major financial challenges to survive. BIAZA ensured that the case of zoos and aquariums is considered in the dissemination of funds from the UK government and secured a total funding of £100 million for its members.

"Our members understand the importance of networking to be effective in their job"

Nicky Needham (Senior Manager, BIAZA)

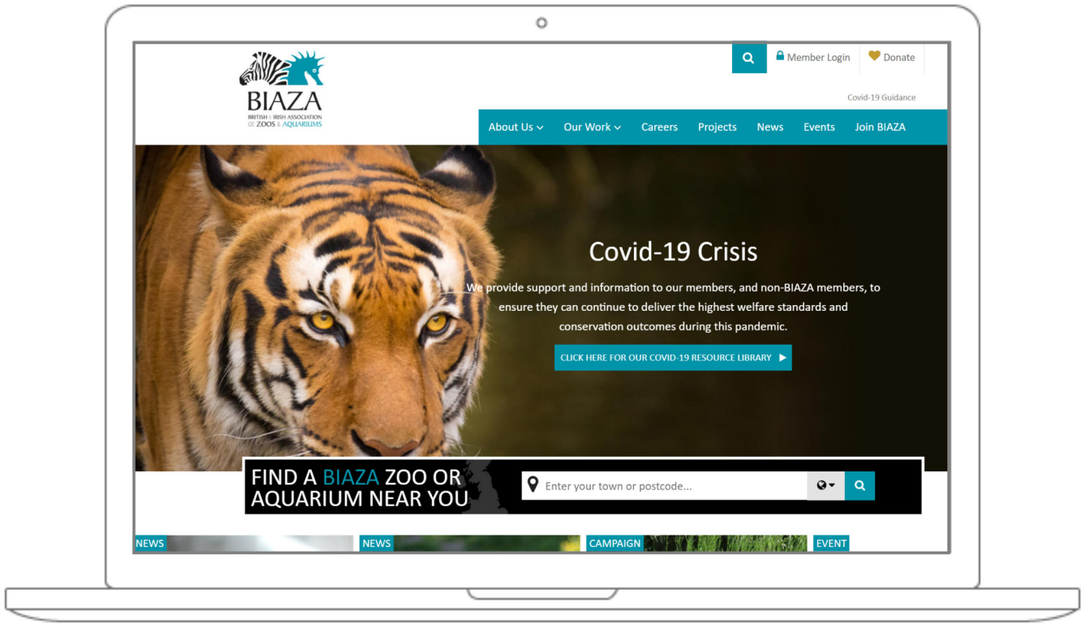


Figure 02: (On right top) BIAZA Website

Figure 2b.(On the right bottom) BIAZA Website

BIAZA

VISION

To be a powerful force in the care and conservation of the natural world.

MISSION

BIAZA is a professional organization which represents its members and promotes the values of good zoos and aquariums. We lead and support our members:

> To inspire people to help conserve the natural world

> To participate in effective cooperative conservation programs

> To deliver the highest quality environmental education, training and research

> To achieve the highest standards of animal care and welfare in zoos, aquariums and in the wild.

1.4.2 How does BIAZA support its members?

BIAZA operates through mainly six committees and their associated working groups. The committees and workgroups consist of individuals across their memberships who are voluntarily willing to contribute to the industry of zoos and aquariums. The committees and workgroups have standard roles of chair and vice chair etc. , who manage the outputs of the team. They meet every three to six months as decided at the beginning of the year.

These committees and workgroups organize annual conferences, training sessions, research conferences,seminars and other events for their members. Apart from this, the workgroups produce documents such as animal welfare guidelines, research guidelines and reports that help zoos and aquariums in their daily operation with animals, visitors and employees. The BIAZA office overlooks the committees and provides them with necessary support to carry out their functions. It disseminates industry relevant news, new government policies issued and other relevant documents produced by the committees across the membership. Moreover, BIAZA is open to employees of its member zoos who can simply call and request any kind of support needed starting from taking care of an animal to growing as a professional.

Other key roles of BIAZA office include political engagement, representation and lobbying, media/public communications, ensuring standards through reviewing of zoo license inspections and complaints procedures.

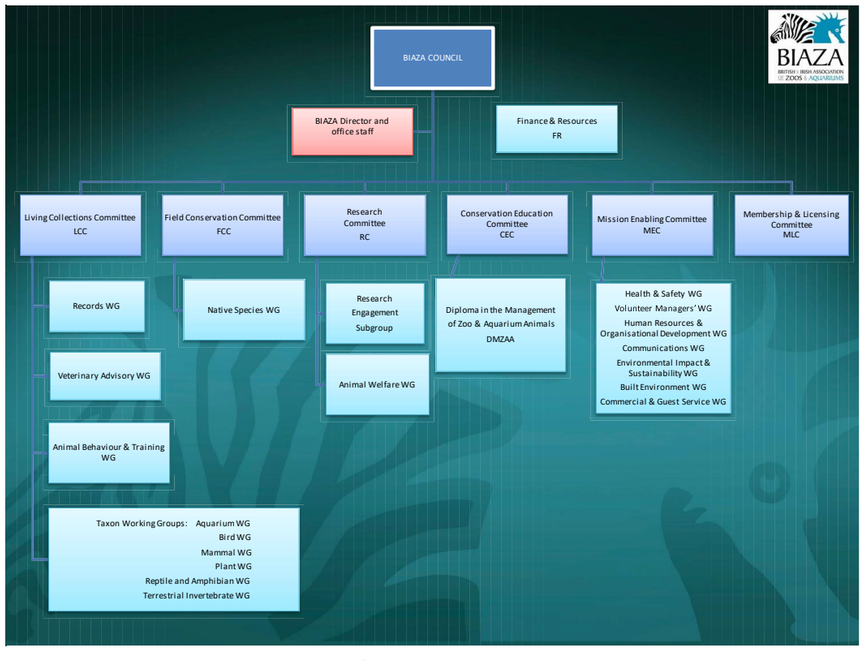


Figure 03: Organizational structure of BIAZA

1.5 Project Brief

The project brief defines the outline of the project as agreed upon by the author, the graduation committee and BIAZA. The original document can be found in appendix T. The project brief as defined at the beginning of the project, is presented here.

Over 32 million visitors from the UK and around the world visit the BIAZA member zoos and aquariums every year. This is equivalent to half of the UK's population. BIAZA being a representing organization of all these zoos and aquariums, holds a large audience who come to their members from all walks of life. Such a great and diverse audience can be looked at as an opportunity to drive a positive societal change towards the sustainability of the natural world and its biodiversity.

1.5.1 Problem Definition and research question

At its core, loss of biodiversity is a problem about unsustainable and illegal activities of people, businesses and organizations. Along with zoos and aquariums worldwide, BIAZA members(BMs) are continuously putting their efforts in trying to save what is lost in the wild or what is at the brink of extinction with various in-situ and ex-situ conservation programs. Zoos and aquariums provide an opportunity for people to engage with the otherwise distant wilderness through visiting and attending workshops. With almost half of the UK population visiting BMs every year, these members have a greater potential to positively influence society and drive a change. Based on this view, the initial research question of the project is defined as "In this time of almost mandatory sustainable transition of society, how can zoos leverage their capacity of reaching millions of people and become agents of positive change in society?" The approach towards answering the question is defined in the next chapter

> ***In this time of almost mandatory sustainable transition of society, how can zoos leverage their capacity of reaching millions of people and become agents of positive change in society?***

Chapter 2

Project Approach

The approach to the project is defined by the various phases pf the project. These phases will be discussed in this chapter.

2.1 Project Phases

The project is divided into four major phases: **Explore and Scope, Define, Design, Test and Validate.** The four phases are discussed in the following section. We will start with the phase of Explore.

Phase 1. Explore and Scope

Since the initial research question is quite broad, the first step of the project is to explore and understand the constituent parts individually.

The main parts as highlighted in the research questions are:
- Mandatory sustainable transition,
- Positive change,
- People and
- Zoos.

These four parts are explored in the following fashion:

A. Understanding Why? (are sustainable transitions mandatory)
B. Discovering What? (positive change to aim for in the UK)
C. Understanding the context (of Zoos)

A. Understanding Why?

Why is a change needed?

The project is based on the problem of unprecedented loss of biodiversity that we (humans) are driving today. This phase explores the **importance of biodiversity, its present status, the factors driving its loss.** It concludes by discussing the role of individual behaviors in driving the loss and scopes the project to focusing on individual behaviors.

Research method: Literature research
Chapters in the report :3 (3.1,3.2,3.3)

Why do people behave the way they do?

Having scoped individual behaviors as a core of the problem, the domain of human behavior in the context of Pro-environmental behaviors is explored. The factors influencing one's behavior are mapped and various approaches to behavioral change are explored. It concludes with recognizing identity at the core of human behavior and a set of design principles to follow as per the behavioral change literature.

Research method: Literature research
Chapters in the report :3 (3.4)
Outcomes: Design principles

2. Discovering What?

The larger context of the project is set in the UK. After understanding what influences human behavior, a brief study about the UK is conducted to understand the status of people's engagement with global as well as local problem of loss of biodiversity. It concludes with discussing a missing sense of connection between people and the animal world and scopes the project to influencing a UK citizen's identity as the change to aim for.

Research method: Literature research, Interviews
Chapters in the report : 4
Outcomes : Change to aim for.

3. Understanding the context (Zoos)

As the immediate context of the project is set as zoos, an exploratory study of a zoo visit is conducted. Through this study, the human aspects such as why people visit the zoos?, what do they do/feel at the zoo and its effects on the visitors mapped. It concludes with pointing out the potential of zoos to achieve the (earlier defined) change to aim for and a set of requirements that design should follow.

Research method: Literature research, Ethnography and Interviews
Chapters in the report : 5
Outcomes : Design Requirements

Phase 2. Define

Based on the change to aim for, an inspiring **future story** about the zoos and the society of the UK is created. The design principles and requirements crystallized in the earlier phase along with the future story forms a **design brief** that defines the goals for the project.

Chapter in the report: 6

Phase 3. Design and Develop

In this phase, a variety of ideas are explored and evaluated. A certain direction for the design is chosen and a **concept prototype is developed.** For zoos, based on the feasibility and viability **implementation guidelines** are provided.

Chapters in the report: 7,8,9

Phase 4. Test and Validate

In this phase, the concept prototype is tested with the users who represent the zoo audience, and validated by experts from the industry. Based on the feedback, the recommendations for the design are made.

Chapters in the report: 10

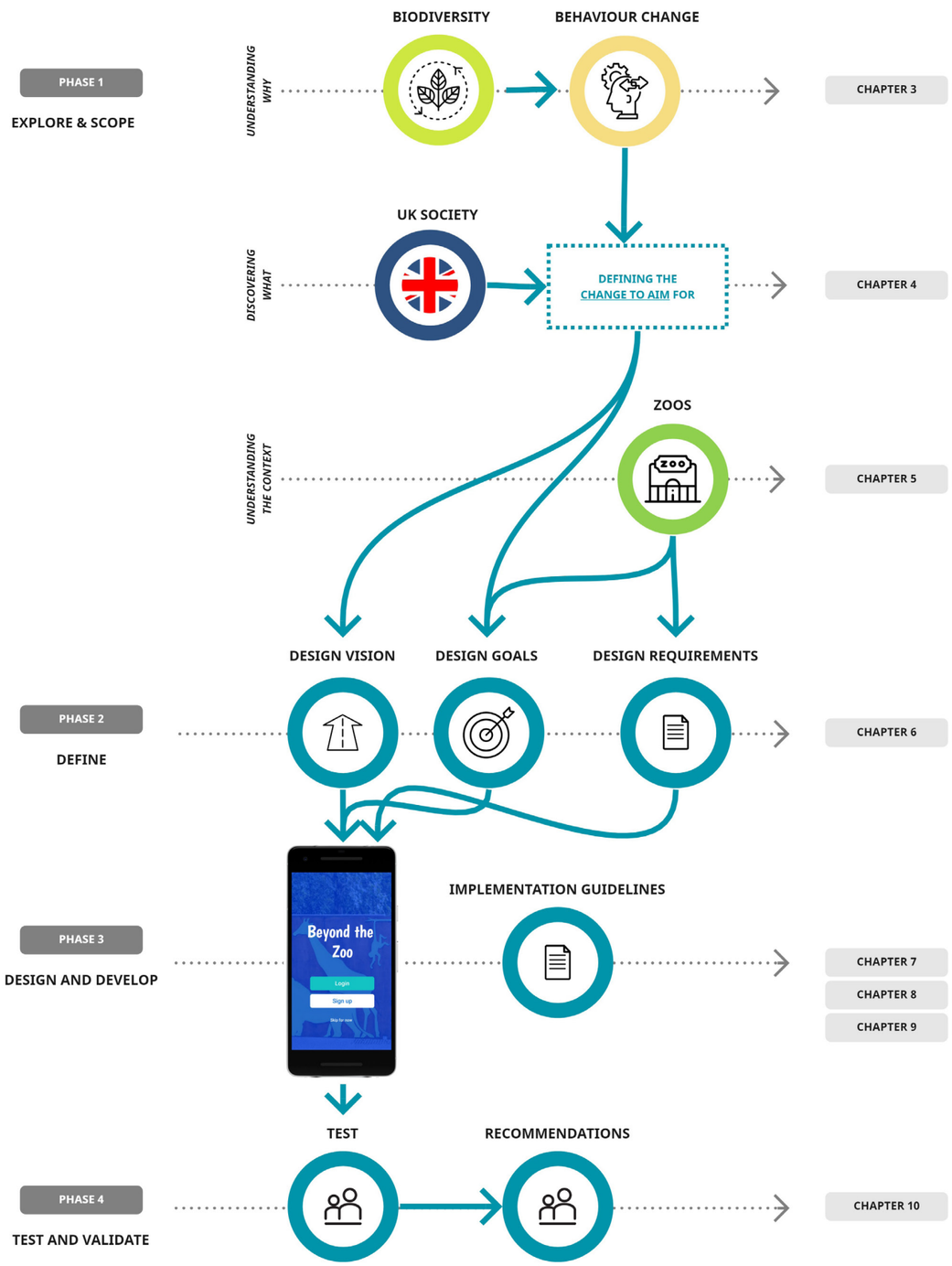


Figure 04: A visual overview of the project approach.

A: Understanding Why?

Chapter 3

Biodiversity and us

In this chapter we will start with understanding biodiversity and the vastness of the natural world. Following this, we will discuss the importance of biodiversity for ecosystem functions and importance of ecosystem functions for human life.

3.1 What is biodiversity and why is it important?

'Biodiversity is variety of life!'

Biodiversity is a combination of two words: Bio, which means life and diversity, which means variety; so it literally means **variety of life.** This variety of life can be measured in three major ways: Genetic diversity, Species diversity and Ecosystem diversity. Genetic diversity is the variety of gene pools within a single species. Species diversity means the variety of species living together in a community and Ecosystem diversity means the variety of different ecosystems found in a region.

Now we will discuss the vast classification of variety of life, organization levels of an ecosystem and the relationships that exist in an ecosystem.

3.1.1 The six kingdoms of life

'Bio' or life is a huge classification that separates living organisms from non-living elements. All the living organisms in the planet can be divided into six kingdoms as shown in the figure 5.

All the different organisms belonging to different kingdoms exist together, in their own ways and they share a relationship with each other as well as with the non-living elements such as soil, air, water, wind etc. Based on these relationships, there are different levels of ecological organization.

Starting from a single organism to the entire biosphere. They are discussed in the next section.

Did you know?

The difference between Algae and Fungi is that algae can produce its own food(called Autotrophs), whereas Fungi decomposes external organic compounds for food. (Heterotrophs)

Figure 05: The six kingdoms of life (Source: Theresa Chiechi)

3.1.2 Levels of ecological organization

Life starts from a single cell, and many such cells together form organisms. For our purpose here, let's start understanding these levels of organisms.

These **organisms** when multiplied form a species population. These **populations** live with other populations of species and form a **community of life**. These communities include all the six kingdoms of life that we discussed above. Together with the nonliving elements such as air, water and soil, it is called an **ecosystem**. Eco- the living part in system - the nonliving part.

Within every ecosystem, there are species and there are the ecological relationships that exist among these species. These ecological relationships are discussed in the next section.

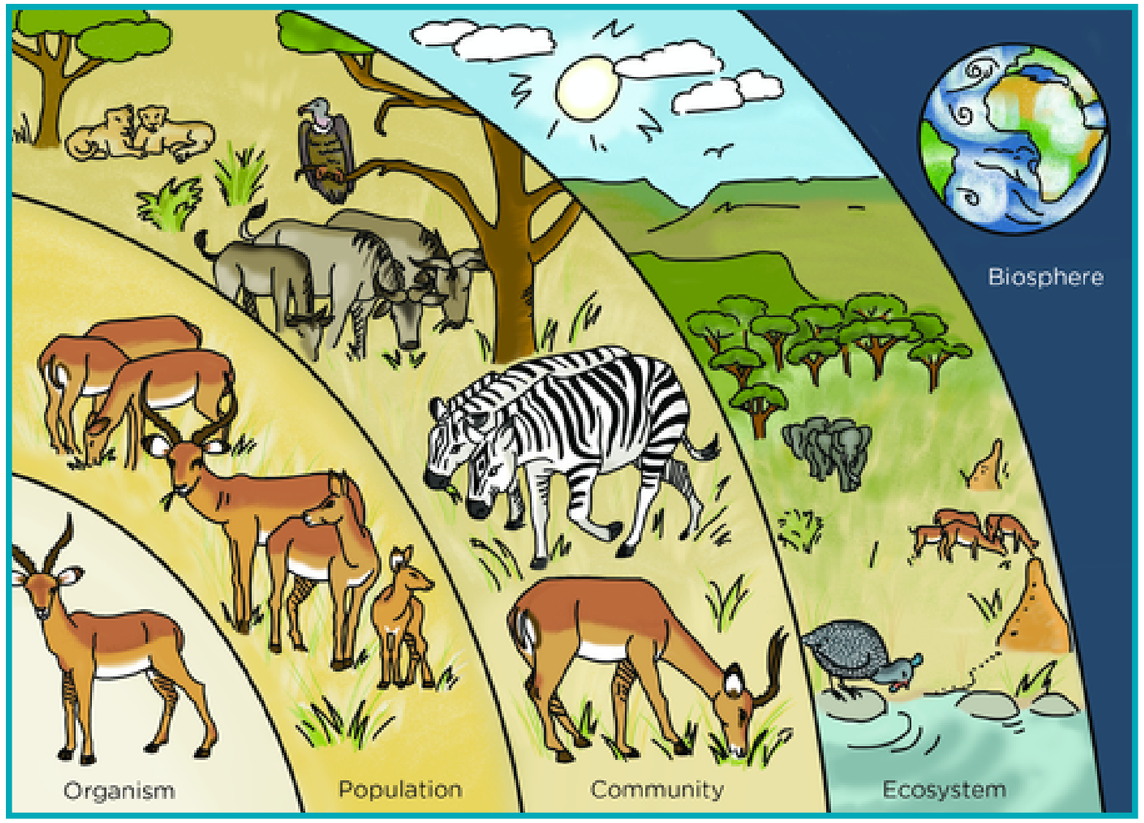


Figure 06: Levels of ecological organization.

3.1.3 Ecological relationships

In every ecosystem, there are five different types of relationships:

Predation

Predation is the relationship between two organisms is which one organism is consumed by another for food. For eg. The relationship between a cheetah and a deer.

Competition

Competition is the relationship in which two organisms are competing with each other either for food or for protection. Competition is almost always present among organisms within a population and between populations that depend on the same food source.

Parasitism

Parasitism is a relationship where one organism benefits and the other is harmed. It is similar to predation but here, the parasite doesn't kill the host instantly. For eg. the relationship between humans and mosquitoes where mosquitoes are parasites.

Commensalism

Commensalism is a relationship where one organism is benefited and the other is neither harmed nor benefited. For eg. the relationship between a bird and a tree. The birds make use of the branches to nest, but it doesn't harm the tree.

Mutualism

Mutualism is the relationship between two organisms where both the organisms benefit each other and none of them is harmed. For eg. The relationship between bees and flowers. Flowers provide their nectar to bees and bees in return do the job of pollination for flowers.

Figure 07: Images of examples ecological relationships between species

3.1.4 Importance of ecological relationships for survival of organisms

All the living organisms need food(includes water) and shelter/protection to survive. Both of these are made available through various relationships they hold with the other species of their community.

Except for the autotrophs (the living organisms that generate their own food using nutrients from soil, sunlight, air and water), all other living organisms depend directly on other living organisms for food. The relationship of predation and parasitism help the organisms nourish themselves. The relationship of commensalism and mutualism usually helps the organisms in finding shelter and fighting other predators or finding food.
For example, whales and barnacles share commensalism where barnacles attach themselves to the bodies of the whales and travel hundreds and thousands of miles in the ocean and eat microorganisms as they move along.

Some relationships between species are indirectly beneficial to other species. For example the predatory relationship between cheetah and deers, keeps the population of deers in control. The controlled number of deers give the opportunity for the smaller plants and bushes to grow, which would have been otherwise eaten by the deers. And the growth of bushes provides food and shelter to many other smaller animals like insects, mammals, birds.

3.1.5 Importance of biodiversity for a stable ecosystem

95% of life is composed of six important elements: Carbon,Hydrogen,Oxygen, ,Phosphorus,Sulphar And Nitrogen (CHOPSAN). **A healthy ecosystem maintains the flow and concentration of these elements in the form of energy, nutrients and organic matter. These integral processes within ecosystems are called Ecosystem functions.** A functional ecosystem is the one that can maintain these functions in a way that sustains life.

In an ecosystem, these flows of energy, nutrients and organic matter happens via transfers between living organisms and non-living elements. For example, energy moves from producers to consumers to decomposers to back to producers. The parent energy provider for the producers here is sun and the nutrients from the soil. This energy is usually transferred through food and nutrition. The series of organisms through which this energy transfers in the form of food is called a food chain. And a cluster of interlocked food chains is called a food web. Through these food webs, the organisms are interlinked with each other allowing the continuous processes of ecosystems. An example of the food web is shown in the figure 8.

Ecosystems, more often that not, can be subjected to external disturbances. The ecosystems that can continue to sustain the integral processes and support life are stable ecosystems. **Biodiversity has a strong positive influence on the stability of an ecosystem.** As diversity of life in the ecosystem increases, the number of interspecific relationships increases. These relationships provide alternate ways for ecosystems to function. Hence, with increase in interspecific relationship, the ecosystem's ability to resist disturbances from within and the surroundings also increases. The more the links, the stronger the net. Conversely, if the ecosystem cannot resist the external and internal changes, it won't be able to provide food and shelter to some of the sensitive species living in it. Subsequently other depending species who depend on these species will suffer. Ecosystems are habitats for the organisms. A disturbed habitat supports only a few species, reducing the overall biodiversity of the ecosystem.

Why is biodiversity important? : A metaphor

Think of the planet as an airplane and the variety of life as the variety of screws, nuts and bolts keeping the plane together. Now consider a situation in which the airplane is flying and one of the bolts becomes loose. Because it makes the overall structure vibrate, two more close by nuts become loose, and the airplane continues to fly. In a while, a thunderstorm hits the airplane and suddenly there's some turbulence. If the majority of the bolts on the airplane are still connected well with the structure, the airplane may survive the storm. But if the bolts get loose owing to the continuous vibration, the airplane may as well break apart mid way and crash. As every single bolt adds to the strength of the airplane, similarly, every single relationship between species cumulatively add to the strength of the entire planet.

Figure 08: Example of a food chain showing the dependence of every species on another species.

3.1.6 Importance of (stable) Ecosystems for human well being.

As any other organisms, human bodies (later referred as 'humans') also require food and shelter to survive. As a society, we have economic systems and social systems through which we secure food and shelter, and in doing so **we take use many resources from nature that are outcomes of ecosystem processes.** For example, a banana fruit is the outcome of a hydrological and nutrient cycle that took place in a banana agricultural ecosystem.

The benefits that we receive out of the ecosystem processes are commonly referred to as Ecosystem Services. Daily (1997) defined them as: **Ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life.**

Ecosystem services can be categorized into mainly four categories:
A. Provisioning Services,
B. Regulating Services,
C. Cultural Services and
D. Supporting Services.

A. Provisioning Services

Provisioning services are material products that we obtain from ecosystems. For example, all the food we eat in daily life come from agricultural farms that have their own ecosystem. Apart from food, ecosystem provide diverse products that act as sources of energy(fuel wood, dung), biochemicals and natural medicines, ornamental products (eg. flowers) etc. that our daily lives and economies rely on.

Direct relevance of biodiversity towards human well being:

Biodiversity that underpins all of the food production comes under the subset of Biodiversity for Food and Agriculture(BFA). It includes agricultural crops, domestic livestock, aquaculture systems etc. BFA contributes to a strong agricultural resilience that can prevent crop failures caused by ecological stresses.

B. Regulating services:

Regulating services are indirect services that we receive which regulate the quantities of (CHOPSAN) elements and pathogenic organisms in an ecosystem. For example, maintaining the quality of air by contributing and extracting chemicals from the air, maintaining timing and magnitude of water run-off, floods, regulating number of pathogens and disease vectors(eg. mosquitoes) that ultimately affect human health and pollination which provides for the majority of our food.

Direct relevance of biodiversity towards human well being:

Apart from regulating pathogens that may impact human health, exposure to biodiverse ecosystems also strengthens our immunity towards inflammatory diseases and allergies.

C. Cultural services

Cultural service are the non-material aspects of life necessary for human well being that ecosystems facilitate provision of. Examples include cultural values, aesthetic values, spiritual and religious values, recreation and inspiration.

Direct relevance of biodiversity towards human well being:

According to Biophilia theory, having evolved from nature, we have a natural tendency to interact with other species and prefer to live in a biodiverse area. These interactions aid us in recovering from psychological stress and mental fatigue that happens in our daily lives. (Aerts et al. 2018)

D. Supporting services

Supporting services are services necessary for the other three services to continue. Photosynthesis by green plants, Soil formation by microorganisms, nutrient recycling across living organisms and nonliving elements and habitats that provide food and shelter necessary for species to thrive.

An overview of all these four services is shown in figure 8.

Figure 09: An overview of four ecosystem services. (Sourced from https://www.earthwiseaware.org/what-are-ecosystem-services/)

3.1.7 Conclusion

Life on earth is predominantly made of six elements : Carbon, Hydrogen, Oxygen, Phosphorous, Sulphar and Nitrogen. To sustain life, these elements have to be present in appropriate quantities at the right places in the form of nutrients, energy and organic matter. These elements flow through living organisms and nonliving things in an ecosystem. These flows can be called as Ecosystem functions and are necessary for a healthy/stable ecosystem.

The ecosystems can be subjected to external(eg. flood) and internal (spread of infectious diseases) disturbances. These disturbances often disrupt the Ecosystem functions by breaking the links that allowed flows of nutrient, energy and organic matter to happen. **Biodiversity or 'variety of life' helps ecosystems resist the disruption of Ecosystem functions by facilitating these flows through alternative pathways. Hence, biodiversity is the key to a stable ecosystem.**

Stable ecosystems generate Ecosystem Services that human lives depend upon. These ecosystem services maintain the supply of consumables such as food, timber, air, water, medicines that are necessary for our survival and the economy. Additionally, they regulate human diseases, floods, erosion control that sustains human civilization. Lastly, ecosystems provide for our non material requirements such as aesthetics, spirituality, recreation, inspiration, cultural diversity. **In a nutshell, our physical, mental and emotional well being depend on ecosystem functions and biodiversity helps maintaining the ecosystem functions. The figure 10 shown below summarizes the links between biodiversity and human wellbeing.**

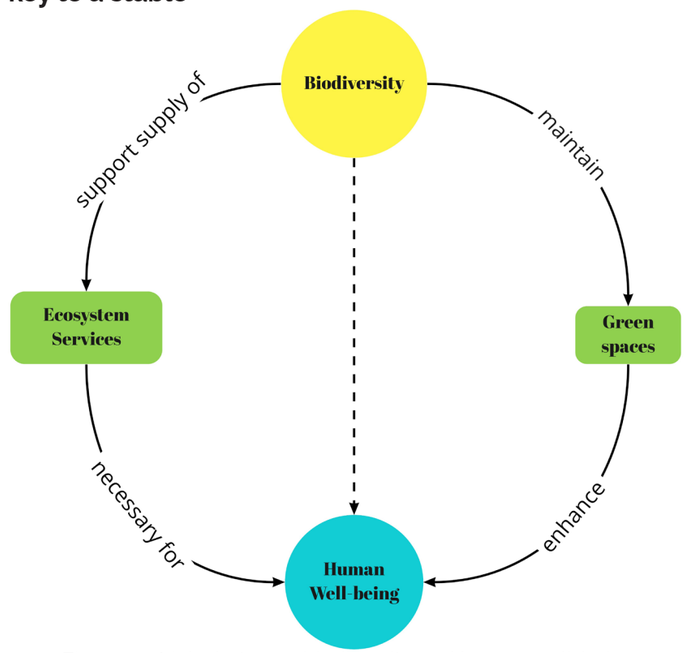


Figure 10: Links between biodiversity and human well-being.

3.2 Today's Status of biodiversity: A global problem

3.2.1 Loss of biodiversity : a global issue

The estimated number of animals and plant species on the planet is 8 millions. **Out of these 8 millions, about a million of them face the risk of extinction and many of them within decades.** According to the Living planet(2014) report we have already lost 52% (global average) of vertebrate species worldwide, with Latin America taking the biggest hit of losing 83% of the species. The planet has lost 76% of the freshwater wildlife, 39% of the terrestrial wildlife and 39% of the marine wildlife in the last 50 years (McLellan et al. 2014).

International Union for Conservation of Nature(IUCN) is an organization founded in 1964 that has the most comprehensive inventory of the global status of species. The inventory categorizes species in 7 categories based on the threat level. These categories are shown in the figure 11.

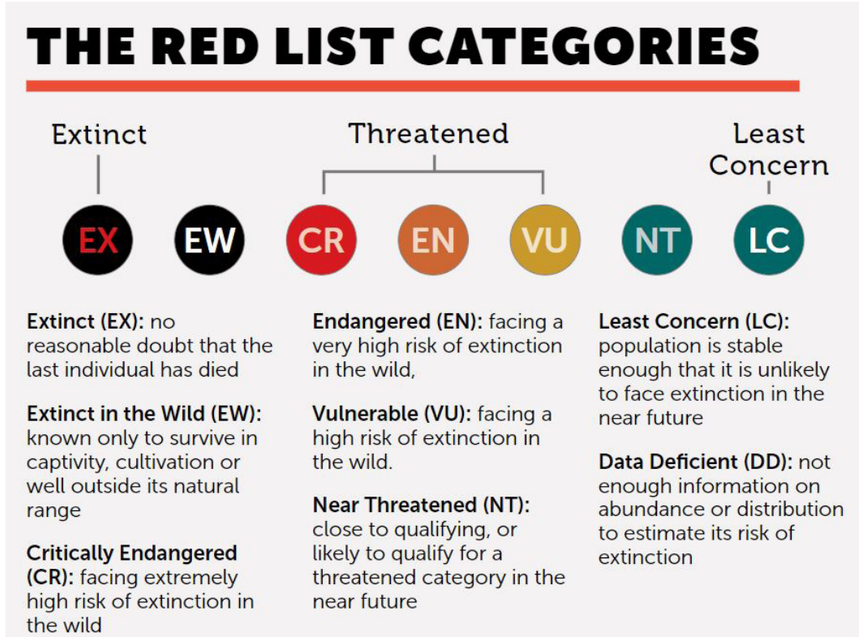


Figure 11: The classification of threatened species according to IUCN. (Taken from https://www.birdlife.org/redlist)

3.2.2 It is a fast paced loss

The rate of loss is considered to be about a 1000 times faster than the natural extinction rate. Living Planet Report suggests that in the last 40 years, we have faced the 60% decline in the size of populations of various species (Grooten and Almond 2018).

The following table compares the numbers of species increased over the years in some of the IUCN .categories.

Category	*No. of species in 2000*	*No. of species in 2020*
Vulnerable	6488	13898
Endangered	2614	11732
Critically endangered	1939	6811

Table 1. Comparison of number of assessed species in three IUCN red list categories is the year 2000 and 2020

3.2.3 Loss in the UK

In the UK, the picture looks no different. 41% of mammals, birds, butterflies and moths have significantly decreased in abundance since 1970. (State of Nature, 2019) The local natives of the UK (eg. Skylark) have reduced to half of its population. The small blue butterfly has reduced by 38%. Hedgehogs, that used to be a common sight for an English native, have reduced to less than half of what it used to be. Figure 12 shows the loss in the UK per IUCN red list category. The overall status of nature is in the UK (specifically England) is shown in figure 13.

Figure 12: Percentage of species in Great Britain in each IUCN category (Hayhow et al., 2019)

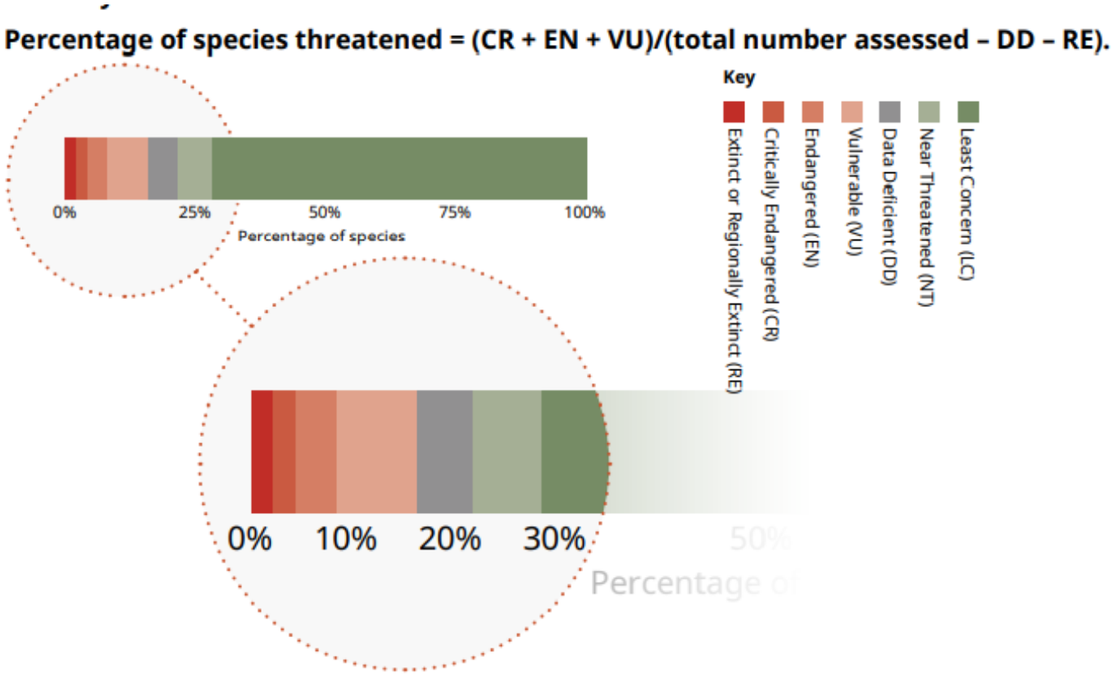


Figure 13: A snippet from the report on State of Nature, 2019.

3.2.4 Why is biodiversity declining globally?

Decline and rise in biodiversity is a natural process. Depending on the climatic conditions and other factors, populations of species rise and decline. However, the current decline is much faster paced than the natural cycles. Hence we are considered to be in the times of Holocene, the sixth mass extinction event. Moreover, compared to the previous extinction events, this time it's happening a thousand times faster, as mentioned earlier.

So what is driving this loss? Well, since the world we live in is connected with the natural world in many different way. Hence are activities have direct influence over the natural world. There are mainly five direct factors that are driving the loss. These factors are influenced by many other factors and global trends, which we will call Indirect factors. Along with understanding the factors, we will also study the human activities responsible for them.

There are five main factors that are driving the biodiversity across the world towards loss:
A. Habitat loss
B. Invasive species
C. Overexploitation
D. Pollution
E. Climate change

A. Habitat loss

Habitats are the ecosystem where organisms have relevant climatic and geographical conditions where they survive. With the loss in habitat, the favorable conditions necessary for survival are lost and with it the species are lost. Habitat could be lost in two ways: Destruction and Fragmentation. Destruction results in immediate loss. Fragmentation on the other hand is more like the habitat is broken down into smaller geographical areas which are disconnected from each other. The disconnection isolates the species, reduces the diversity and becomes vulnerable to disturbances.

What kind of human activities create Habitat loss?
Since the human population has doubled in the last 50 years, the amount of space required to provide for shelter and food has also increased. This has led to **conversion of well functioning ecosystems into agricultural farms and ranches.** Industrialization turned these places into factories. Urbanization/Globalization turned them into roads and highways causing huge fragmentation. Figure 14 shown an example of such activities.

In the UK, the biggest impact on biodiversity is due to agricultural intensification. About 70% of the UK's landscape is covered in agricultural land. Between the 1970s and 2015, the population of farmland birds have declined by 56%. The loss of the number of individual birds is estimated to be 44 million birds. (Eaton et al. 2012) **Agriculture supported by industrialization has provided enough food for humans, but at the loss of countless species in various ecosystems**.

Figure 14: An image of a Brazilian forest being converted into agricultural land

Figure 15: An image of a bard overgrown with Kudzu vine.

B. Invasive species

Invasive species are those species that are non native to an ecosystem, but which significantly modifies the ecosystem it colonizes(Kolar and Lodge, 2001). More often than not, these species destroy the biodiversity of the ecosystem by multiplying uncontrollably (as they do not have any natural predator) and exhausting the organisms and species it feeds on. For example, lion fishes which are native to Indo-Pacific waters, invaded Florida coast significantly affecting the local marine species' population. In absence of their natural predators (like Eels) their voracious appetite and their very fast growth rate, they affected the native ecosystems quite significantly.

What kind of human activities create Habitat loss?

These species are sometimes deliberately brought to a new place since they serve human needs. Other times, they travel with humans and end up in a different ecosystem. For example, Kudzu, a vine that is native to South-East Asia was brought to southern America for decorative purposes. It spread in the wild like a wildfire earning the phrase 'the vine that ate the south'. Figure 15 shows an image of Kudzu vine.

C. Overexploitation

When a species is consumed or harvested in huge quantities faster than it can replenish, that species along with others face the risk of extinction. For example, overfishing is a global issue threatening marine ecosystems. According to IPBES (2020), overfishing is the primary factor for extinction of marine ecosystems. Overexploitation also occurs in the form of wildlife trade that drives species to extinction. For eg. Rhinos in Africa are poached for their horns which are then sold worldwide. Between 2013 to 2017, every year about 1000 rhinos were killed (Save the rhino, 2020).

Figure 16: An image of forest being overexploited for timber. (Source: Shutterstock/Nalidsa).

D. Pollution

When a substance is added to the environment much faster than its natural removal, it accumulates to become pollutant. This substance could also be a form of nutrient that normally supports the ecosystem. A rise in the availability of such nutrients shifts the competitive relationships between species and invites invading species that eventually can outgrow the native species.

What kind of human activities create Habitat loss?

There are many different ways by which humans add additional substances to the ecosystem. Usually this addition is unintended and a side effect of a desired activity. For example, with increase in human population, food requirements have increased. With increased food requirements, the use of nitrogen (in the form of chemical fertilizer) increased. Nitrogen, when mixed with water bodies, tends to generate effects like Eutrophication, where algae thrive at the cost of other plants and fishes living underwater.

E. Climate Change

Climate change is referred to as a change in the average condition like temperature, rainfall in a region over a long period of time. In terms of planet earth, there has been a rise of temperature of the earth's surface temperature. This phenomenon is commonly referred to as Global warming. The overall rise in temperature, unusual summer and winter patterns affect the habitats of species. For example, oceans are the largest heat sink on the planet. With the rise in temperature of water, coral reefs started bleaching and many infectious diseases spread within coral colonies. Reefs being the backbone of the marine ecosystem, significantly affected many marine ecosystems and species. Figure 17 shows an image of bleached vs normal coral reefs bleached.

What kind of human activities create Habitat loss?

The rise of Greenhouse gases (Eg. CO_2, NO_x, CH_4) in the atmosphere exacerbates the problem of global warming. The burning of fossil fuel releases CO_2 in the atmosphere, raising cattle for the meat industry releases Methane, which is a much more harmful gas than CO_2. IPCC (2014) report suggests that there is more than 95% probability that human activities have warmed the planet in the last 50 years. Moreover, the growing demand for food resulted in clearance of many forests and other ecosystems. This has reduced the number of pathways in the ecosystem for the elements like Nitrogen and Carbon to cycle through.

Figure 17: Bleaching of a fire corals due to severe bleaching. (Left: Healthy coral, Right: Bleached coral). Image by: The Ocean Agency / XL Catlin Seaview Survey / Richard Vevers.

3.2.5 Mini Conclusion

In the last 50 years, we have lost a significant amount of known species. Out of 8 million known species, about a million of them are facing risks of extinction. The rate at which we are losing the species is alarming since these species form the overall 'diversity of life' which maintains the Ecosystem services we depend upon.

The greatest factor driving the fast-paced loss of species is human activities such as expansion of agricultural lands for food production, development of urban landscapes for economical utilities, addition of pollutants like nitrogen, methane and carbon in the air, water and land and exploiting a particular resource such as fish and timber at the expense of overall balance of the ecosystems.

As such a loss threatens survival of our future, generations, how can this loss be prevented, is discussed in the next section.

3.3 How can the loss be prevented?

The factors driving the loss that we discussed in the previous section, are mainly due to the large systems in place that are a result of our political, social and economical systems. One way to go about addressing this issue is to shift the priorities of these human driven systems and make them such that they do not cause the problem in the first place. However, these systems are ultimately a result of human mind and human actions. Hence, acknowledging the need for such a systemic change, I have **focused on an individual's behavior change as a way to influence change in these large systems.**

3.3.1 Why focus on an individual's behaviors?

I choose to do this because, in many ways, individual choices that we make supports or generates the political, social and economical systems with priorities that cause the problem. For example, the choice of buying bottled water may seem to be an innocent choice, but when a million people choose to do so, it becomes an attractive opportunity for industries and subsequently for economical reasons they over consume.

On an individual level, we make many choices everyday. Starting from what to eat, how much to cook, which movies to watch to which car to buy, which client to take, which policy to support and which political party to vote for. There are also choices of inaction that we make. If someone is cutting down a tree in a protected zone, not notifying the authorities is an inaction , but it's also a choice and many of these choices directly and indirectly impact the natural world.

The actions that one does to help support the environment can be referred to as Pro-environmental behaviors. These Pro-environmental behaviors are discussed in detail below:

3.3.2 Pro-environmental behaviors(PEBs).

Pro-environmental behaviors can be defined as: '**The behaviors conducted through the motivation to conserve the environment and that actually contribute to or are perceived to be contributing to conservation.** (Kurisu 2015).

There are two important phrases in this definition that are important to elaborate.

What is meant by 'conducted through the motivation to conserve the environment'?
One could perform a behavior that contributes to the conservation , but is performed with a different purpose. For example one may choose LED bulbs instead of incandescent bulbs because they are cheaper and saves money. Although the behavior helps saves electricity and contributes to less use of fossil fuel, it is not performed with an initial intention to contribute to conservation. Pro-environmental behaviors in this report do not mean these behaviors.

Why 'perceived to contribute'?

The definition includes of behaviors that are 'perceived to be contributing' to acknowledge the behaviors that seem like pro-environmental like using refillable metal bottles so as to reduce the plastic waste, but without calculating the impact of supply chain of manufacturing and delivering the metal bottles, which can put larger environmental loading in other areas, it is difficult to say that it actually contributes to conservation. Generally pro-environmental behaviors (PEBs) are recommended based on the greenhouse gas emission or waste generation. For the purpose of this report, we will consider the definition mentioned above.

As we saw above, there are many choices that we make and each of these choices, directly or indirectly impact the natural world. This means that all our behaviors can be pro-environmental or against it. To clarify, **the PEBs are looked at as overall behaviors of an individual that stem from a conviction so conserve the environment and not the only that are usually promoted in the society such as reducing use of plastic and reusing products.** This out look towards PEBs is inspired by the work of McGuire(2015).

If the PEBs that I'm referring to are not just a few commonly known, what's the extent of these behaviors? To understand the extent of it, let's look at the next section that talks about classification of these behaviors.

Note that this classification is simply for the purpose of understanding the PEBs discussed here in a better and structured way.

3.3.3 Classification of Pro-environmental behaviors.

PEBs can classified in five main categories:
• Activism
• Non-activist conservation behaviors in the public sphere
• Private sphere conservation behaviors
• Conservation behaviors direct to species and projects
• Pro-organization conservation behaviors

A list of types of behaviors that are included in the five categories along with their respective definitions are shown in the table below.

Table 2: Classification of PEBs and their definitions (Maynard et al. 2020)

Conservation behaviors by level of classification	Definition
1.0 Environmental activism conservation behaviors	Recruitment and activist behaviors in the public sphere
1.1 Spreading information	Spreading information about the project or biodiversity issue with personal networks or using technology (e.g., social media)
1.2 Recruiting others	Recruiting friends, family, and/or close connections for joint action in the conservation behavior or the project.
1.3 Joining a partner organization	Participating in the project by joining in with another organization's efforts on the project, becoming a member, or donating to their role on the cause.
1.4 political advocacy	Supporting policies/law, petition signing, contacting politicians for conservation issues.
2.0 Non-activist conservation behaviors in the public sphere	Engagement behaviors in the public sphere
2.1 Using new learning resources	Engaging with the issue by learning more, exploring additional resources and websites, signing up for listserv and taking other opportunities to learn about project and/or biodiversity issue
2.2 Environmental stewardship	Supporting environmentalism with positive attitudes, developing a sense of responsibility that influences public actions, pro-environment lifestyle
3.0 Private-sphere conservation behaviors	Private consumption and waste behaviors for individuals
3.1 Resource sustainability	Reduce, reuse, recycle; reducing waste, diverting to recycling streams, and maintaining household equipment, driving less
3.2 Sustainable purchases	Sustainable consumer purchases and cause marketing.
4.0 Conservation behaviors direct to species and project	Actions that the public can participate in which directly connect to the species or project
4.1 Citizen science	Citizen science with direct observation of the species or habitat to record species presence, behaviors, habitat health, etc.
4.2 Species or habitat supporting behaviors	Reducing impact on habitat, habitat restoration and protection, collecting resources needed for the project
5.0 Pro-organization conservation behaviors	Behaviors that support the conservation organizations' efforts for the project
5.1 Philanthropic funding	Donating to the organization for the project, species, or issue.
5.2 Volunteering	Volunteering time at the organization to support the project

3.3.4 Mini Conclusion

Acknowledging the systemic change required to shift the human interactions with the natural world to become more sustainable,I have chosen to influence the behaviors that people perform on their individual level. This is because these behaviors also have the capacity to influence the larger systems. The stance towards these behaviors is such that it includes behaviors from supporting a political party to reducing one's consumption on everyday life.
How can such a large domain of behaviors be changed? This brings us to the next section where we discuss the factors that influence and drive our behaviors.

3.4 Understanding (behavior) change for conservation of biodiversity

In the previous section, near the end we looked at the large categories of pro-environmental behaviors one can perform. In this section, first we will discuss the factors that influence one's pro environmental behaviors. Following this we will discuss the approaches for behavioral change in the literature and then the approach I will choose.

Why we do things the way we do is a very complex phenomena. Our decisions, intentions, actions are influenced by many internal and external factors. Moreover, the one factor that instigates one Pro-environmental behavior, does not necessarily be enough to instigate another behavior. As a part of my elaborated research on behavioral change , I read an interesting book called "Why do good people do bad environmental things?" (DeSombre E, 2018) that strengthened my concepts about behavioral change. The following section integrates the findings from the literature I read in the form of research papers and reports.

3.4.1 Factors that influence Pro-environmental Behaviors

There are mainly two types of factors that influence our behaviors:
• Individual factors or internal factors
• Contextual factors or external factors

3.4.1.1 Individual factors

Individual factors can be referred to as internal factors or factors of the mind that drive a person's behaviors. It does not indicate that an individual has control over them or that they are not affected by external factors. I considered following Individual factors:

A. Knowledge or awareness
B. Response Efficacy
C. Motivations
D. Values
E. Emotional Involvement
F. Identity.

A. Knowledge or awareness

Knowledge or awareness is the first that comes to mind when we think of why people do or do not act. But scientifically speaking, knowledge has much lower influence on our behaviors. However it is still a component that drives our behaviors. Knowledge can be further understand in three ways:

1. Do we know about the problem?

Do we know that a problem exists in the first place! It is impossible to take a conscious positive action towards solving something without knowing the problem.

In recent history, the conversations about climate change have gained much traction in our social, political and economical landscape. On an individual level as well, people are generally aware about climate change as a problem. But are they aware about loss of biodiversity as a problem? We will discuss about the awareness of it amongst citizens of the UK in the next chapter.

2. Is it 'urgent' to us?

By urgency it means two things: **if the problem matters** to us and **do we see** it affecting us.

Firstly, if we do not understand the relevance of biodiversity for our daily lives, or why biodiversity is important, we may acknowledge the problem of its loss but may not consider it as 'our' problem. It may not matter to us or threaten us. According to literature, awareness about the threat is an indirect but an important step on the way to behavioral change(Bamberg and Möser 2007).

Secondly, with regard to most environmental problems, the actual problem is not visible to us, because it takes place somewhere else(distance) and in a different time frame(future). The two can be referred to as the **'problem of scale'.** Here visibility also includes experiential aspects, meaning apart from not seeing the problem in everyday life, we also don't experience its effects on us.

3. Do we know what to do about it?

Knowing about the problem is only half of the battle won in the knowledge component. The other half is knowing **what to do about it** and even more importantly knowing **'how' to do it.** The first can be referred to as knowledge to take action and the latter as procedural knowledge. With regard to pro-environmental behaviors, many times, people know about 1 and 2, but they know only certain things that they can do. Additional to knowing these certain things that once can do, the 'procedural knowledge' is sometimes absent. Knowing how to do it also helps one decide if one has the ability to do it. Its importance is emphasized as 'perceived behavioral control' in the theory of planned behaviors (Ajzen 1991).

There's a darker side to knowing about the problem and not knowing about the actions to take. It can drive people into apathy(Futerra, 2010), where they stop caring about the problem and even believe that one cannot do anything about the problem. This leads to lack of motivation to act as well as response efficacy, both of which we will discuss later in this section.

4. Is this whole thing caused by me?

Because of the 'problem of scale', the negative effects of our everyday actions are not visible. Additionally the negative effects of degradation are 'slow' and they're manifested through a complex system. Let's elaborate.

It is easy for us to view sudden changes that happen around us. Most of the ecological problems surface over a period of time, which makes it difficult for us to recognize them. Similar to the frog who doesn't jump out of a vessel of water that is being boiled gradually, we also do not perceive these changes and hence do not act. Moreover, our actions impact the natural world in complex ways which makes it cognitively difficult for humans to understand. For eg. uprooting a tree in the garden may take away home of many insect species resulting in an overall loss of biodiversity in the garden which may stop the supply of food for the birds affecting their numbers and breeding rates which further degrades the biodiversity.

From the above discussion, some design principles to keep in mind while influencing the knowledge factor are extracted as follows:

Design principles for behavior change:

1. If I inform people about a problem, I should always inform them about an action they can do to solve the problem.
2. If I inform people about a problem, I should always inform about why it is relevant to address the problem.
3. If I inform people about action, it'll be wise to inform about the 'how' to take that action.

B. Response efficacy

Response efficacy is the belief that one's behavior will create the desired impact. In the context of conservation, it can be seen as a belief that a pro-environmental behavior will result in conservation of the environment.

This belief is considered as an important aspect of Value-Belief-Norm theory for behavior change. (Christmas et al. 2013). S**cientific studies also show that response efficacy is a significant determinant of Pro-environmental behaviors.** (Christmas et al. 2013; Kim, Jeong, and Hwang 2013) Most of the environmental problems need collective action for a significant positive change and we know it. But knowing if many others are doing the behavior can greatly influence response efficacy as it encourages one to believe that since many others are acting, one's own actions will also contribute to the conservation of nature. (Christmas et al. 2013)

For clarification, note that self-efficacy is different from response efficacy. Self efficacy is a part of the Theory of Planned Behavior, which indicates the person's belief about hi/her own ability to do a certain behavior.

From the above discussion, a design principles to keep in mind while influencing the response efficacy is extracted as follows:

Design principles for behavior change:

4. After making one aware about the actions to take, reinforce one's belief that one's action matters.

C. Motivation to act

Are we motivated to perform a pro-environmental behavior?

Motivations are the 'whys' of behaviors. According to Self-Determination Theory(Deci and Ryan, 1985), motivations can be classified in two types based on difference in goals: intrinsic and extrinsic. **Intrinsic motivations** stem from motivation to receive a personal reward such as enjoyment, satisfaction, expression of one's true self, whereas **extrinsic motivations** stem from

motivations to achieve an external reward to avoid a punishment.
With regard to Pro-environmental behaviors, intrinsic motivation to act can come from deeper factors such as values and identity. Whereas extrinsic motivations are mostly financial incentives in the form of monetary gain or avoiding monetary loss(or saving money). For eg. Returning empty beer bottles help in recycling but it also pays money, whereas using solar panels for electricity can be cheaper and it saves money. Extrinsic motivations are easy to influence but difficult to sustain as external

circumstances may stop the incentives resulting in lack of motivation to act.
As discussed earlier in the definition of Pro-environmental behaviors, the behaviors that come from an extrinsic motivation are not considered as Pro-environmental behaviors. Our motivations can also be looked at as:

• Primary motives and
• Selective motives.
Primary motives are motives that we live our life with. For eg. earning great wealth or being more environmentally friendly in everyday life. Selective motives, on the other hand, are motives related to specific situations. For eg. if it is winter, should I walk to the supermarket? (Kollmuss and Agyeman 2002). Many of the times, selective motives, take over the primary motives and act as a barrier to pro-environmental behaviors. When faced with a dilemma of such nature, stronger values may come to help in motivating us towards a positive behavior, which brings us to the next factor.

From the above discussion, a design principles to keep in mind while influencing the motivations is extracted as follows:

Design principles for behavior change:

5. Tap into the intrinsic motivations one may have to encourage a behavior, instead of showing an extrinsic benefit.

D. Values

Values are fundamental beliefs that guide our motivation to act. What we really value in our everyday life, drives our behaviors. The factor of knowledge about relevance of importance of biodiversity may play a role here in what one values.

In relation to conservation, Crompton(2010), distinguishes two different types of values: Egoistic and Ecocentric. Egoistic values are driven by self-interest like comfort, saving money whereas ecocentric values are altruistic in nature stemming from concern for other living things. Ecocentric values are derived from a greater sense of connection with nature.

When awareness and behavioral change campaigns communicate why a certain behavior should be performed, it should be carefully evaluated as to what king of values it promotes. The campaigns that promote pro-environmental behaviors in a context of egoistic values (Save energy because it saves money) undermine long term engagement with the conservation issues as they form habits for environmental behaviors out of extrinsic motivations.

From the above discussion, a design principles to keep in mind while influencing the values is extracted as follows:

Design principles for behavior change:

6. When a behavior change is encouraged, it should be encouraged in the context of Ecocentric values.

E. Emotional involvement

Emotional involvement here means an emotional connection with the natural world. If we feel an emotional connection with something, we tend to value it and care for it. It is agreed that the stronger a person's emotional reaction to environmental problems, the more likely the person is to engage in a pro-environmental behavior. (Kollmuss and Agyeman 2002). To think of it, this fact is reflected in the campaigns about the loss of the natural world that emphasize flag-ship species such as orangutans and elephants receive much more public support than abstract issues like climate change and global warming.

In our everyday life, due to 'problems of scale' it is not possible for us to be involved emotionally with environmental problems. However, there are certain problems that might be visible to us but we do not know them as problems, leading us to lack of emotional involvement. For eg. Rhododendrons in the UK are an invasive species that has negatively affected the biodiversity of the country. But lack of knowledge about ecological relationships and invasive species, the common reaction to the sight is almost always positive as compared to seeing a flock of seabirds stuck in an oil pool.

F. Identity:

Identity is the psychological construct that relates to self-image and individuality. It is about how we look at ourselves and what we believe of ourselves.

In the context of conservation it can be looked at as Environmental Identity(EID). Specifically, It can be referred to as a "extent to which the natural environment plays an important part in a person's self-definition" (Clayton and Opotow 2003). Environmental identity can be measured via EID scale developed by Clayton(2003).

EID is a strong predictor of PEBs. An individual with a stronger environmental identity is deemed to behave in a sustainable way as it falls under one's own self interest to take care of and value the natural environment and its well-being (De Young, 2000). Other studies have also suggested **environmental identity has been found to be the strongest predictor of conservation attitude and behavior.** People with strong environmental identity tend to actively pursue behaviors where they are relatively free to act such as activism and 'green' consumerism (Holland and Kempton, 2003)

Through the lens of motivations, it can be seen as EID contributes intrinsic motivations for one to pursue a behavior. EID also can contribute to the development of ecocentric values. It must be acknowledged that identities are developed over time and are difficult to change in a short time.

With regard to conservation of biodiversity, an environmental identity that recognizes and acknowledges the relationship between humans and the animal world has the potential to enhance one's values towards supporting the animal conservation. (Clayton et al. 2011)

Apart from internal factors discussed above, there are also contextual or external factors that influence our behavior. They will be discussed below.

3.4.1.2 Contextual factors

There are largely two contextual factors that I recognized in the literature:
A. Subjective Norms
B. Structures

A. Subjective Norms

Loosely stating, **norms are behaviors that are agreed upon as accepted behaviors in the society.** Subjective norms are a component of social norms. They are also called 'Normative social influence'. (Fang et al. 2017).

Norman et. al (2005) pointed out that, in fact subjective norms can be further understood by two of its components : Descriptive norm and Injunctive norm

1. Descriptive Norm

Descriptive norms are related to the perception of weather other individuals in the relevant group perform the behavior. For eg. in an experiment of encouraging guests in a hotel to reuse the towels, the message "HELP SAVE THE ENVIRONMENT. You can show your respect for nature and help save the environment by reusing your towels during your stay." inspired 37% of the guests to reuse towels. On the other hand, the message "75% of the guests who stayed in this room (#xxx) participated in our new resource saving program by using their towels more than once" inspired 49% of the guests to reuse the towel.

Here, the difference in messages point out the impact of descriptive norms on people. The descriptive norms are around in the society influencing our behaviors.

2. Injunctive Norm

Injunctive norms, on the other hand are about perceived pressure from other individuals in the relevant group to adopt the behavior(McKenzie-Mohr, 2011). Or in other words, the behaviors that are not perceived(visible) directly but are either approved or disapproved of. An example of an injunctive norm would be that throwing garbage out on the streets is disapproved of in the UK and one would refrain from doing it.

With regard to conservation behaviors, people who belong to a certain community can be targeted by portraying certain behaviors as norms of the community.

B. Structures

Structures are infrastructures that drive the availability of pro-environmental options such as public transport, availability of green products in supermarkets near-by. Policies can also be considered as a part of these structures. Generally the policies, laws and infrastructure that support pro-environmental behaviors are difficult to bring into motion. However, a greater consciousness amongst general citizens will drive and push the government and businesses to change their ways of working impacting conservation goals at a much larger scale.

These contextual factors refer to the social, economic and political systems we are a part of. Although they are as important as individual factors, as discussed in 3.3.1, influences of these factors is not accounted in this project.

3.4.2 Approaches to behavior change

In my literature study, I came across many approaches to behavioral change such as Theory of Planned behavior (Ajzen 1991), Community Based Social Marketing ((McKenzie-Mohr 2000), Motivation-Opportunity-Ability Model and a few more. **A common aspect about all these models is that they advocate targeting a specific behavior for behavioral change.** For example, if the behavior I want to change is that people install electricity saving light-bulbs in their homes, then I can use any of these behavioral change approaches to find strategies to influence one's behavior. These strategies could vary from distributing free light-bulbs initially to incentivize use of such bulbs(extrinsic motivation:3.3.1.1-c). Choosing one behavior and using one of these models could've been one approach. However, **since a larger societal change is at the core of the project, simply changing one behavior did not seem like a desired outcome.**

Compared to all of these models that consider factors such as attitudes, motivations, ability to perform etc, environmental identity is a better predictor of the behaviors. Moreover, from the work of McGuire (2015), also suggested that what we need is a shift in global behaviors (every single behavior one does) and an environment in identity can be useful in achieving them. Hence, the approach of influencing one's identity is chosen as an approach towards behavioral change.

3.4.3 Mini Conclusion

What drives a person's behaviors is heavily dependent on internal factors such as knowledge, motivations and values, identity, beliefs as well external factors such as social norms, structures, incentives etc. Out of many approaches that influence these factors for behavioral change, the approach to influencing one's identity is chosen. However with this, the other factors (of 3.4.1.1) are not to be ignored, as they also form the basis for an environmental identity. Hence the principles that were extracted out of the discussion are integrated in the design brief.

Having discussed many factors influencing the behaviors and concluding the approach to developing one's environmental identity as an approach for this project, let us move to the next chapter that portrays inclinations of the people of the UK, with regard to nature and their overall engagement with the problems of loss of biodiversity.

Design principles towards Pro-environmental behavior change

1. If I inform people about a problem, I should always inform them about an action they can do to solve the problem.
2. If I inform people about a problem, I should always inform about why it is relevant to address the problem.
3. If I inform people about action, it'll be wise to inform about the 'how' to take that action.
4. After making one aware about the actions to take, reinforce one's belief that one's action matters.
5. Tap into the intrinsic motivations one may have to encourage a behavior, instead of showing an extrinsic benefit.
6. When a behavioral change is encouraged, it should be encouraged in the context of Ecocentric values.

B : Discovering What?

Chapter 4

UK citizens and Biodiversity

In this chapter, we will discuss the overall status of the UK society with regard to the factors discussed in the previous chapter. We will start by understanding the overall attitude of a UK citizen towards nature and then examine aspects related to knowledge, values and identity. We will end the chapter by defining the systemic change to aim for.

Research method: Interviews

Being a native of a different country than the UK, it was very important for me to understand the people, the culture and the nuances in the society related to the natural world. To understand this, two sets of interviews and literature research in the form of government and organization reports were conducted.

Profile of the interviewees:
Interviewee 1: A professional storyteller and editor of a 'nature magazine' and writer of a book about engaging people with local biodiversity.
Interviewee 2: A 28 year old citizen of the United Kingdom working at a nature conservation organization.

Insights from the research are presented in this chapter.

4.1 The people of the UK have a very high connection with nature...

The culture of the UK is proud of its natural heritage. There are designated areas in the countryside which are called Areas of Outstanding Natural Beauty' (AONB) that are designated for conservation. Because of their landscape value, every year, millions of visitors visit many countryside places including AONB for holidays and nature excursions.

"People love the idea of a rolling British countryside that's green"

Interviewee 1

4.1.1 There are huge businesses about nature

The UK has huge businesses revolving around natural television. BBC producing world famous documentaries like Planet Earth and Blue planet are largely driven by the UK audience. Every Spring and Autumn, BBC presents programs such as Spring Watch and Autumn watch which are basically live video camera feeds of wildlife in their natural habitats around the UK and people love to watch that.. In the year of 2019, Spring watch had a total audience of 1.86 million people(Springwatch). Conservation charities are flourishing in the UK. Royal Society for the Protection of Birds (RSPB) founded in 1889 is one of the largest charities with 1.2 million members and about 18,000 volunteers. The Wildlife trust has about 850,000 members with a huge number of 38000 volunteers. Moreover, it is quite a common thing in the UK to gift these nature organization's memberships to family members on special occasions such as birthdays.

The overall attitude towards wildlife is very positive and people have a tendency to want to interact with it. People do wildlife gardening which is about managing private gardens in a way that attracts wildlife. People do activities like putting ponds in their gardens, planting wildflowers and installing bird feeders to support wildlife in their gardens. Every year as a nation the UK spends £200-300 million on bird feeding products each year(Plummer et al. 2019). People love some of the local wildlife such as hedgehogs and they're a huge excitement. **There's a lot of love about everything people do with nature.** People's love and compassion for wildlife is reflected in stories about rescuing a baby bird in their backyard.

However, there's flip side to it.

" We have programs called a spring watch and autumn watch, which are basically like live feed cameras where people sit and watch pictures of cute birds in their gardens. But they're absolutely huge. It's a huge business. It's really kind of simple, cute stuff."

Interviewee 1

Figure 18: A snippet of the BBC website page about Spring watch

4.2 ...but their idea of nature is limited to 'lush green countryside'

The love and compassion people feel is limited to only some species and more so it's about helping something that is "smaller than you"(Interviewee 1) and not necessarily because it is valuable. Although people love to go out in nature and like to attract wildlife to the gardens, there's a lot of appreciation about the aesthetics of nature, but not necessarily the variety of life it supports. **The idea of nature is that of a 'lush green countryside' which may not even have a great biodiversity, but that's what people love and think of nature as.**

"People in the countryside can be proud of species that they see but if you live in the city, you're far from it and you don't feel a part of it."

Interviewee 2

"We love wildlife, but we love bits of it."

Interviewee 1

4.2.1 Do UK citizens know about local biodiversity?

People generally do not have the knowledge about the species and biodiversity around them. They may be aware about certain species like hedgehogs, foxes and some birds but that is the extent of it. Children in the school, also do not learn about the local nature. Through their visits to the zoo, they learn about the big exotic species such as tigers in other continents but "they won't be able to identify birds in the garden." (Interviewee 1)

There are also organizations that are acting towards making people aware about local species. For example, The Wildlife Trust, recently launched a campaign called 30 days of wild where people were encouraged to explore the wild around them in different ways (figure 19 on the right).

Figure 19: A snippet of the National Trust's website page about activities to engage with local wildlife.

4.2.2 Low awareness and concern about local biodiversity loss

According to a survey in 2019, about 38% of the UK citizens were unaware about the local biodiversity loss or were aware and still not concerned. Out of the remaining, only 20% people were aware and extremely concerned. (Monitor of Engagement with the Natural Environment, 2019). Interestingly, in the same survey, about 90% people agreed with "I am concerned about damage to the natural environment" **indicating that biodiversity is not really acknowledged as a part of mental models of people about nature.**

4.2.3 Ecosystem services are unacknowledged

A study in the UK suggested that when asked about the importance of biodiversity or Ecosystem services, the first responses of people were around the themes of 'freedom' and 'relaxation'. (Define Research and Insight, 2007) Another qualitative study showed little awareness about the regulating, provisioning and supporting services that human life depends on.(Christmas et al. 2013). **This indicates that the overall ecosystem services we get out of the natural world are not recognized or are not acknowledged in day to day lives.**

4.2.4 Younger generation is more understanding

Across the world the younger generation is joining the movement to stop environmental crises in various different forms. So is the case in the UK. Interviews revealed that the older generation is tired of listening about climate change, but the younger generation is open to conversation.

According to the MENE report, about 34% stated that they intended to make lifestyle changes and a further 12% showed interest but lacked know-how or found it to be difficult. In both these groups, younger people were more likely to say so. (Monitor of Engagement with the Natural Environment, 2019)

"Most members of charities tend to be 55 or older. Those people have very entrenched views. They have very entrenched ideas of what nature is. And so they simply will not accept that climate change is a thing. Or if they do, they don't see what they can do to stop it. So now, the magazines aren't necessarily the best vehicle. we all use magazines like that (To talk about biodiversity issues). But we tend to get really negative feedback about those arguments because people feel like they're being told off"

Interviewee 1

4.2.5 Mini Conclusion

Although the people of the UK have a high connection with nature, the nature they are connected to is more like 'green space'. The overall importance of ecosystems and biodiversity is lacking in society. Their awareness about the loss of biodiversity and actions to take is also low. They may invite wildlife in their garden and take care of it, but that is out of altruism and not out of recognition of its value. The problem of loss of biodiversity is not apparent to them and they can't link their actions with the negative impact. Overall their connection with the animal world is limited to fascination and amusement.

Demographically, the younger generation is much more willing to change their lifestyle compared to the old generation.

4.3 Master conclusion

The insights from the research on the UK citizens are reflected on with the lens of behavioral change to understand the larger level change required in the society. It informs the project about the change to aim for.

As the ecosystem services are not recognized in everyday life, the overall relevance of the problem(3.4.1.1-A) will be less. Since the local biodiversity is also not known by people, the overall emotional involvement(3.4.1.1-E) with biodiversity is also less. Not knowing about the variety of life around them, makes biodiversity a concept that is not a part of their daily life, preventing the development of an environmental identity that acknowledges their relationship with the animal world(3.4.1.1-F). Naturally, if ecosystem services are not well recognized, the relationships between biodiversity and ecosystem services are not known which may lead to lack of concern on a daily basis. Moreover, if people are not aware about the ecosystem service one receives and function of biodiversity around them, it develops into a worldview that 'Humans are independent of nature" which further leads to egoistic values (3.4.1.1-D) and negatively influences environmental identity(3.4.1.1-F)

The visual map of the above synthesis is shown in the figure 20.

Defining the change to aim for

In the UK, the connection with the animal world is missing in society, which has the potential to contribute to the environmental identity(3.4.1.1-E) which has the potential to influence one's overall behaviors. **Hence from the society's end, the larger change that is needed is identified as development of an identity that recognizes and acknowledges the relationship with the animal world.**

From the research of biodiversity, we understand that the animal world is a complex world in itself, where so many forms of life(3.1.1), levels of organizations(3.1.2) and ecological relationships(3.1.3) exist together. Although it is a complex system, we hardly see or experience these complexities in our daily lives. **To make it a part of one's identity it is important that this complexity is made relevant and relatable for the people of the UK.** This idea of touching people though "Resonance, not Reason" is also recommended in the literature (Christmas et al. 2013).

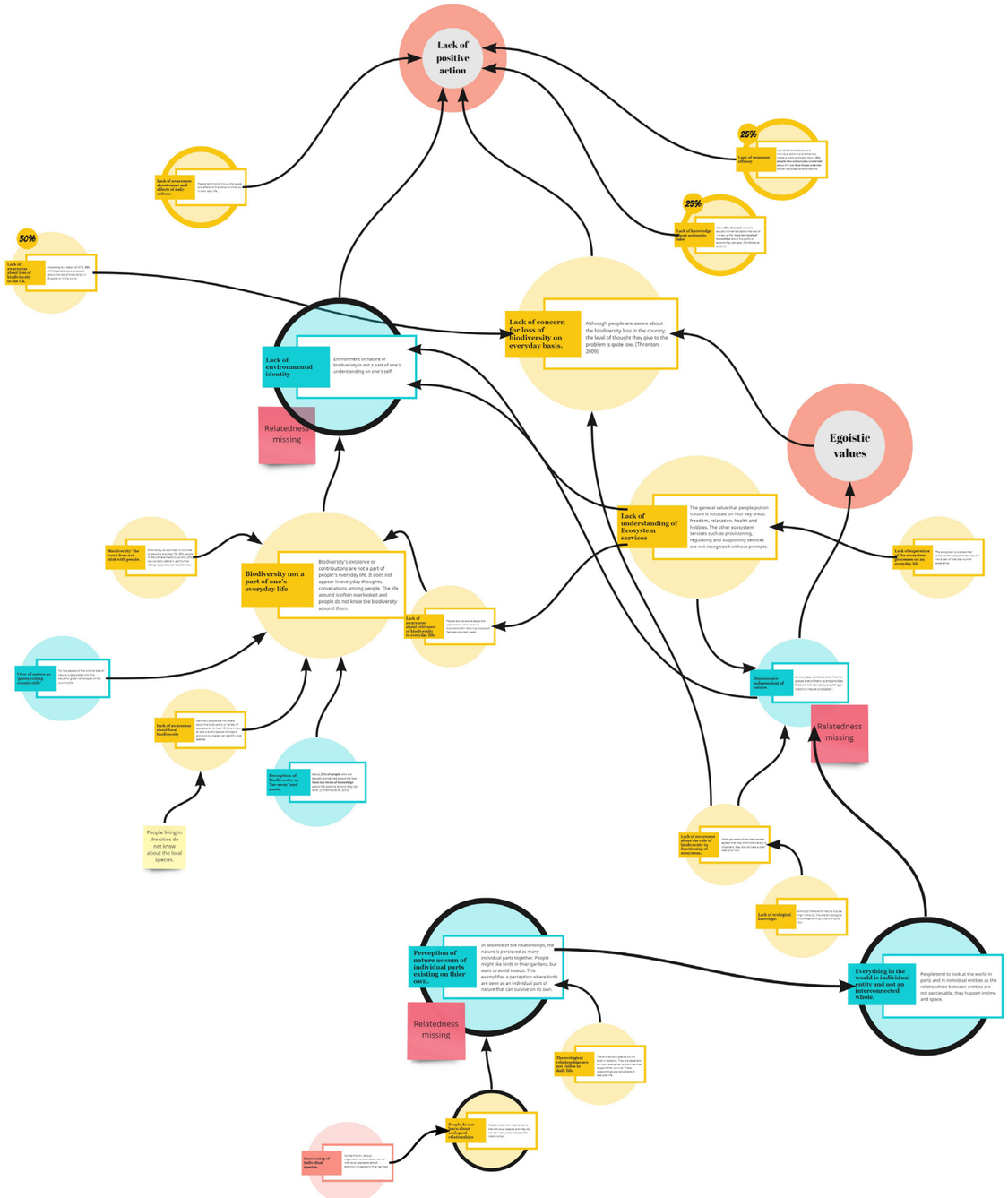


Figure 20: Visual synthesis of the research about behavior change literature and the state of UK society. For full visibility, refer appendix K.

C : Understanding the context

Chapter 5

Zoos

In this chapter, we will discuss the following main sections:
5.1 Zoos and their activities
5.2 Motivations of Zoo visitors
5.3 Effects of a zoo visit on the visitors.

Since most of the literature was available about the Zoos, the research is focused around the Zoos leaving the aquariums out of the scope. Although this is the case, the relevance of the research conclusion can be applied well to the aquariums too.

As the larger goal of the project is decided(4.3), and zoos are the context for designing, this chapter will help us scope the context within zoos where the design shall intervene.

Research method: Interviews, Literature research and Website reviews

To understand the aspects related to Zoos as organizations and its priorities a varieties of methods were used. Interviews with two education officers and one zoo researcher were conducted. Apart from interviews, reports, research papers were studied.

Additionally the websites of mainly London Zoo(approx. 900,000 annual visitors), Chester Zoo(approx. 1,100,000 annual visitors) and Marwell zoo(approx. 300,000 annual visitors) was studied.

Profile of the interviewees:
Interviewee 3: Head of Zoo Education Department, German Zoo (Online)
Interviewee 4: Official of Zoo education Department, Rotterdam Zoo (Off-line)
Interviewee 5: PhD Researcher at Paignton Zoo. (Online)

These interviews were audio recorded and later they were re-listened for insights. Relevant parts were transcribed and then clustered. The transcribed quotes and clusters can be found in Appendix I. The main insights from the research are integrated in the following sections.

5.1 Zoos and their activities

5.1.1 A brief history of zoos

Captivating animals for the pure purposes of exhibition goes back to even before the 17th century. It was called menageries back then. Exotic animals such as elephants, rhinos, giraffes etc. were captivated in enclosures by the kings. To take care of these animals, history suggests that animal handlers were hired. They ensured their survival and arranged for reproduction of the animals. However, the modern zoos of today serve far greater purpose than simply exhibiting animals.

Figure 21: Picture of the Jardin des Plantes, Paris 1902 (left) and Blijdorp Zoo, Netherlands 2015 (right)

5.1.2 Modern Zoos: From Animal exhibits to Conservation centers

The modern zoos of today ensure, no matter what, that the captivated animals are given utmost physical and psychological care. The enclosures are designed in a way that feels like a natural habitat. Modern zoos have adopted the practice called animal enrichment as a part of which relevant natural stimuli is provided to the animal for its optimal psychological and physiological well-being. For example, felines rely greatly on their olfactory senses (ability to smell). Keepers for leopards use the scents that are similar to their prey in the wild to lead the animal to the hidden food engaging the animal's various abilities which would be engaged in the wild. A similar example for elephants is shown in the figure below. (Figure 22)

Figure 22: Elephants feeding enrichment (left) that offers the elephants to replicates their behaviors in the wild (right)

The scope of the activities that modern zoos pursue have expanded from exhibiting animals to pursuing conservation of biodiversity worldwide.

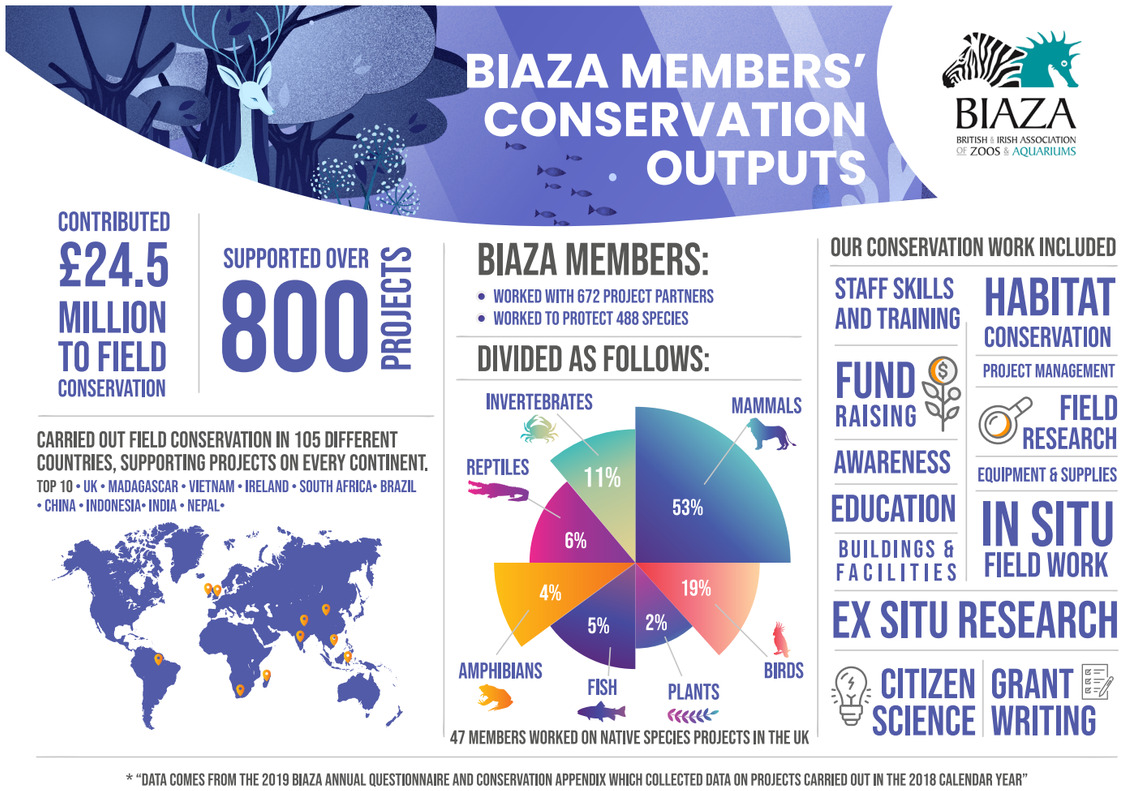
With animal's well being as top priority, the zoos in UK and worldwide are involved three major activities:
- Conservation of wildlife,
- Research that informs conservation activities and
- Education of people about the wildlife and conservation issues

5.1.2.1 Conservation of wildlife

Conservation of wildlife can be understood as activities that help protect a wild species and its habitat. Zoos across the world are engaged into many in-situ and ex-situ conservation activities.

In-situ or 'on-site' conservation is about carrying out activities to restore the population and diversity of a species where it is found in the wild. Activities include reintroduction of species in the wild, investing zoos resources such as expertise and finances to projects in the wild. On the other hand, Ex-situ or 'off-site' conservation is about rescuing the threatened species from the wild and preserving it in captivity to preserve the genetic material and breed the captive animals for reintroducing them in the wild. Zoos are one of the places where Ex-situ conservation is carried out very well. For example, for reintroduction of the species, the species needs to be bred with proper genetic family and need to be prepared to survive in the wild. Figure 23 shows the overall contribution the field of conservation by BIAZA members.

Figure 23: BIAZA members' involvement and contributions to the field of conservation of biodiversity in the year of 2018. (Source: BIAZA)



5.1.2.2. Research

Conservation of species requires us to understand them first. What is the typical food for a species?, How do the species survive the weather?, what are its natural behaviors?, how to treat the animals during sickness? and many more questions need to be answered to guide conservation projects. Researching about the animals or species requires a great amount of observation in the wild and even in the zoo. Zoos provide funding, space, expertise, time and resources needed to carry out this research.

5.1.2.3. Education

Educating visitors about the wild animals and the natural world is a key activity for zoos. Zoos across the world educate people about the animals, their habitats, their behaviors in the wild and sometimes also about the threats the animals in the wild are facing. Zoos worldwide are mandated to put some information about the species such as its scientific name, IUCN red list category and information about geographical locations of its habitats. But zoos pursue the goal of education beyond this.

BIAZA member zoos are required to have an educational strategy that includes different educational activities performed by the zoos for various target audiences. Apart from the mandatory information about a species, depending on the resources available to the zoos, many different educational activities are carried out by them.

These activities are offered in mainly two ways: **Formal Education and Informal education.** These two forms are discussed in the following sections.

A. Formal education

Zoos formally educate people by hosting group sessions for children and adults where they are taken into a classroom type setting and an expert from the zoo educates the participants about a certain topic about nature and wildlife. Usually, the participants are school children on school visits, but the programs are also available for adults. In 2018, out of 32 million visitors to the zoos, about 900,000 were school students on formal education trips and about 140,000 visitors included scouts, adults and other groups. (BIAZA, 2018)

The education sessions for school students revolve around the National Curriculum goals. The content of these sessions is curated according to the needs of the schools to inform and inspire students about specific topics about wildlife and nature.

There are mainly two ways in which the session takes place;
- at the zoo, in the form of workshops and
- outside the zoo at a school, in the form of outreach programs.

1. Workshops

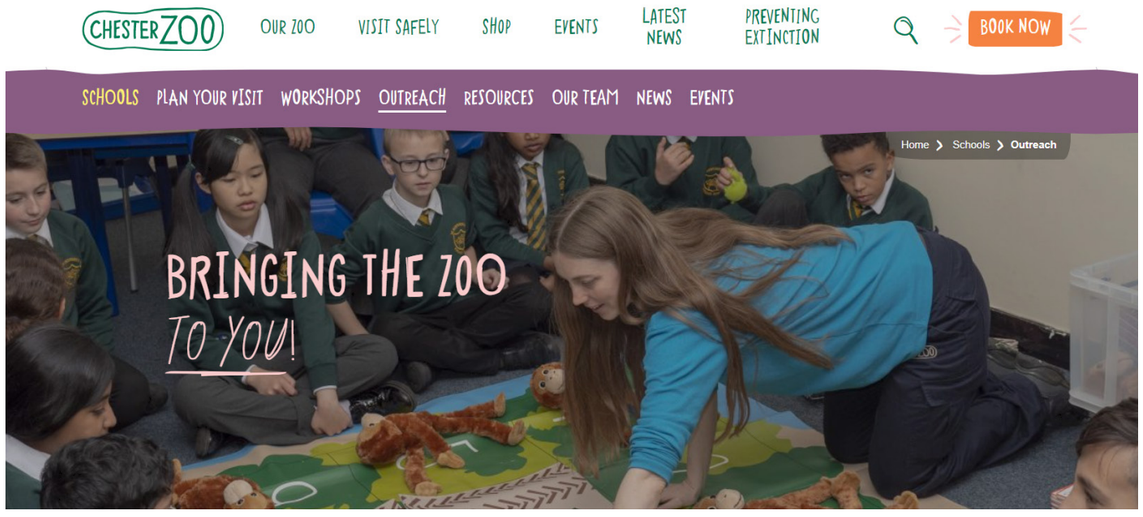
Most of the Zoo educational activities focus on children. Many of the BIAZA members offer nature education courses for children from age 3 to 18+ that aligns with the National Curriculum of the UK. These are mostly divided into KS1, KS2, KS3, KS4 (Key stages). Figure 24 shows an example of a typical workshop at the zoo.

Figure 24: School children learning about animals in a workshop at London Zoo

2. Outreach programs

Many of the zoos also do outreach programs where experts from the zoos take amazing animal bio-facts such as elephant tusks, snake skins, feathers of birds and sometimes live animals to the schools for one-day workshops. Sometimes these activities are organized for a greater diversity of organizations such as hospitals, retirement groups, scouts etc. Figure 25 shows an example of the program.

Figure 25: A snippet from Chester zoo's website showing outreach programs as "Bringing the zoo to you!



B. Informal education

BIAZA member zoos have more than 30 million visitors every year who visit the zoo as a general visitor. These visitors are informally educated about the animals at the zoo, their habitats, the conservation projects of the zoos and sometimes the danger faced by the animals in the wild and what they can do to protect it.

Informal education takes place in the following different ways:

1. Keeper talks

Keeper talks are talks delivered by either volunteers or zoo keepers while they are feeding the animals. During the talk, the keeper or the volunteers talks about feeding habits, natural habitats, behaviors in the wild, conservation status and efforts by the zoo to preserve the animal. Figure 26 shows an example of a keeper talk.

Figure 26: Jack the rhino keeper giving out a keeper talk at Folly Farm, UK

2. Animal Experiences

For a much closer encounter with the animals, zoos offer 'animal experiences' where the visitors get to interact with the animal along with the zookeepers. These experiences offer a much more personal time with the animal. These include Feeding the big cats, feeding penguins, tickling Tapir etc.

3. Information boards

Through information boards, zoos generally educate people about the animal's scientific name, its habitats, difference among animals from the same species. These boards also involve pictures of animals in the wild. Some zoos also use the opportunity to give out personal information about the animal in the enclosure such as their name, age, family members in the zoo etc.

4. Interactive boards

To make the visit much more interactive and engaging, creative boards are also installed around the zoos. These artifacts offer knowledge about the animal's unique qualities or similarities with humans in an interactive way

Depending on the educational priority of the zoos and availability of resources, the zoos choose the mediums to engage visitors and informally educate them.

"So, you know, some are quite reliant, I think on just information boards and stuff around the zoos and others have a much more active program with lots of volunteers as well"

Interviewee 5

Figure 27: A visitor feeding the penguins as a part of Penguin Encounters at Folly farm, UK, (Top)

Figure 28: An information board giving information about threats faced by Giant otters at Chester Zoo (Middle)

Figure 29: An interactive element showing the variety of seasons and the food we can eat. (Bottom)

5.1.2.4 Other ways of engaging with and educating people

A. Social Media

Some of the BIAZA members are very well received on social media like Instagram and Facebook. However, these channels are mostly used to attract new visitors and maintain engagement with the people in general. Figure 30 and 31 shows examples of an Instagram page of a zoo.

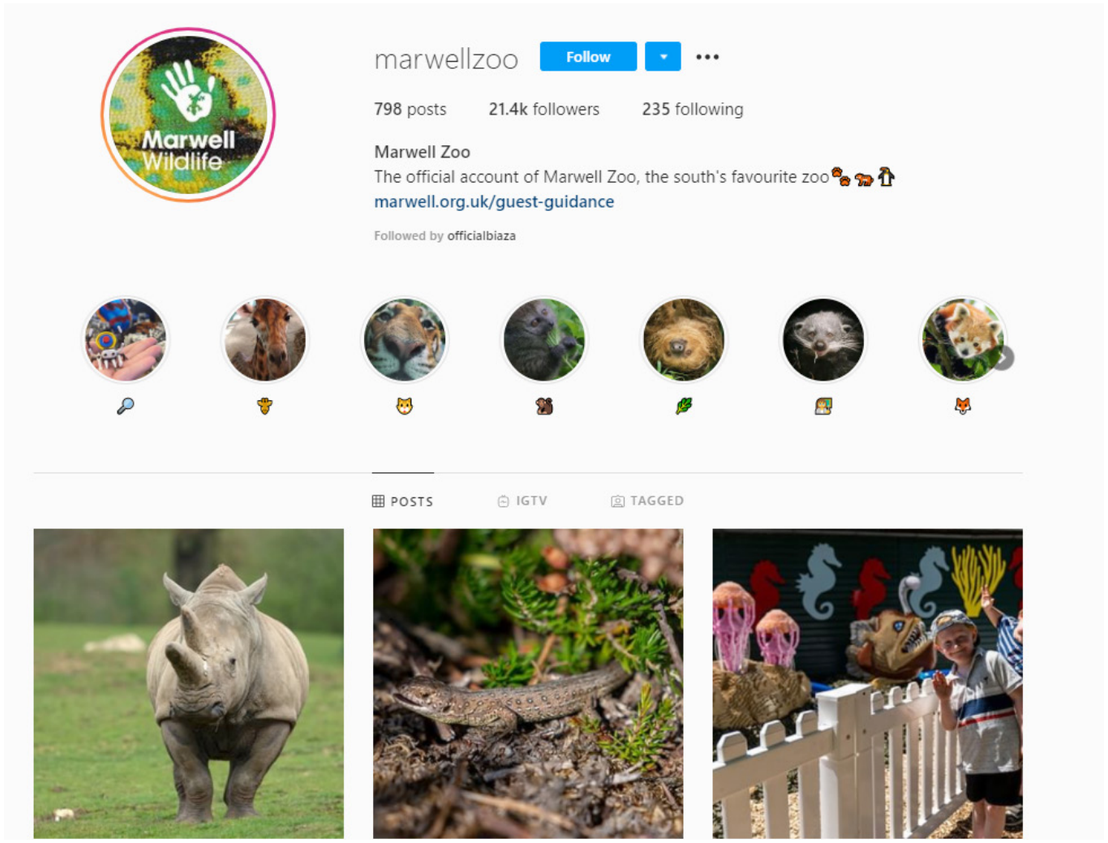


Figure 30: Snippet of the Instagram page of Marwell Zoo, UK

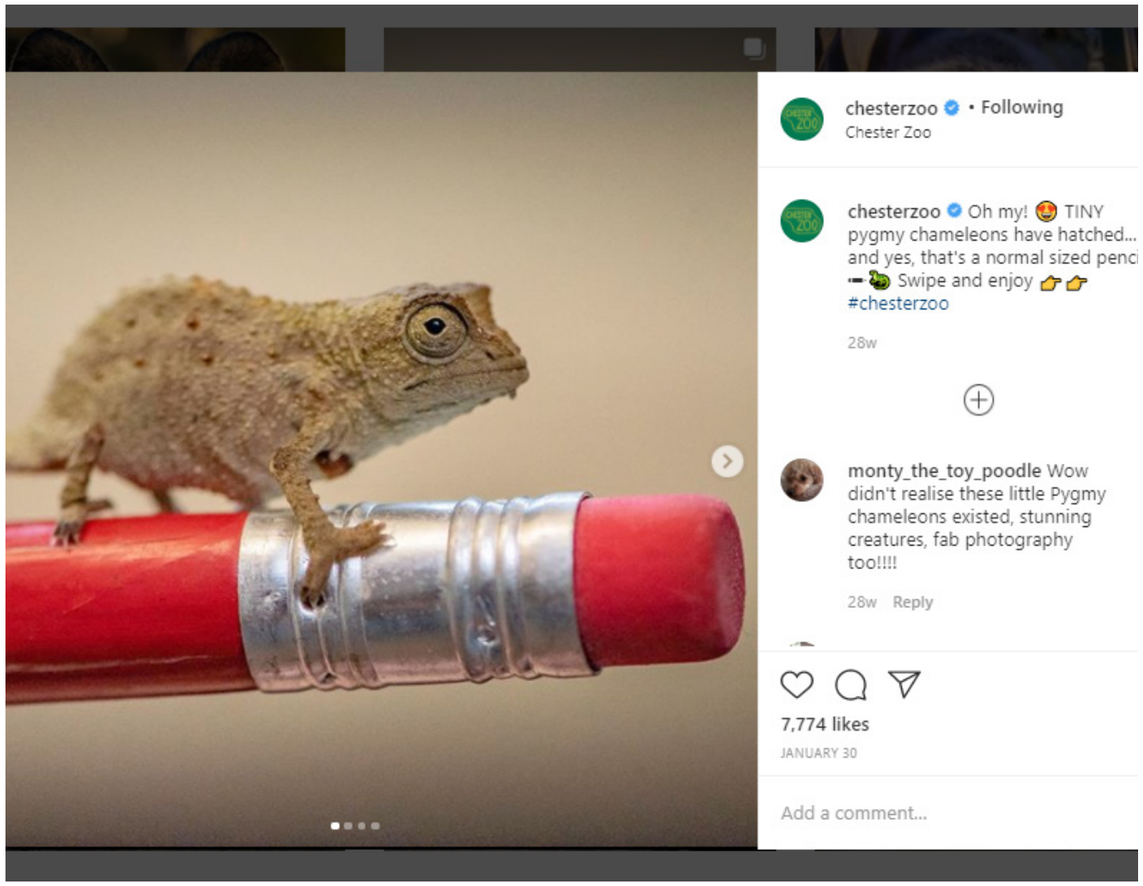


Figure 31: Snippet of an Instagram post by Chester Zoo reflecting the content and response of a follower.

From a short overview of looking at the Instagram handle of five zoos in the UK, it could be concluded that **right now these channels are very useful in maintaining the love and fascination about the natural world** amongst the followers and inform them about the updates at the zoo. However, overall, **the posts were not educating people about loss of biodiversity or sustainable behaviors they can do.**

B. Education through free learning resources on the websites.

The off-line educational initiatives of a zoo are discussed above, however zoos also provide educational material through their website. The content of this material is often designed for kids' learning which can be facilitated by adults. These materials are in the form of activities that children can do. Figure 32 shows an example of such an activity.

Figure 32: Images of one of the activities for kids offered by Marwell zoo through their website. Source: https://www.marwell.org.uk/media/other/where_do_i_live.pdf)

Marwell Wildlife

Where do I live? – classroom based

This activity involves pupils matching four different animals to their habitat based on their adaptations. Pupils should be encouraged to give reasons for their decisions that are linked to the animals' adaptations (not answers like, 'Because I know'). This could be used as a starter or plenary activity.

Curriculum Links

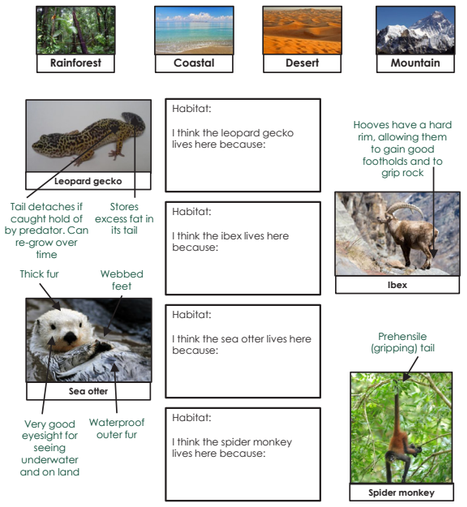
SCIENCE
Genetics and evolution
Inheritance, chromosomes, DNA and genes
• differences between species
• the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection

Answers
Leopard gecko – desert
Ibex – mountains
Sea otter – coastal habitats
Spider monkey - rainforest

Marwell Wildlife

Where do I live?

Look at the following animals and their adaptations - less obvious adaptations have been labelled to help you. Can you match the animals to their habitat? Choose from the habitats below and give reasons for your choice based on the animals' adaptations.



C. Magazines and Email updates to members

BIAZA members and most of the zoos worldwide offer memberships to the visitors. The benefit includes magazines, some goodies, Email updates, Newsletters, and maybe some 'member-only' benefits to attend certain talks. Regarding climate change and loss of biodiversity, and actions one can take, an editor of a magazine mentioned that mostly this information revolves around wildlife gardening and steps people can take to develop such a garden, but that's mostly it.

The quote below shows the effect of the magazines on the member's individual actions.

"50% of memberships maybe lead to someone taking action in their own life for wildlife. So they might do some wildlife gardening, or they might support a campaign or they might write to the government and tell them that they care about a wildlife issue. They might buy a gift membership for someone else. So that kind of further support, I would say comes from about 50% of people. And it's all on a sliding scale, you get maybe 10% of people are really hardcore."

Interviewee 1

5.1.3 Conclusion

Zoos are active in three major domains with an overall purpose of conservation of the natural environment. These domains are conservation, research and education. Zoos educate people formally through pre-designed workshops as well as informally, through zoo visits. Apart from informal education zoos also engage people through some digital channels such as social media, websites and emails. **Compared to formal education through workshops for children and adult groups, zoos have a much larger audience that is exposed to informal education every year, the zoo visitors. Hence the scope of the project is chosen as the informal zoo visits to explore opportunities to engage such a mass audience.** The next chapter discusses how zoos engage people with the problem of loss of biodiversity through informal education.

5.1.4 Conservation education at zoos.

Having discussed the different channels of informal education, this section will focus on educational components related to the loss of biodiversity that zoos focus on.

We will first discuss the content of the education, mediums used for education and the challenges faced by the zoo educators. Following this we will explore the various PEBs zoos are promoting and the different forms they use for this promotion. Near the end, we will discuss innovative ways adopted by some zoos to engage people in conservation.

5.1.4.1 Content of the education

What is the content of education regarding loss of biodiversity? Naturally, the starting point of the loss of biodiversity information presented at the zoo is the animals present at the zoo. Often big mammals such as chimpanzees are used to draw visitor's attention. Through these animals, the dangers their counterparts are facing in the wild are communicated, through text and sometimes images. Depending on the dangers, certain actions that visitors can take are also communicated. These actions could be a one time action or daily behaviors. A visual overview is shown in the figure30

For example, starting with the Chimpanzees, the problem of deforestation and these animals losing its habitat is communicated. The human activities that drive deforestation for purposes of logging, mining and farming are mentioned and a one time behavior of recycling old phones is suggested. A collection point is also set up near the exhibit, where visitors can bring their old smartphones to deposit it for recycling.

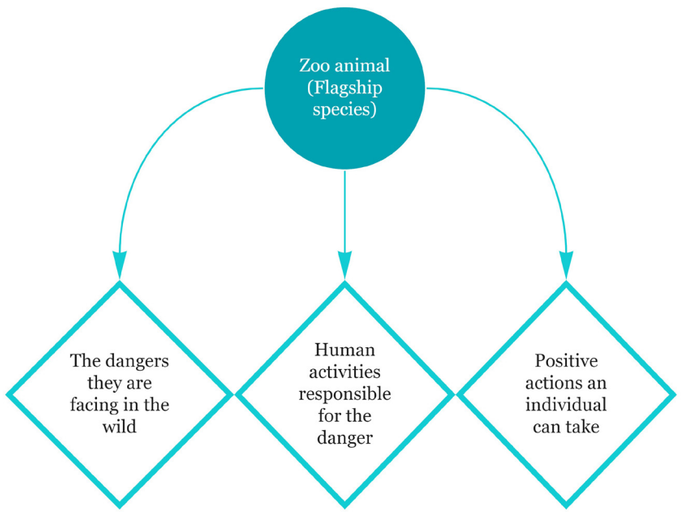


Figure 33: The starting point and content for the conservation education at the zoo.

From behavior change perspective, it seems like the knowledge component we discussed at the behavioral change is complete. However, possibly there's one information missing: "Is it urgent to us"?. This may be the case because the animals at the zoos already engage visitors emotionally and sometimes visitors also feel a connection with them. Subsequently when their plight in the wild is presented, visitors are engaged enough to feel sorry for them and take the action. However, these emotions may not last beyond the zoo for them to take action. This will be elaborated later in the next chapter where we take a deep dive in the 'effects of a zoo visit on visitors'

5.1.4.2 Channels of education

Educating the visitors about the importance of ecosystems, danger the wild world is facing and actions people take to prevent the loss is mostly done through the signages, information boards, interactive installments, keeper talks and animal experiences. Signages and information boards mostly contain text and images. Interactive installments vary in their nature. Most of the time, they are designed to attract a visitor's attention to the problem in a way that the problem is clearly visible. An example of this is shown in the image below. These installments could also be interactive in nature. **The purpose behind including interactive elements is that it can attract visitors to interact with it and in the process they also learn.**

Figure 34: An installment at Blijdorp zoo, Rotterdam educating visitors about plastic pollution. The image on the right shows how plastic and jellyfish look the same and many sea animals choke because of plastic.

However, the **most preferred way to communicate about these problems is through the keeper talks and animal experiences.** This is because these experiences engage visitors emotionally with the animal and since a keeper or a volunteer talks about a problem instead of passive reading of signages, it could be much more effective in communicating the urgency for action.

"The learning at the zoo mostly happens through animal talks and signage."

Interviewee 2

Having discussed the content and channels of the information, let's discuss the challenges about education at the zoo, as faced by a Zoo educator.

5.1.4.3 Challenges faced by a Zoo educators in educating visitors

Through a group session with the education department of Blijdorp zoo, Rotterdam(Interview 4) and an interview with an education officer of a German zoo(interview 3), some more challenges that educators face were recognized. These are discussed below:

A. Visitors often do not read signs and information boards

As pointed out by an education officer, visitors often read the initial couple of signs and boards and later ignore most of them. This was also an observation also made by me during my zoo visits. According to the officer, generally visitors are not very much interested in reading and the big information boards were for "most interested visitors"(Interviewee 4).

B. Interactive exhibits and installments get boring pretty soon

Through a group discussion session with Blijdorp zoo, Rotterdam department of education, another behavior of the visitors came to light. With the installments that are more creative than the static signages, the visitors engage with it once, twice and then third time they simply walk past it. (Interviewee 1)

C. Placing negative imagery showing the loss of wild

Educators are also concerned about presenting the negative information in forms of pictures. Their concern is that if the pictures are related to the loss and show the destroyed lands, it may produce negative feelings for the visitor, which contradicts the motivation to visit the zoos in the first place(which we will discuss in detail in the next section 5.2). However, the literature suggested that, the visitors are now willing to see some negative images at the zoos and these images have potential to increase the concern for the wild animals (Esson and Moss 2013).

"Visitors come out for a nice day out, so we don't want to bombard them with negative information."

Interview 3 (Zoo Educator)

D. Informal panels have to be small

During an informal conversation with an educator, I recognized another concern that educators had. She mentioned that every sign has the IUCN Red list scale, but it's too small, and that is because these panels cannot be big because it'll otherwise obstruct the animal's view and draw the visitor's attention away from them.

5.1.4.4 Promoting specific Pro-environmental behaviors:

Having discussed the aspects of informal education that take place within the zoo, let us now look at the Pro-environmental behaviors that zoos promote outside the zoos. They do this in two forms:
• Via their website
• Via campaigns in the city

A. Zoo website

Some of the BIAZA members' websites are found to be extremely engaging and educational regarding animals and species specific loss related problems and also certain behaviors citizens can do. **But what kind of behaviors do they promote?**

To answer this, a brief review of three top visited BIAZA members' websites was done. The rationale behind looking at three top visited zoos was that these zoos are also the most earning BIAZA member zoos and hence they would have the most resources to include diverse information on their website.

These zoos promoted following behaviors:

- Financial support through donations towards the overall as well as specific work of the zoo, becoming members and visiting the zoos. (Primary, all three zoos)
- Volunteering for the zoos and its various activities such as beach cleanups. (All three zoos)
- Developing gardens and wildlife friendly local space. (Chester zoo and London Zoo)
- Specific consumption based behaviors such as reducing plastic use, buying sustainably sourced products (Chester Zoo, London Zoo)
- Helping scientific conservation community through citizen science (Chester Zoo, London Zoo)
- Reporting illegal wildlife trade. (Chester Zoo)
- Signing petitions to appeal to the authorities

Examples of how the behaviors are promoted is shown in the figure 32.

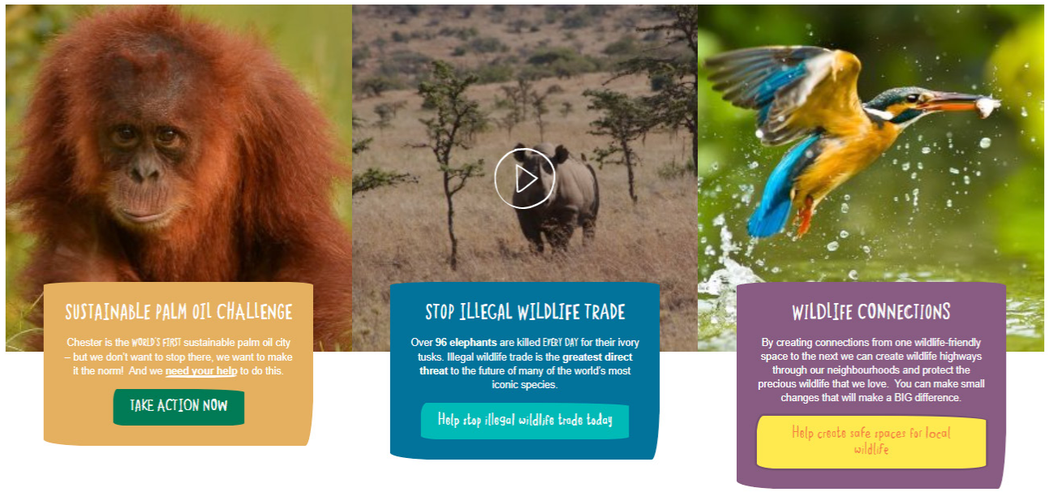


Figure 35: A snippet of a section of the website of Chester Zoo, July 2020

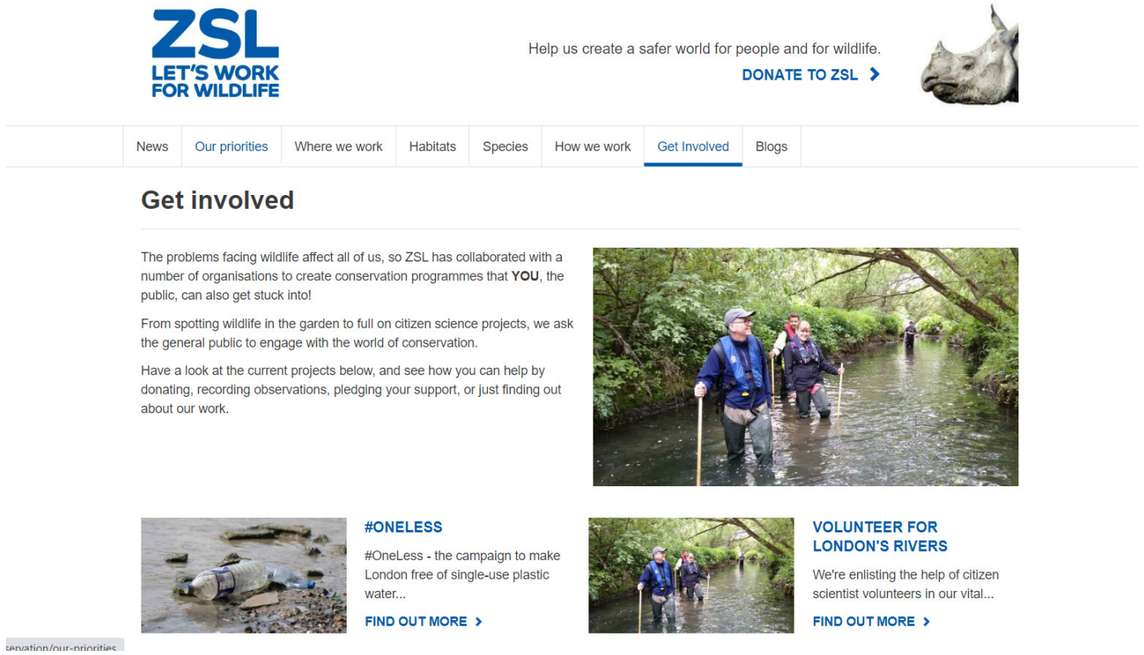


Figure 36: A snippet of a section website of ZSL, London, July 2020

This review suggests that some of the BIAZA members promote a variety of Pro-environmental behaviors through their websites. However, briefly reviewing other members' websites, it was noticed that only a few members have a section that talks about what one can do on an individual level to prevent loss of biodiversity.

Moreover a recent study on 211 North American websites concluded that most of the projects(18.5%) "encourage their audiences to learn more and explore additional resources". "Behaviors to support the organization itself" like donating followed the lead. (Maynard et al. 2020)

Micro conclusion: From here, it can be concluded that, if zoo visitors are curious to know as to what they can do, there is no such information available at the zoo. And only a few members' websites promote only some day to day actions one can take. Most of the behaviors prompted by the zoos fall into the category of learning more and donating to an organization. Considering the importance of knowledge to take action(3.4.1.1-A) and lack of it in the society(4.2.2) , this is a gap that design can target.

B. Special campaigns for promoting sustainable behaviors

Some of the leading BIAZA members also take their efforts to drive a sustainable change regarding particular behaviors such as buying sustainably sourced products (Chester Zoo) and using reusable bottles instead of disposable plastic bottles (ZSL London). These two campaigns are discussed below.

Palm-oil campaign by Chester Zoo

In 2015 Chester zoo did a campaign to make the city of Chester free of Non-sustainably sourced palm oil. The campaign involved activities like Taking a pledge, fund raising, petitioning to the government. A rap song sung by a famous rapper was also a part of the campaign. The campaign appealed to the local businesses like restaurants, cafes, schools and manufacturers to adopt sustainably sourced Palm oil products.

Figure 37: A snippet of the palm-oil campaign section website of Chester Zoo (Bottom)

Figure 38: A snippet from the video of rapper John Chase educating people about issues around palm oil usage (Right)

Hello London, Good bye Ocean Plastic supported by ZSL London:

This campaign was launched in 2016 that appealed to the locals and the tourists to stop buying bottled drinking water and rather use refillable water bottles. As a part of the project, drinking fountains were also installed across London. Many other tourist attractions were also partnered with to encourage the public to use reusable bottles.

Figure 40: An advertisement of the 'Goodbye ocean plastic' campaign on a busy London street

Figure 39: A volunteer filling up bottles at the installed water fountains in London

Mini conclusion:
These campaigns suggest three major things:
i) that citizens of the UK are willing to change their ways including businesses and organizations,
ii) that citizens of the UK are engaging with the zoo even outside the zoos.
iii) Through campaigns, specific Pro-environmental behaviors are promoted.

In recent times, some zoos across Europe and the UK have adopted innovative ways of engaging their audience with conservation. Two examples of them are mentioned below:

5.1.4.5 Innovative ways of engaging with the audience (Examples of niche innovation from zoos)

Niche innovations are carried and developed by small networks of dedicated actors, often outsiders or fringe actors (Geels and Schot, 2007). During research I came across two interesting ways that some zoos in Europe adopted, to engage people with conservation and wildlife. They are discussed below:

A. Snapchat X Kölner Zoo, Germany

Recently in October 2019, Kölner Zoo launched a week-long campaign called 'Endangered Awareness' in partnership with Snapchat to raise awareness about the endangered species among the visitors in a creative way.

As a part of the campaign, Kölner zoo emptied the enclosures of the endangered animals and moved them to a safe space within the zoo and Snap chat provided a 'Snap-code' for visitors to scan and view the animals in Augmented reality through their smartphones. The image below shows how it worked in real life. The idea was to bring the issue of loss of species to life by showing the visitors a future where these animals are extinct in the wild and the only way to see them is through a digital interface. The campaign video can be watched here.

Figure 41: A visitor viewing the tiger in Augmented Reality as part of the Snapchat-zoo partnership

B. Wildeverse by Chester zoo, United Kingdom.

Chester zoo in collaboration with a studio called 'Internet of Elephants' launched a smartphone game called "Wildiverse". The purpose of the game was to bring the far-away forest of Amazon to one's own home using Augmented Reality. The game allowed the user to explore the rain forest and find animals in the way conservationists will find them, but looking for their poop traces, foot prints etc. The game allowed one to take notes like a real life explorer and provided

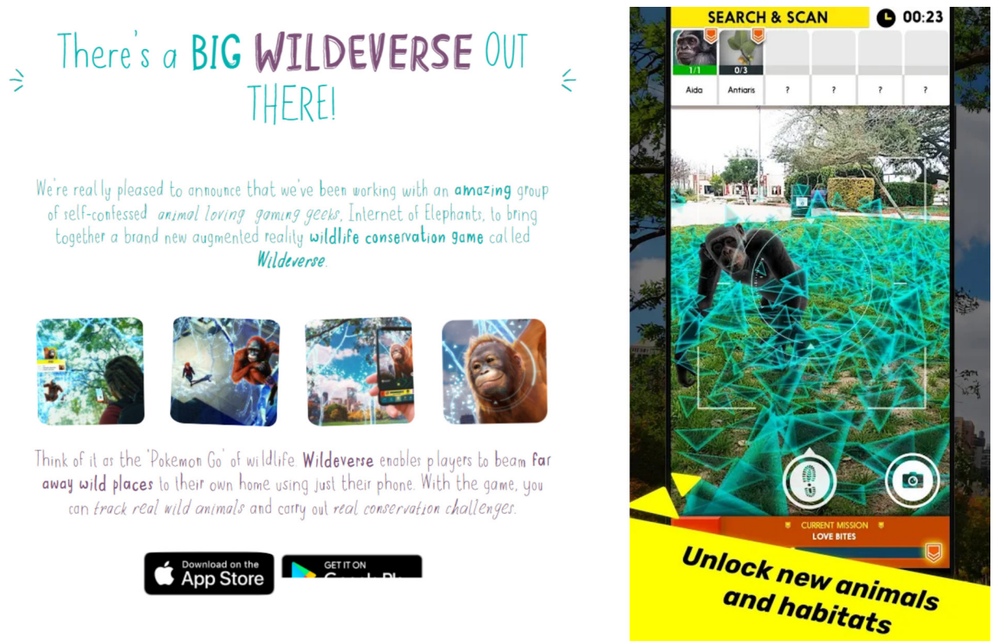


Figure 42: Snippets of promotion of the app on Chester Zoo(left) and on the google play store(right).

real-life conservation challenges. Figure 42 shows the announcement of the app from the Chester Zoo as well as a snapshot of the app.

The app was well received among people, especially children who loved using the app and exploring the wild. A picture of one of the review of the app on play store is shown below(figure 43):

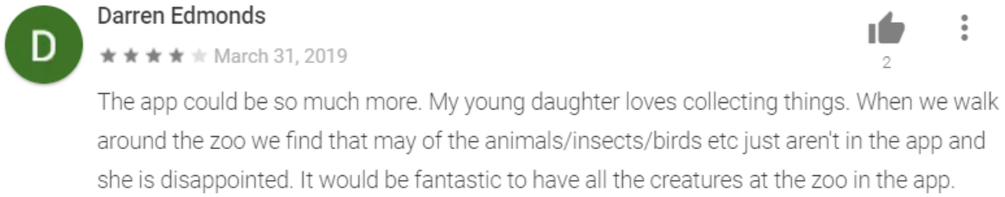


Figure 43: A snippet of the review of an app user found on Google play store

5.1.4.6 Design requirements

Through this chapter, there are certain design requirements that can be extracted. These are as follows:

- The design should have as little reading material as possible.(5.1.4.3-A)
- The design must be easily renewable or updateable. (5.1.4.3-B)
- The design should not obstruct viewing of animals. (5.1.43.-D)

5.1.4.7 Conclusion

The live animals present at the zoo, gives a great starting point to engage visitors with conservation. However, beyond this point, zoo educators face challenges with engaging people further without the presence of a keeper or volunteer to talk about the issues.

In terms of pro-environmental behaviors, there is willingness in society to change their behaviors, but many of them do not know more than certain behaviors that they can do. Zoos on the other hand also promote only a few day to day actions people can do through their websites and campaigns.

The use of mobile technology to engage people with conservation is emerging among the zoo community indicating the desirability of it within visitors and the feasibility of its application as a part of the zoo visit. **Use of smartphones is an opportunity area for design.**

5.2 Zoo visitors and their motivations

In the previous sections, we mainly discussed the organizational side of the context of the zoos. In this section we will discuss the people side of the story ie. the visitors.

The two main questions this chapter answers is **Who visits the zoos and why?** These questions are largely answered by literature research. However, to empathize with the context of the zoo and what does it mean to visit the zoo, I conducted four interviews with some of my friends who had visited the zoo in the recent times.

Profile of the interviewees:
The interviewees ranged from the age of 21 to 27 years. One of the four interviewees was also a member of a zoo, meaning she visited the zoo quite frequently than others. Although, this group does not represent the overall demographic of the zoo visitor but it represents the younger adults well.

5.2.1 Who visits the zoos?

The visitors of the zoos and aquariums are quite diverse in age varying from infants to much older people. The majority of the wildlife market(59%) consists of families with children and the rest of it are people who never go to the zoo with children(BIAZA, 2017) In the UK, out of 32 million visitors, about 7.6 million are frequent visitors as they are either members or season ticket holders(BIAZA, 2017).

Figure 44: Diversity in visitors at Blijdorp zoo, Rotterdam

5.2.2 Why do visitors visit the zoo?

The motivations to go to the zoo can be represented by five main identities who visit the zoo. These are Facilitators, Explorers, Hobbyists, Experience Seekers, Spiritual(Falk et al. 2007). These categories were originally developed to understand motivations of museum visitors, however, research suggests that they are also quite applicable to zoos and aquariums. The table below shows the Identity and relevant information.

These categories suggest that the **two most dominated identities are that of facilitators and explorers who are socially driven and curiosity driven**

Identity	Drivers	Experience outcomes	Visit led by (Kids or Adults):	% of visitors with single dominant motivation
Facilitators	**Socially driven** - To enable the experience for others	Wonderful experience for the others in the group	Kids	16
Explorers	**Curiosity driven** : To learn something new	Satisfaction of their curiosity about the animals	Adults	16.3
Hobbyists	**Specific Content driven**: To increase/satisfy specific knowledge	Satisfaction of a specific purpose they visited the zoo with.	Adult	10.3
Experience seekers	**Fun Driven**: To have the experience of visiting a specific venue	Such a fun experience and great outing day	Kids and Adults	7.8
Spiritual	**Reflective purpose** - to get away from daily hustle and bustle	Quiet and inspiring experience for themselves	Always adult	4.4

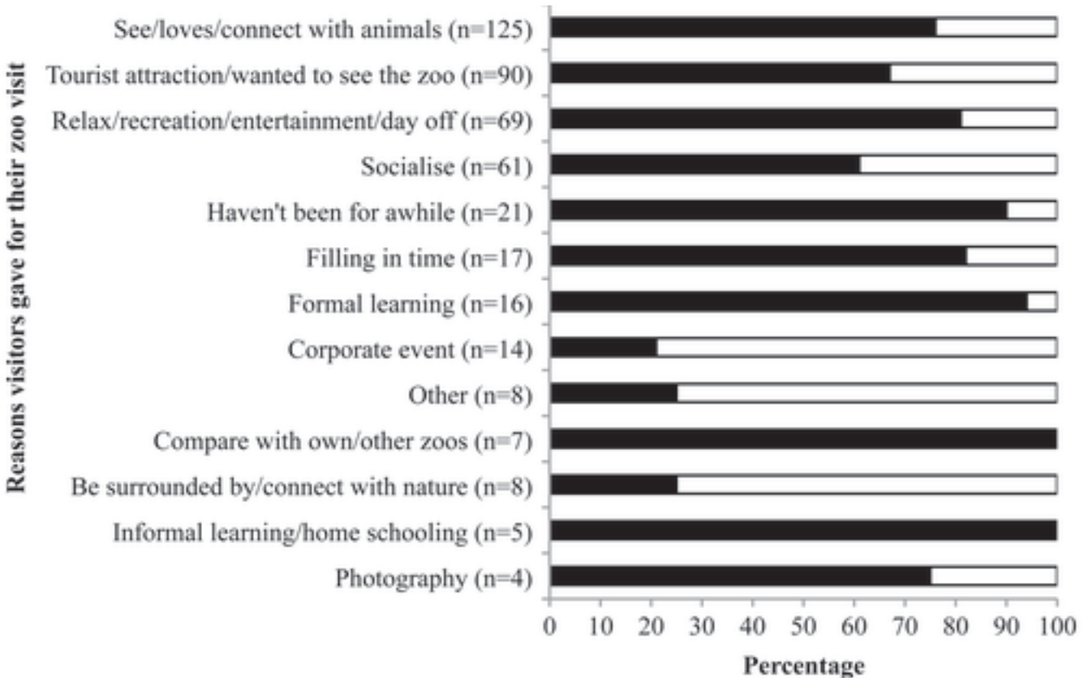
Table 03: showing drivers, experiential outcomes, leaders of a zoo visit (Falk et al. 2007).

A qualitative research that studied the motivations of people for visiting the zoo, showed similar results, with **social experience**(family outing/children, socialize) and **curiosity towards animals**(see/loves/connect with animals) **being the driving motivation for most of the visitors**(Roe and McConney 2015).The social experience is also facilitated by the animals at the zoo as visitors usually enjoy sharing the experience of animal viewing and being at the zoo (Clayton, Fraser, and Burgess 2011). Moreover, the table below also suggests these two motivations, learning is a big part of the reason for coming to the zoos.

For the purpose of this project, these two categories of identities of visitors are targeted and hence explored in detail to understand what does it really mean for visitors. The insights are elaborated as below in three parts:

A. Social experience
B. Moral development of children
C. Curiosity to learn.

Table 4: Table showing primary motivations behind zoo visit of 540 visitors (Roe and McConney 2015)



A. Social experience

Most people visit the zoo in groups, as shown in figure 46. The composition of the group may vary as discussed above and depending on the composition, the behaviors of the group may differ. But generally, **viewing the animals is something that visitors almost always like to share with someone in the group.** Visitors often talk about the animal characteristics, its behaviors, their past experiences in another zoo or related to a show on TV etc. People often try to pose with the animal while someone from their group takes their picture. **During ethnographic research at Blijdorp zoo, Rotterdam, I observed visitors to be quite commonly engaged with their mobile photography about animals and people.** Some other activities that visitors share included pointing at the animal, imitating it and showing it to their group members(Clayton, Fraser, and Burgess 2011). Figure 45,47 shows instances of visitors engaged in social experience.

For members and other frequent visitors, zoos act as a place for a casual social interaction with their friends and family. For example, one of the interviewees, who was a member of Blijdorp zoo, mentioned that **she visits the zoo whenever her cousin or brother visits her, and even that she often visits with a boyfriend for a nice walk**(Interviews). Apart from viewing the animal, zoos usually offer many places which support this motivation for eg. restaurants, cafes, playing parks and random places to eat, talk and interact with the group.

Figure 45: A family of five parents sitting at a table next on a green patch while their one of the daughters is enjoying the free area.

"For us, it was also a social activity. So, while watching the animals, we are also catching up with each other. Just about things in general, not necessarily about animals or a zoo.

And sometimes also we do talk about the animals but just by pointing something out to each other."

Zoo Visitor, Interviews

Figure 46: Three groups of visitors watching Sea lion enclosure at Blijdorp zoo, Rotterdam. (Top)

Figure 47: A mother, her child and her grandmother cherishing a social moment (Bottom)

B. Moral development for children

One of the key motivations to visit the zoo with their children is for children to have a nice time and to expose them to the natural world, which is otherwise not possible in the city. Parents believe zoos to be quite an important place for the overall growth of their children. A qualitative research revealed that there are four main themes of motivations for parents to bring children to the zoo : Promoting Altruism, Transferring environmental values, Encouraging self-esteem, Inculcating cultural norms. (Fraser 2009)

Figure 48: A father pointing at the enclosure to show something to the child at Blijdorp zoo, Rotterdam.

Figure 49: A child pointing at the enclosure while its mother and grandmother facilitate the experience.

C. Curiosity to learn

Zoos and aquariums bring the fascinating and wonderful exotic wild species, almost at the door stop. Curiosity, awe and wonder that one can experience at the zoos attracts many visitors. Explorers, which is the biggest motivation segment, are driven by curiosity. The fact that zoos offer experiences that are otherwise not accessible, coupled with the desired social experience fuels the motivations of many.

However, it must be noted that not many people visit the zoos solely to learn, as discussed above. Compared to a study in the 1980s, a recent study showed that more than 70% of people's agenda to visit the zoo is also to learn things about nature. The number in the earlier report was only 30% (Roe and McConney 2015). This change also reflects the expansion of zoos from being only entertainment places to also educational places. This also suggests that entertainment and education at the zoo go hand in hand and "they're not only compatible, but synergistic". (Packer and Ballantyne 2010)

5.2.3 Deep insight: Freedom is a common theme that attracts visitors.

Zoo visitors visit the zoo with many motivations, within three above mentioned themes. When looked through the lens of NADI model(van der Bijl-Brouwer and Dorst 2017), the theme level observed insight is freedom which manifests in three forms: Freedom to learn, Freedom to interact and Freedom to grow.

5.2.4 Design Requirements

To design for such an audience, the following requirements should be met:

- The design should be easy and attractive to engage with for the audience of 18 to 40. (5.2.1)
- The design intervention may support social interactions, but it must not hamper them.(5.2.2-A)
- The design intervention must satisfy curiosity to learn. (5.2.2-C)
- The design intervention must offer people freedom to learn. (5.2.3)
- The design must not feel like a forced activity. (5.2.3)

5.2.5 Conclusion

Visitors mostly come to the zoo with their friends or family. The age group of these visitors is diverse ranging from infants to older retired audiences. **Since we saw in section 4.2.4, the younger generation is already inclined to act, hence they are selected as the target audience for the design.** These groups visit the zoos with motivations that are mostly socially driven and curiosity driven. Moreover, almost all visitors also include learning as part of their motivations to visit the zoos, indicating that zoos are places where visitors like to have learning experience as well. Hence learning is an inseparable phenomena from other motivations for visit.

Under all these experiences, lies the theme of experience of freedom to choose the motivation they want to pursue.

5.3 Effects of a zoo visit on the visitors

In this section, will discuss the immediate and long-term effects of the presence of the live animals and the interpersonal interactions on the visitors emotions and overall learnings. Following this, the factors that influence one's learning will be discussed and with this we will conclude the research.

Zoos being an open environment where freedom is the core of the experience, produce many effects on the visiting individuals and groups. These effects are studied through a vast literature research and interviews with visitors and experts. Note that these effects must be looked at as potential effects instead of definite effects of every zoo visit as they are heavily specific to the zoos and cannot be generalized for all the zoos.

The relevant effects are classified into two categories:
Affective effects and Cognitive/ educational effects.

5.3.1 Affective effects

"Affective" largely relates with feelings, attitudes and moods. Therefore, affective effects are effects that are related to a person's internal feelings, attitudes and moods. These terms vary in their definitions, but they convey the use of affective quite wholesomely, hence they are put together. These effects are:

A. Feeling an implicit connection with nature

Connectedness with nature is a person's belief about the extent he/she feels a part of nature. There are many measures (Inclusion of Nature in Self Scale, Schultz, 2002; Environmental Identity Scale, Clayton, 2003; Connectedness with Nature, Mayer & Frantz, 2004) that measures this belief, when it is explicitly acknowledged by the person. On the other hand with IAT (Implicit association test), the implicit connectedness with nature can also be measured.

Visits to zoos have found to have increased the implicit connectedness with nature. (Bruni, Fraser, and Schultz 2008). It means that this connectedness was not apparent to the visitors and could not acknowledge it themselves. Literature suggests that spending even a little amount of time in an urban space, compared to a natural environment decreases the feeling connectedness with nature (Mayer et al. 2009). Therefore it is natural for zoo visitors, who come from urban areas to feel this connectedness.

"Yeah, I would just say it is a fun way to be like outside and connect to nature"

Zoo Visitor

There is something unique about a zoo setting that promotes an individual's connectedness with nature.
(Bruni et al. 2008)

B. Feeling an emotional connection with the animal

A typical zoo visit involves many instances where a visitor attempts to make verbal comparisons and physical imitation of the animals. This leads to a variety of emotional responses in a visitor. **The most common emotions experienced are Awe and wonder, Enjoyment and love/empathy.**

These emotional responses towards an animal are also important in developing a positive connection with the natural world(Richardson et al., 2015a; Richardson et al., 2015b). Most of these emotions are towards the animal in sight. However amongst frequent visitors(members) and some infrequent visitors emotion of care and concern for the counterparts of the animals in the wild are also recorded, indicating the potential of zoos for facilitating such care and concern(Warren, 2019).

These emotional responses provide an opportunity for increasing the concern for the natural world. With signages and interactive installments that inform people about the loss of biodiversity, this is what is intended, but as we discussed, they are not enough to engage people with the issue.

"My strongest feelings were when I saw the dolphins and what smart amazing animals they are. Also the bears as to what their thought patterns are about people looking at them."

(Packer and Ballantyne, 2010)

C. Development of a identity acknowledging the relationship with the animal world

The emotional responses discussed above also leads to a felt connection with the animals. The acts of imitation with the animals lead to discussions regarding the similarities between the animal and the humans. Moreover ,the information boards present at the zoos also instigate such conversations. An example of such an exhibit is shown in the figure.

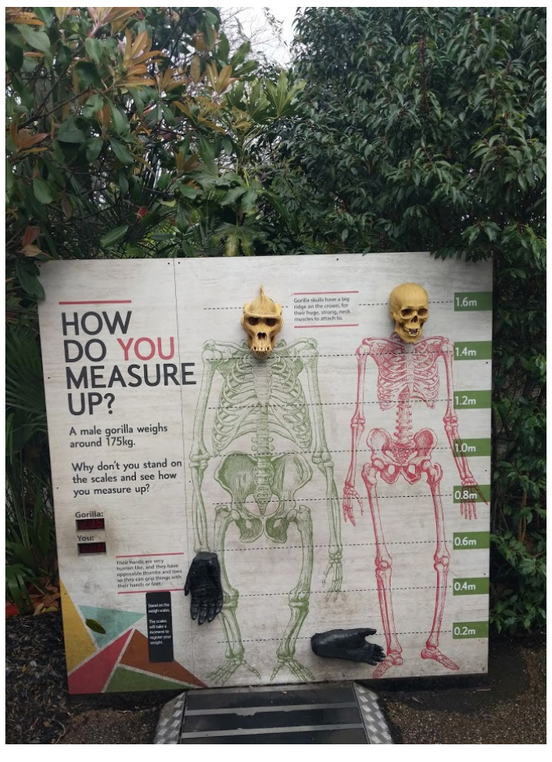
This felt connection along with social interactions provide an opportunity "that may nurture an environmental identity that promotes a sense of similarity with animals and thus leads to care and concern for those animals."(Clayton et al. 2011)

As identities are developed in the early years, the conversations among families with their children, may also contribute to construction of such an identity within the child (Fraser 2009)

Conclusion

There's something unique about the zoos that makes the visitors feel connected with nature. But this felt connection is not always acknowledged by them. The presence of live animals generates emotions of awe and wonder, love and empathy. These emotions also lead to a personal connection with the animal. **This connection with an animal paves a way towards development of an identity that acknowledges the connection with the animal world** . While the animals present at the zoos support building an emotional connection, visitors fail to see the actual ecological connection between them and the animals world. However, **zoos certainly present an opportunity where such connection can be recognized and intentionally built.**

Figure 50: A zoo information board comparing animal characteristics with humans



5.3.2 Affective effects

These effects are mainly the visitor's reception of informal education provided by the zoos. As like affective effects, cognitive effects are also much dependent on the various elements within the zoo can and cannot be generalized for all the zoos.

A. Visitors learn about animals and species in general

Through interviews, it was found that through signages and talks, visitors learn about the animals' names, their habitats, where they are found on the globe and some of their praying and living habits. Through personal visits to a zoo in the UK and a zoo in Rotterdam, I recorded similar learnings myself with additional learning about comparison between animal and human physiology.

"Going to the zoo has also some more educational side to it to see what the animals are doing, learn about maybe their, where they come from, where they eat those kinds of things"

Zoo Visitor

B. Limited learning regarding loss of biodiversity and actions to take.

The interviewees of my research barely mentioned learning related to loss of biodiversity or extinction as a part of their zoo visit. They vaguely remembered noticing the IUCN Red list classification on the signages, but that was the extent of it. Research from various studies showed varied results regarding learning related to loss of biodiversity. For example, a 2007 study at 5 of the BIAZA members in the UK revealed that zoos have no effect on conservation knowledge, knowledge to take action or ability to take action. (Balmford et al. 2007).

Another global study researched pre-visit and post-visit differences is measurement of Knowledge about biodiversity and actions one can take to support them, concluded with significant increase in both

(Moss, Jensen, and Gusset 2015). The study also recorded that **just over half of the respondents saw or heard biodiversity related information during their visit.**

The visitors who participated in animal experiences remembered learning about the species specific issues and some steps they can take to contribute to conservation. But as mentioned in the quote, there's no information about PEBs at the zoo that is readily available. Moreover, the information presented through signages might not be read as well.

"There's no information about PEBs readily available [at the zoo]. Through social media, zoos spread activity sheets for kids but not for adults"

Interviewee 2.

5.3.3 Long term effects of a zoo visit

Having discussed the immediate effects of a zoo visit, let's discuss what happens in the long term. Although there have been limited studies measuring the long term effect of a zoo visit, these studies mainly concluded that even after feeling a higher concern for the animals or species in general during the visit, the concern dwindles back to what it was pre-visit (Adelman et al., 2001b; Dierking et al., 2002). Although, one study indicates that visitors' overall knowledge to take positive actions had increased after two years of their zoo visit, there could be other factors responsible for the improvement. (Jensen, Moss, and Gusset 2017).

Although the immediate effects of a zoo visit may dwindle in the long term, reinforcing these effects after the visit through post-visit engagement is possible. Some evidence to this thought is demonstrated via a study that measured the usefulness of Post-visit action resources(PVAR) in engaging visitors with conservation learning. It concluded that "in tandem, interpretive wildlife experiences and post-visit action resources are a powerful mechanism for prompting changes in families' conservation knowledge, attitudes and behavior"(Hughes, Packer, and Ballantyne 2011).

The study also suggested that the design of the PVAR :
- **Must reiterate the conservation messages from the site(in our case, zoos),**
- **Remind visitors about importance of individual actions, and**
- **Provide specific strategies and suggestions that can be incorporated into everyday routines.**

These suggestions are in line with the behavioral literature that we discussed.

Having known about the educational effects of the zoo, let's discuss what are the factors that influence visitor's learning.

5.3.4 What influences environmental learning at the zoo?

A. Reflective engagement

Zoos, much like museums, are understood better as a free-choice learning environment (Dierking 2005). This means that visitors are free to choose what they learn and how they learn. In such an environment, a key step for learning to take place is reflection.

Research has recorded that the experiences the people have at zoos, do have potential to engage people into reflection about the global environmental challenges (Packer and Ballantyne 2010). **The excitement visitors feel when viewing an animal plays an instrumental role in engaging people into reflective thoughts** which relates strongly with learning. (Ballantyne, Packer, and Falk 2011)

"I never used to think about the effects that climate change or global warming would have on marine life. I? I never have had much interaction with it! But now I understand a little more and find myself wondering what little things I can do to help, small though they may be."

a zoo visitor (Packer and Ballantyne, 2010)

B. Personal talks and films

Zoo visitors when engaged in a talk from a keeper or a volunteer, tend to remember more and learn more (Interviewee 3) The interpersonal context of conversation tends to stick better in the visitor's minds. Moreover, talks facilitated by keepers and volunteers can easily capture visitor's attention, connect the content with their prior knowledge and also make it a fun experience. All three being crucial to the learning process (Godinez and Fernandez 2019)

C. Environmental orientation and motivations

Zoos being a free-choice learning environment, much of the environmental learning depends on the visitor's motivations for the zoo visit (Packer and Ballantyne 2002). As a result, people who engage with biodiversity related films and signages, score higher in biodiversity knowledge. (Godinez and Fernandez 2019). However, the motivations of people to visit are not formed independently in isolation. They are also influenced by the perception of the zoo and how the "site is marketed" (Ballantyne et al. 2011).

5.3.5 Design requirements

Based on the discussion about effects of a zoo visit, the following design requirements are distilled.

- The design should engage people in reflection about their own relationships with nature (5.3.4-A)
- The design continues to engage the visitors after the zoo visit and it:

A. Must reiterate the conservation messages from the site(in our case, zoos),
B. Remind visitors about importance of individual actions, and
C. Provide specific strategies and suggestions that can be incorporated into everyday routines (5.3.3)

5.3.6 Conclusion

The presence of live animals and the emotional connection people establish with animals, makes the zoos a great place to establish the connection between humans and the natural world.

On the cognitive side however, this connection is not supported. Educational effects of the zoos do not include learning about interspecific relationships that exist in nature nor about the importance of variety of life.

Generally, the learnings of the zoo visit are forgotten over time, but post-visit engagement can help in retaining this knowledge as well as influencing behaviors of a person.

Reflection during their visit is a key component for one to learn in free-choice learning environments such as zoos.

5.4 Concluding the research phase

In chapters 2,3 and 4 we discussed three main areas of research: Biodiversity, the society of the UK, and the context of Zoos. With this, we end the phase of Explore and Scope. The overall conclusions from the discussion are presented below.

Biodiversity is the variety of life. In nature, life is present in the form of six large kingdoms of species. Every species live in a community of many different species. All of these species share a relationship and in this way, they are all interconnected. The five types of relationships they share are predation, mutualism, parasitism, commensalism, and competition). Through these interspecific relationships, they source food and shelter which are necessary for their survival. Through these relationships, ecosystems carry out their core functions of cycling the six main elements(CHOPSAN) that make up 95% of life. As the variety of life in an ecosystem increases, the number of pathways through which these elements can be transferred increases providing ecosystems with insurance in times of disturbances such as drought, floods, heavy rainfall, etc. Hence biodiversity helps in maintaining a healthy ecosystem. A healthy ecosystem provides a multitude of services to humans known as ecosystem services. These services are mainly classified as Provisioning services, Regulating services, Cultural services, and Supporting services. Our daily lives, our societies, and our economies greatly rely on these services. In a nutshell, our personal lives and the larger systems we are part of, depend on ecosystem services and biodiversity helps to maintain these services.

Today, we are losing biodiversity at an alarmingly fast pace. The human activities are mainly responsible for the rate of species loss. The main human activities that drive the loss are intensive agricultural, urbanization, overexploitation, climate change, pollution, and invasive species introduction. To slow down the loss of biodiversity, a large systemic change on social, political as well as economical front is required. However, as much as the systems are responsible for the problem, so are the individuals and every individual action has the potential to cumulatively create a large impact.

Many factors influence one's pro-environmental behaviors. Out of all the factors, one's environmental identity plays an important role in influencing one's pro-environmental behaviors. Although identity development is a long-term process, it is defined to be the direction that the design aspires to move the people in.

The citizens of the UK are close to nature but their mental model of nature is not nuanced. Overall, the green countryside is appreciated as nature. People like to care for wildlife and interacting with it but mainly because of fascination and amusement and not out of recognizing it's intrinsic value. In terms of environmental identity, their relationship with the animal world is unacknowledged. Hence the direction of the project should be towards the development of an acknowledged relationship with the animal world.

Zoos, on the other hand, provide a great opportunity for identity development. The presence of live animals at the zoos

along with the information present shows great potential in instigating reflection and conversations that can contribute to the development of an identity that acknowledges the human-animal world connection. Live animals pave the way towards an emotional connection with the animal, but the connection lasts for as long as people are in front of the animals, and over a period it dwindles. Learning wise people barely learn about how is biodiversity really important or how do animal communities play a role in maintaining the ecosystems on which we all rely on.

In a nutshell, the change to aim for is defined as the development of an identity that acknowledges a relationship with the animal world. As the context to design for is zoos, context-based design requirements are gathered and mentioned in each section of chapter 4. From the behavior change literature, certain principles to design by are gathered and mentioned in 3.4.3
A visual summary of how research informs the design is presented in figure 48.

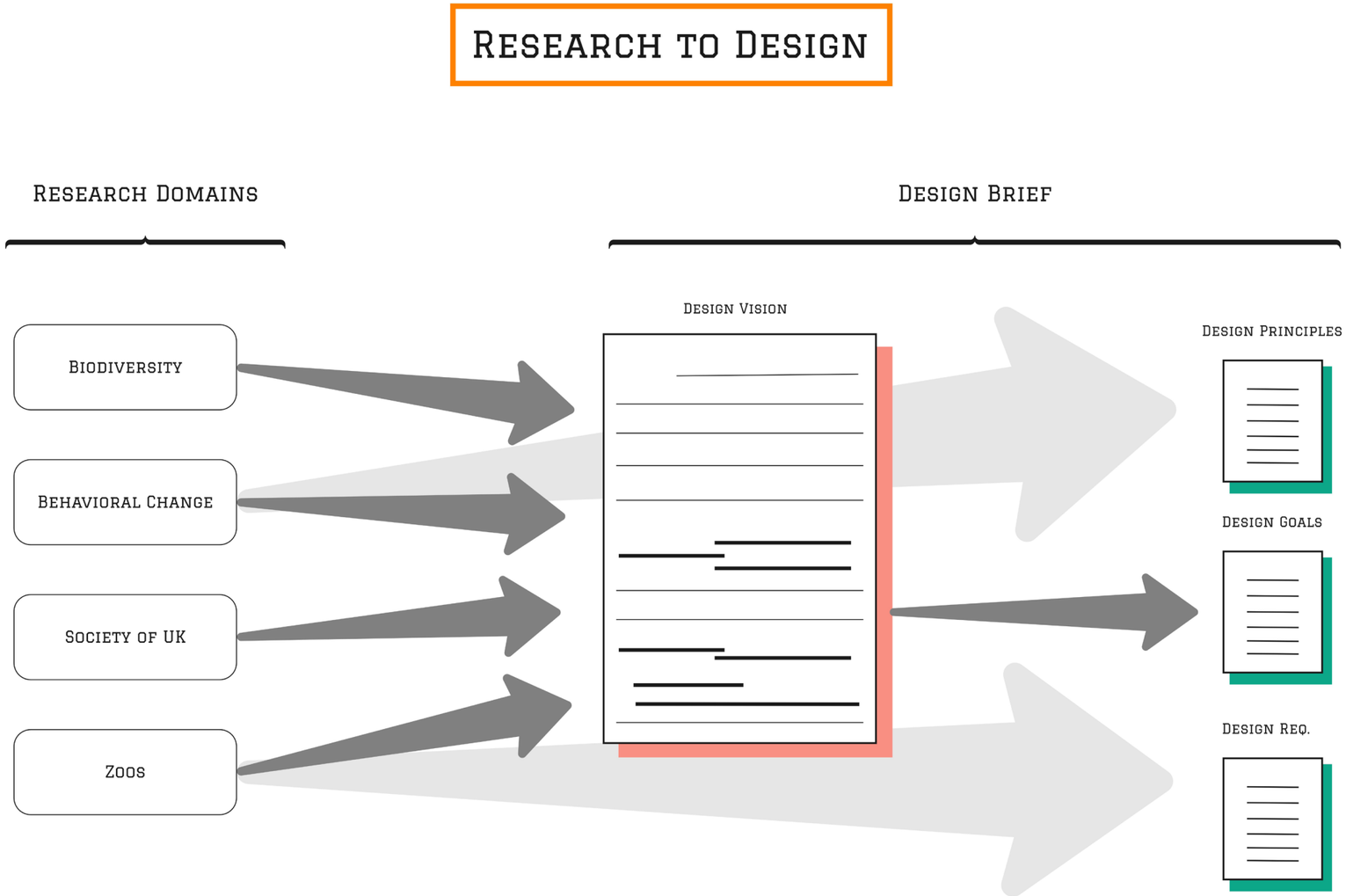


Figure 51: A visual representation of how research informs various parts of a design brief.

Chapter 6

Design brief

Based on the research conclusions, a design brief for the project is created to move from research to design. This chapter discusses details such as Systemic direction for the zoo, the role of zoos and a future story.

To move from research phase to design phase, a new vision for the society and zoos is created. Instead of co-creation of a new vision, incidentally it was solely done by me, as of a contemporary pandemic situation. However, due to practical limitations of the project, I shared it with my mentors and two experts to have their feedback on it. Although this vision was created in isolation, the main element of the vision(Development of environmental identity that acknowledges the relationship with the animal world) is the core outcome of the research which is based on literature research and expert interviews.

6.1 Zoos of tomorrow...

A future story for the society of UK and zoos

It is the first day of the year 2030. For some years, the first day of every year is celebrated as 'Thank you Nature' day. On this day, the entire country celebrates the diversity of life in nature. Artists across the nation produce special art, organizations distribute packets of wildflower seeds among the employees, and children spend the full day in their private garden playing with animal species.

In the last 10 years, Great Britain has seen a transformation in the natural landscape and the society. The local species of the UK are thriving in the cities and in the countryside. The overall consumption of the society has reduced. Nearly all of the citizens buy locally grown food, recycle nearly 100% of the waste, and use the organic waste to fertilize their private gardens. The private gardens have become connected hubs for local biodiversity to thrive. The agricultural soils have become pesticides-free since people started supporting products from organic farms. The farmers practices and governmental policies have prevented biodiverse lands from turning into a land with only a few species. This has led to a richer and stable ecosystems.

The society appreciates the vast contributions of local and global ecosystems. An individual knows about the complex structures of ecosystems that help provide, regulate and support many services that humans receive. Parents help their children identify the local species in the gardens and that has become a favorite activity of a generation. Newspapers, more often than not inform people about mating species of various native species in the city and recommend people particular things they can do in their gardens to support the species. The overall understanding of society about nature is very different from what it used to be. People love to see more species in their gardens than just have greenery around. Instead of lawn, people prepare wildflowers. Behaviors like 'turning off the porch light' in the night to let the 'nocturnal animals carry out their activities' have become social norms. Overall, **the idea of nature has become much more nuanced and knowledge of ecological relationships and processes is all-pervasive in the society.**

Zoos and aquariums have become places of discovering wild and exotic ecosystems and celebration points of the relationships. Decades back, zoos transformed their position from "bringing exotic animals close to people" to "bringing exotic relationships close to people" too. This change in narrative at the zoos have shifted people's worldview towards that of interdependence and co-existence. The species at the zoo fascinates people and the information people receive at the zoo inspires them to make a change in their own lifestyle. **They learn about the many different relationships these species hold in the wild and how the far away ecosystems are contributing to their lives. Parents teach children how an Asiatic lion keeps the ecosystem in place and an African elephant helps small species survive.** Through these stories, children learn about the value of species and various relationships. They realize that they are connected with and impact the ecosystems through a series of relationships. **They understand how some of the transactions within human-nature relationships are harming nature and are willing to change their own practices to drive a larger change.** Zoos and aquariums are also places where people learn about practices that one can adopt in daily life. Visitors actively seek out such information during the visit and zoos have developed services and infrastructures that answers their questions.

Zoos have now partnered with local organizations that promote local biodiversity such as The Wildlife Trust. Through these partnerships, zoos have supported promotion of local biodiversity. At the zoos, information about local biodiversity is also readily available. The walking routes that are surrounded with native species of plants and animals are designed to inform people about the local species too. This has contributed greatly to the overall interest and knowledge about the local species.

In a nutshell,zoos have become places where visitors find ecological relationships, their own relationship with nature and ways in which they can better the relationship with nature far away and nature around them. Zoos and Aquariums of the UK are declared role models by UNO for all the nations. A University on Biodiversity & Ecosystems is established by patronage of the Queen of the UK. Practices of Zoos and Aquariums of the UK are now followed by several zoos and aquariums world wide. Scope of work of Biaza is now extended as Consultant for transformations of zoos and aquariums of all European countries. Zoo superintendent from Ahmedabad just recently visited to give the final shape to the blue print of all Indian Zoos and Aquarium, which is the result of partnership of BIAZA with Indian Association of Conservators of Biodiversity & Ecosystems (IACBE)

6.2 Systemic Direction

In the conclusion the change to aim for was identified as **"To recognize one's own relationships with the natural world that includes of variety of species and realize one's own dependence on it for daily life."(4.3)** Based on this, the direction in which the intervention should move the society is defined as follows:

Development of an identity that recognizes and acknowledges the relationship with the animal world.

At the core of this direction lies the aspect of recognizing and acknowledging the relationship with the animals world. While the systemic goal remains so, **For zoos moving in this direction means strengthening people's relationships with biodiversity.**

To fulfill this goal, based on the understanding developed about zoos and visitors, a possible line of narrative around which the educational activities of the zoos can revolve is proposed.

6.2.1 Proposed Line of narrative

Zoo already have many different species. What is missing is the visibility of the connectedness or relatedness between these species. **These relationships can be brought to life and be emphasized** in the zoo visit to inform people about the interconnectedness.

Through interconnectedness between exotic species, the narrative of the content can draw people towards relationships being important to ecosystems and subsequently **explicitly show relationships between humans and ecosystems.**

The narrative of the relationship between ecosystems and humans also provides a healthy platform to **talk about human's positive impacts as well as negative impacts.**

The last part of this narrative can be **'Towards bettering the relationships...' , which can point people to reflect on their own lives** about the positive behaviors they can do and at the same time, recommend some behaviors(discrete behaviors)

The narrative is translated in a three phased approach shown in the figure 49.

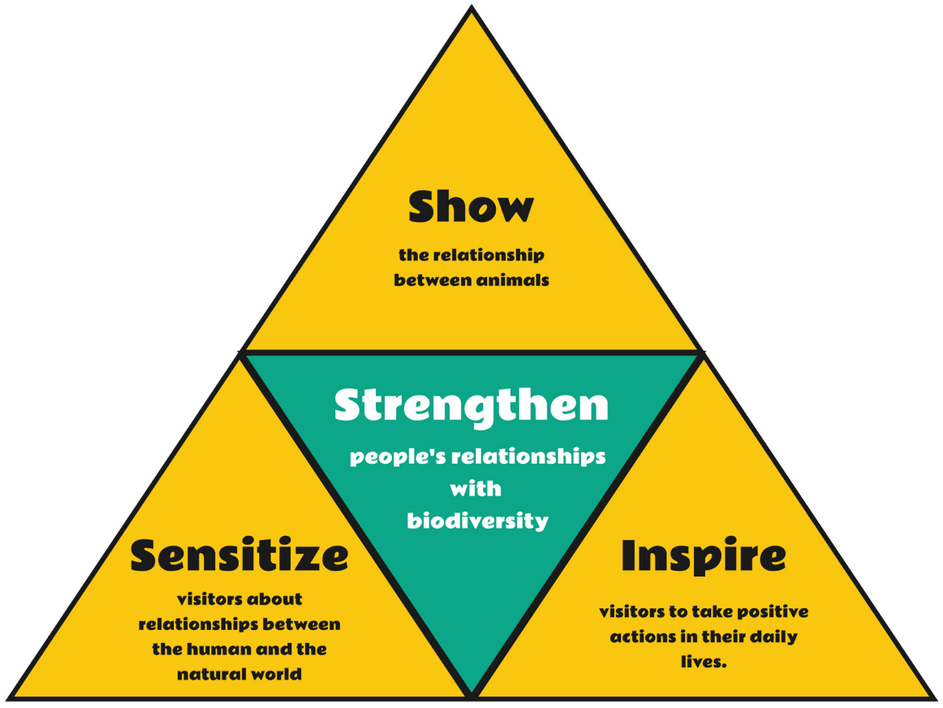


Figure 52: Three phased approach for the zoos to achieve the goal that can help move the society in the systemic direction

6.3 Design goals

The design

- **Shows visitors the relationship between the animals.** It
- **Sensitizes them about the relationship between them and biodiversity.** It
- **Educates visitors about the issue of loss of biodiversity**, and further
- **Informs and inspires people to perform Pro-environmental behaviors** that are relevant for conservation in their daily lives,

6.4 Design Principles for behavior change

From the conclusions of the research about behavior change literature, certain principles that were recognized are gathered here to guide the design.

1. If I inform people about a problem, I should always inform them about an action they can do to solve the problem.
2. If I inform people about a problem, I should always inform about why it is relevant to address the problem.
3. If I inform people about action, it'll be wise to inform about the 'how' to take that action.
4. After making one aware about the actions to take, reinforce one's belief that one's action matters.
5. Tap into the intrinsic motivations one may have to encourage a behavior, instead of showing an extrinsic benefit. Emphasize the intrinsic motivations one may have to encourage a behavior (rather than emphasizing on extrinsic motivations).
6. When a behavior change is encouraged, it should be encouraged in the context of Ecocentric values.

6.5 Design Requirements

As zoos are the context for which I am designing, based on the research, the following design requirements are gathered.

1. The concept of ecological relationships, levels of organizations and Ecosystem services should be relatable to people.
2. The design should have as little reading material as possible.(5.1.4.3-A)
3. The design must be easily renewable or updateable. (5.1.4.3-B)
4. The design should not obstruct viewing of animals. (5.1.43.-D)
5. The design should be easy and attractive to engage with for the audience of 18 to 40. (5.2.1)
6. The design intervention may support social interactions, but it must not hamper them.(5.2.2-A)
7. The design intervention must satisfy curiosity to learn. (5.2.2-C)
8. The design intervention must offer people freedom to learn. (5.2.3)
9. The design must not feel like a forced activity. (5.2.3)
10. The design engages people in reflection about their own relationships with nature (5.3.4-A)
11. The design continues to engage the visitors after the zoo visit and it(5.3.3):
    - **a.** Must reiterate the conservation messages from the site(in our case, zoos),
    - **b.** Remind visitors about importance of individual actions, and
    - **c.** Provide specific strategies and suggestions that can be incorporated into everyday routines

6.6 Conclusion

In this chapter, the systemic direction, what it means for the zoos and a three phased approach that zoos can adopt to move the society in the systemic direction is discussed. Along with it, the principles and requirements from the research are gathered to inform the design.

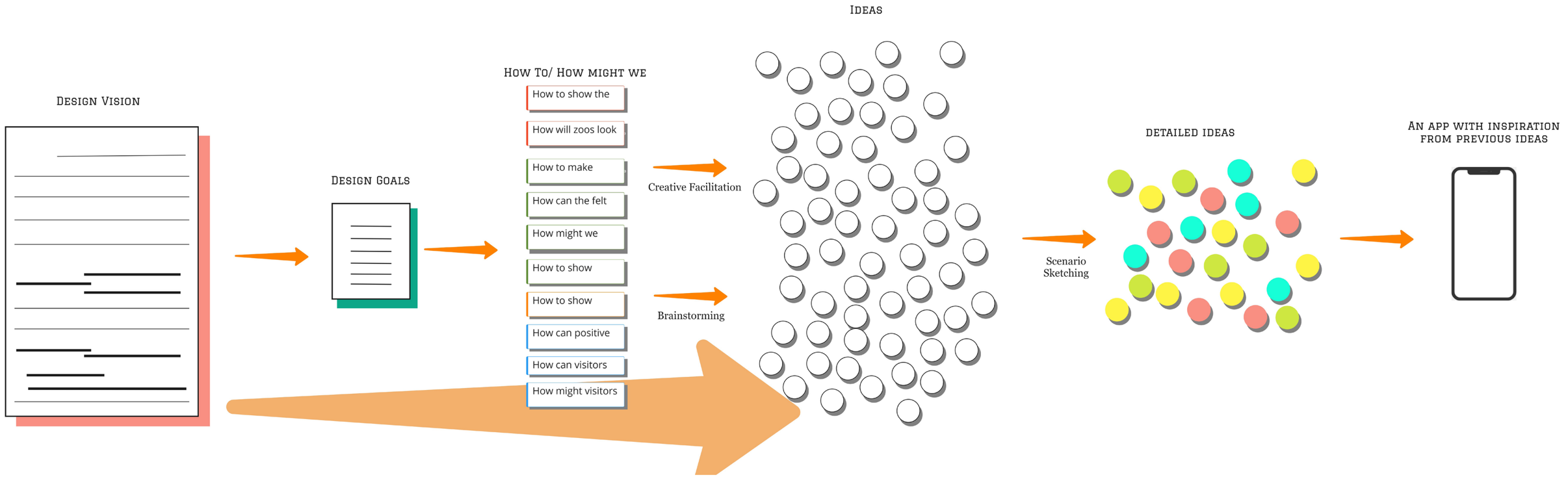
Chapter 7

Ideation

In this chapter we will discuss ideation process in two parts: Generating ideas and Selecting ideas. Methods such as ‘How Tos’, Scenario sketching, and creative facilitation is discussed.

7.1 An overview of ideation process

Having discussed the strategic part of 'What to do', this chapter explores the operational part 'how to do it'. The chapter will begin by giving an overview of different stages of the ideation process and end with making a decision of an idea that will be further developed into a concept that can be tested.



7.2 Brainstorming with How To?

Based on design goals and the future story, multiple ideation questions were created in the beginning of the process. These questions were re-framed for the purpose of SPARKing the question and inspire ideas (Heijne & van der meer, 2019). For eg. “How can interdependencies between animals be shown to visitors?” was converted into “How can visitors learn about the communal living amongst the species?” Some of the abstract questions based on the future story were also included to inspire flexibility of the ideas. For eg. How might we inspire visitors to

respect nature?
To inspire myself, I watched nature videos, used my own memories of the past and visited Blijdorp zoo, Rotterdam during the ideation process. I mainly used the technique of brainstorming for initial ideation where I took one question, set a timer and tried to write and sketch ideas on sticky notes. Sometimes I used external material such as zoo magazines, pamphlets and pictures of the zoo(from Google images and those clicked by me) to force fit them and expand my ideation space. During these sessions, the future story was also used as an inspiration to increase the fluency and flexibility of ideas. (Heijne & van der meer, 2019).

7.3 Creative Facilitation

Since I had discovered my love for facilitating creative problem solving sessions with an elective course, it was my personal goal in the project to facilitate a session for myself. Having ideated all by myself, I decided to host a creative facilitation session. Initially, I had planned to host the session with the education department of the Blijdorp zoo. Unfortunately due a medical emergency, the session was canceled. But this gave me an opportunity to ideate more by myself at the zoo, which was very inspiring. Figure 54 shows my personal brainstorming session at the zoo.

Although the session was canceled, I used my session planning to host a similar session with four other industrial designers. Three of them had visited a Dutch zoo in recent times(less than a year). The fourth designer had visited an Indian zoo a while back. He was chosen intentionally to add diversity to the group and hence to the possible ideas. The details of the session planning, ideas and final concepts can be found in the Appendix O. Figure 55 shows the set-up of the session.

Figure 54: Personal brainstorming session at Blijdorp zoo, Rotterdam

Figure 55: Four industrial designers generating ideas based on the design questions.

7.4 Scenario sketching

The ideas generated through these brainstorming sessions were diverse but still superficial. To know which ones would achieve the design goals and also meet the key criteria, I tried adding some scenarios in which the visitors may use the idea. I detailed all of the personally generated ideas and a few selected ones from the facilitation session. The ideas from the facilitation session were selected intuitively based on its novelty and feasibility. For clarity of the ideas, I made an Idea template for myself, which would help me achieve the equal details for all the ideas. The template can be found in Appendix L, along with the ideas in Appendix N.

It is rightly said that "The devil is in the detail". Sketching and adding some level of details to the initial ideas helped to see it's potential. Many ideas that sounded interesting in my head did not look as interesting when sketched. An example of this is shown in figure 56. In the end, fewer ideas survived the process of scenario sketching.

7.5 Idea selection

Out of many generated ideas that survived scenario sketching, some of the ideas were discarded. These ideas mainly belonged to the category of 'physical installments at the zoo'. An example of such an idea is shown in the image X. The limitations of these ideas are discussed below:

1. Staticness of the idea:
The content these physical installments would communicate and interactions it will facilitate will be limited by its physical characteristics. To renew the content, it'll need physical alterations which might be a cumbersome process for the zoo staff. Moreover, the same content will eventually become less interesting and as discovered in the research, visitors might just ignore it.

2. Experience limited to the zoo:
Since the interactions will only happen at the zoo, it is highly likely for people to forget about the learnings after the zoo visit. Although this limitation can be addressed through various digital technologies, the possibilities were not explored because of the limited time in the project.

3. Detailing without inputs from zoo officials:
This was the greatest limitation of all. Because of the ongoing pandemic, the circumstances had made it impossible for me to have feedback from BIAZA members or other zoos. Since these physical installments would have occupied space of the zoo and time of the zoo staff(to run/maintain), it was crucial to have their perspective about the ideas. The alternative was to take a multitude of decisions on my own, which in my perspective would not have yielded in great results. Another issue was with testing them. Since I could not have been able to test the physical prototypes, evaluating its success and iterating it would have been problematic.

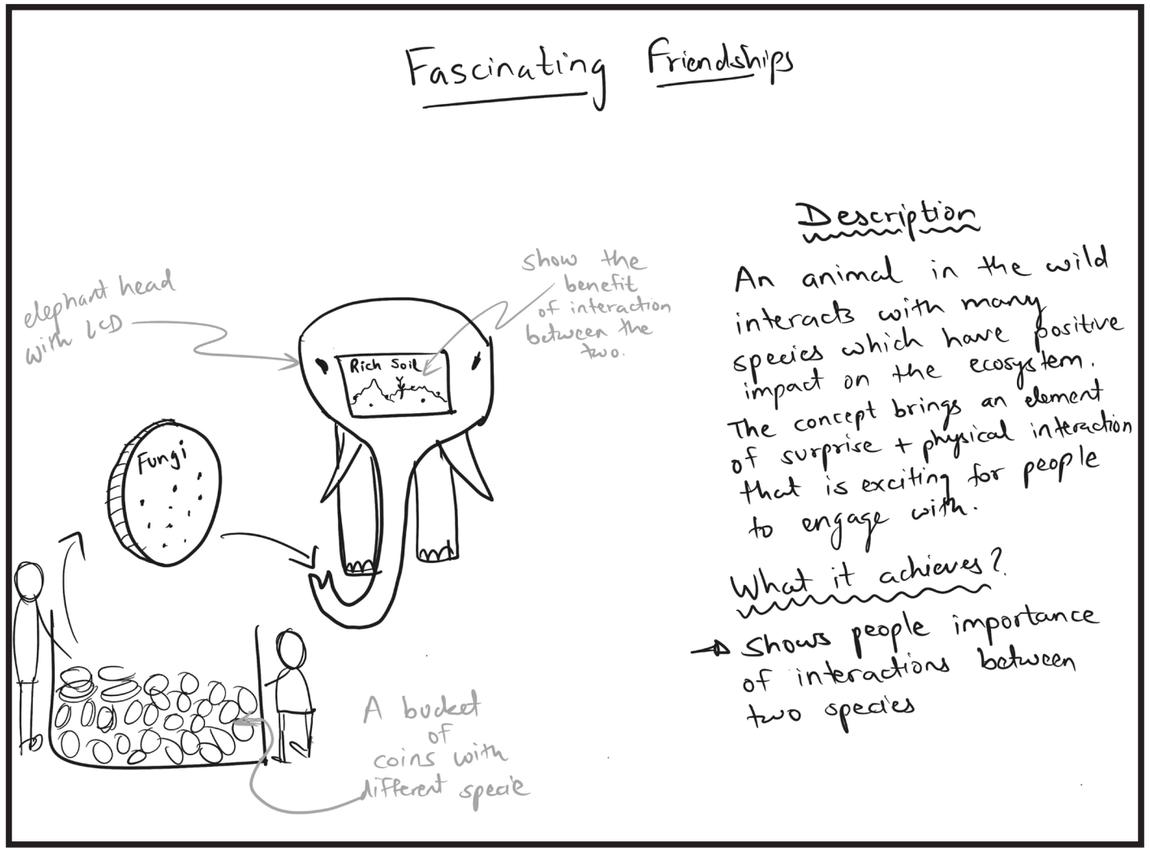


Figure 56: Sketch of one of the ideas under the category of 'physical installments at the zoo'

7.5.1 Some other directions of ideas and its limitations:

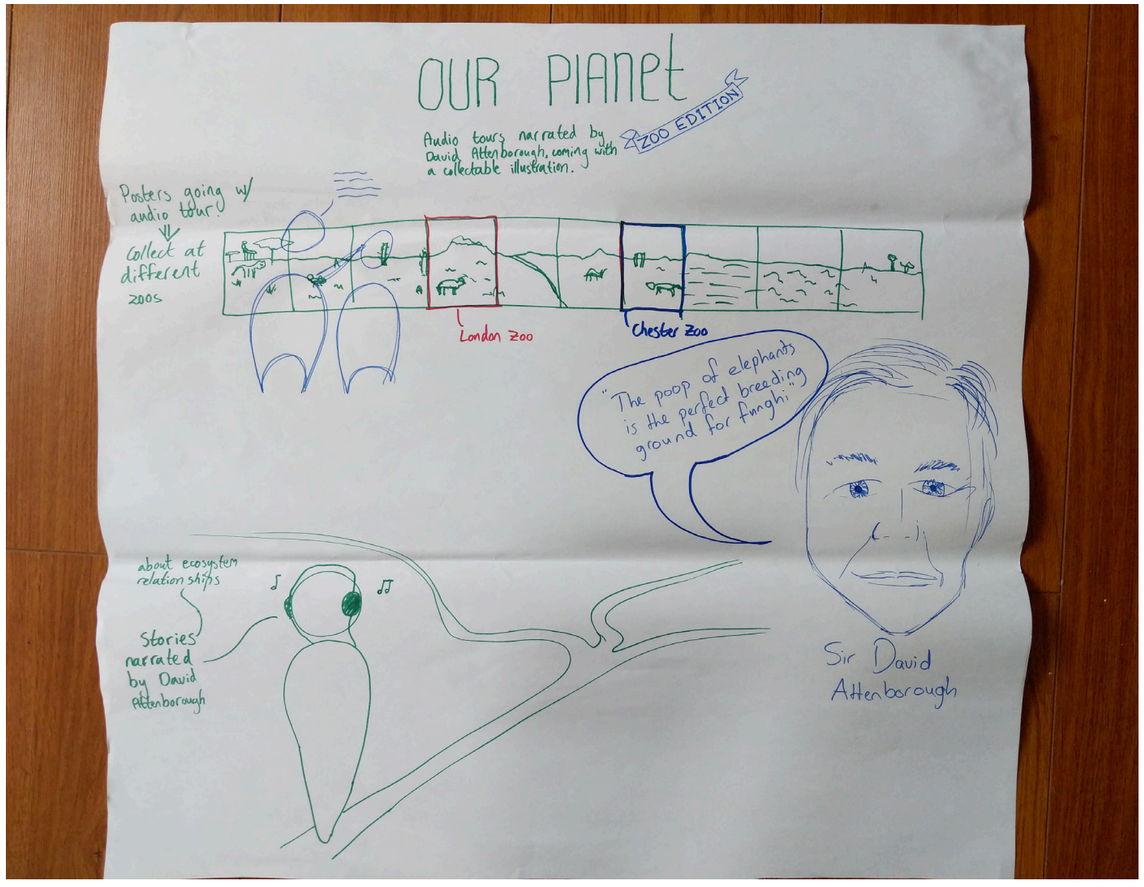
Sustainable behaviors workshops:
A particular direction of ideas that were not selected were about hosting workshops regarding sustainable behaviors. Image X is an example of such an idea. Although these ideas would have added a lot of value to behavioral change in my perspective, they did not really fit well with the context of the zoos. Further exploration would have helped establish a strong relevance with animals and the zoos, but they were not explored due to limitations of the project.

Audio-tours:
An interesting idea about a special edition "Zoo tour with Sir David Attenborough" came out of the Creative Facilitation which was also developed into a detailed concept by the participants. The picture of the concept is shown in Figure 57. This idea was very different than all the ideas I had sketched and hence it was investigated further. Through research I came across an audio-tour introduced at Belfast zoo in August 2019.

However, I could not find how this new tour was received by the visitors. On the app, it had only 5 reviews, with the last review in Feb 2020. On reflecting about this concept, it looked like having to hear the audio through earphones or loudspeaker, may hinder the verbal interactions within the visitor groups impacting the social experience which is at the core of the zoo visit.

Considering these limitations, I let go of ideas related to physical installments, sustainable behaviors workshops and audio-tours. What remained were different ideas with digital interactions, which I could have developed on my own and partially test through screens. They can be found in Appendix M, N.

Figure 57: Sketch of one of the ideas from the creative facilitation session.



Many of them leaned towards use of a mobile interface. On reviewing all of them, developing an app seemed to be the best option. The motivation for an app is discussed below.

7.5.2 Why a mobile app?

1. Insights from Research:
Use of smartphones while visiting a zoo is quite a common thing. People use it to click pictures of their group members as well as the animals. The concept can be easily linked with visitor's current behaviors to make it easy to adopt and use by the visitors.

2. Design goals and criteria:
According to design goals, the app could achieve all the design goals at the same time. Many of the digital interactive installments were limited to achieving only one particular goal as they were generated out of one 'How-to' question. Additionally, in contrast to other ideas, the app was something that could stay with the visitors the longest offering opportunities for beyond-the-visit engagement.

3. Dynamic in nature:
The content on the app can be flexible and be updated and renewed easily maintaining novelty for the curious visitors.

4. Not limited by physical space:
An app can be used anywhere in the zoo and not be limited by the physical space. This means more than one visiting group could interact with its elements simultaneously without obstructing each other.

5. Corona, the new normal:
The biggest benefit of an app is that it limits interactions with physical objects at the zoo which people might not prefer owing to the new normal of social distancing because of Corona pandemic.

Chapter 8

Concept development

This chapter discussed the three main stages in which the selected idea was developed into a concept.

8.1 Sketching interactions

Initial ideas of what an app should do, were sketched in the form of the storyboards as shown in the figure 58. Based on design goals, and imagining scenarios of where and how the app would be used, it was developed further.

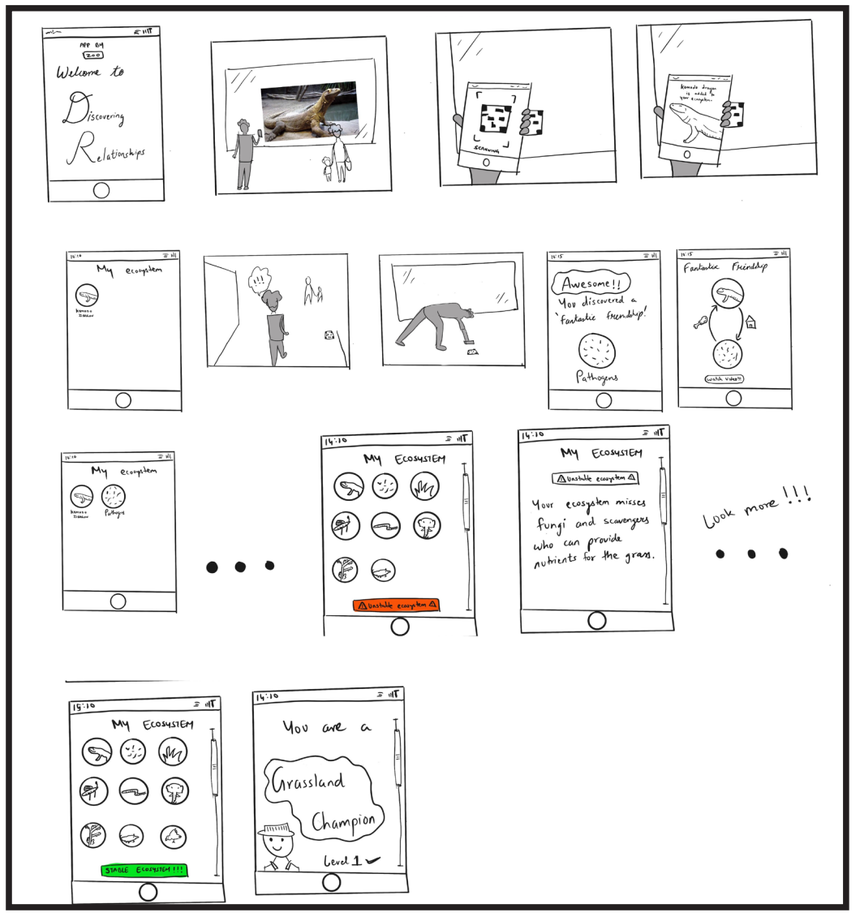


Figure 58: Initial storyboards of the app showing scenarios of use.

8.2 Revisiting discarded ideas

As there are four different design goals, the app is required to have different sections that achieve the goals. At the same time, the sections of the app are also required to be relevant for each other so that they make sense to the users. To establish the relevance, the app needs to follow a common thread on which the sections can be based.

To explore ways in which the app can meet the goals and requirements, previously generated ideas were revisited. The interesting aspects of some of the ideas were recognized and were made a part of the app. For eg. one of the crucial features of the app was derived from the idea of a physical installment at the zoo. The image of the original idea and the interesting part is shown in the figure 59 below.

Animal communities as common thread
One of the key requirements of the app was that it provided a common thread that will connect the sections of the app.

To establish a common thread to achieve the design goals, different communities of animals that live in certain ecosystems offered a good option. Moreover, showing the interdependence between animals was the first goal, and it was easy to achieve it through the concept of communities. The next challenge was to integrate other design goals with the storyline of communities. To explore these, the various flows of information were explored in the form of paper prototypes.

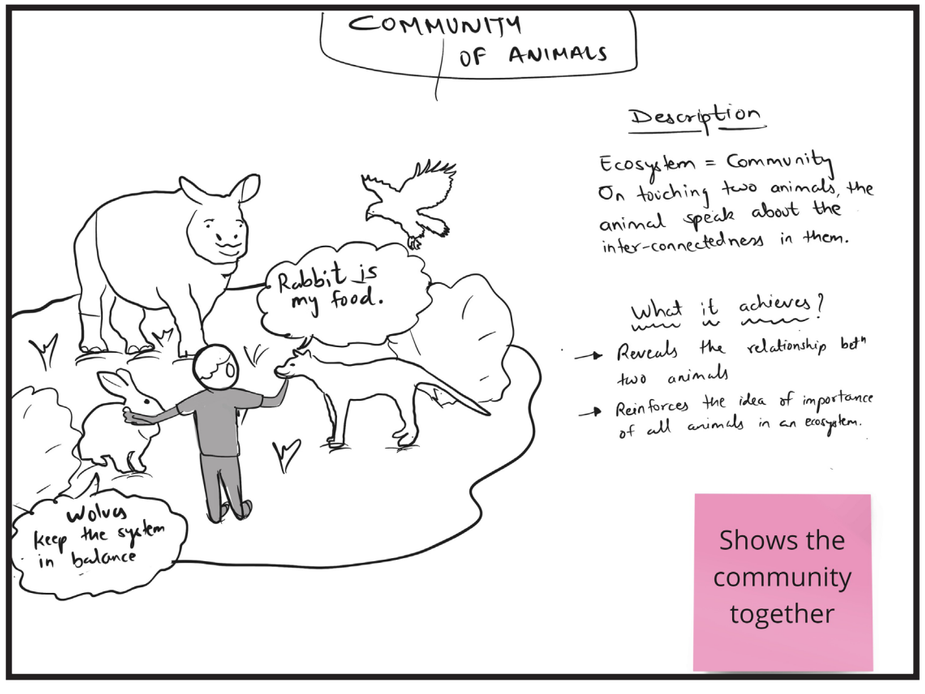


Figure 59: One of the discarded ideas that inspired the development of the app.

8.3 Paper prototyping

Paper prototyping is a way to initiate the development of the wireframes. Developing the wireframes in this way offers flexibility to the designer to think freely and create tangible outcomes. Through the paper prototypes, the first draft of the flow of the app was conceptualized. In this phase the design requirements and design principles were included as a part of the concept. An overview of the screens of paper prototype is shown in the figure below:

Figure 60: Paper prototyping

8.4 Digital wireframing

With paper prototypes, it was possible to map features and sections of the app. To explore the interactions and interfaces of the screens, digital wireframes were created. Navigation of the app plays a crucial role in the user experience. With these digital wireframes it was possible to iteratively design navigations of the app. Moreover, these wireframes also helped in making decisions on the amount and placement of the content on the screens. Examples of these wireframes are shown in the picture below.

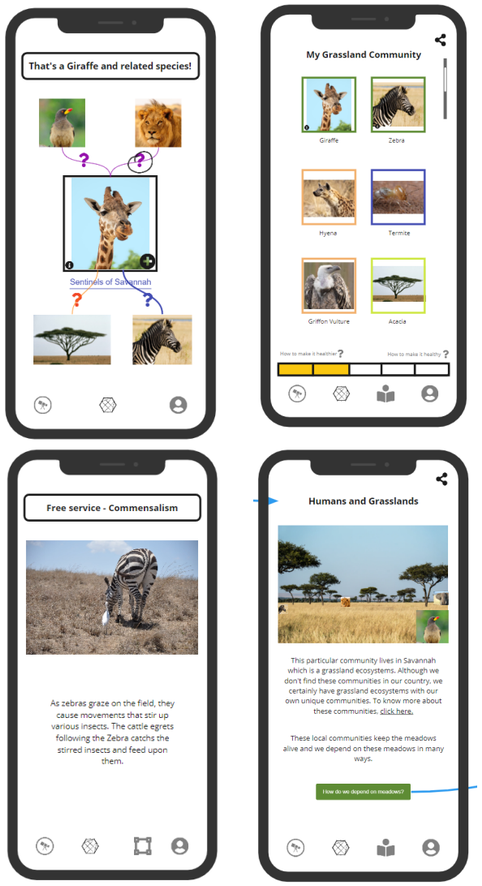


Figure 61: Examples of Digital wireframing

8.5 Digital Prototyping

Through digital wireframing, the navigation, content and a draft UI was decided. However, there were many details that were yet to be added to the concept to turn it into the final design. Moreover, to test this concept, it was important to have a clickable prototype. Hence, the concept was taken into Figma(a software used for digital prototyping) to convert it into a full fledged design.

During this last phase of concept development while the prototype was being developed, iterations based on the readability of the content, its interpretation and even navigation were made. Some new features were added to improve the user experience of the app. In this phase, feedback from project mentors were also taken into account. The designed interfaces were also shown to a Digital Project Manager Mr. Shreyas Chaudhary to make the first iterations on the concept before testing it with the users and validating it with the experts. Based on these feedbacks, the concept was iterated.

In the next chapter we will discuss the final design of the mobile app. The final design is the results of the user tests and validation interviews that were conducted one the prototype was ready.

Chapter 9

Beyond the zoo

A mobile app that takes visitors beyond the world of individual animals and towards a world of relationships

In the chapter we will discuss the final design concept, its features and implementation guidelines for the zoos. The final design is a result of one round of iteration with users.

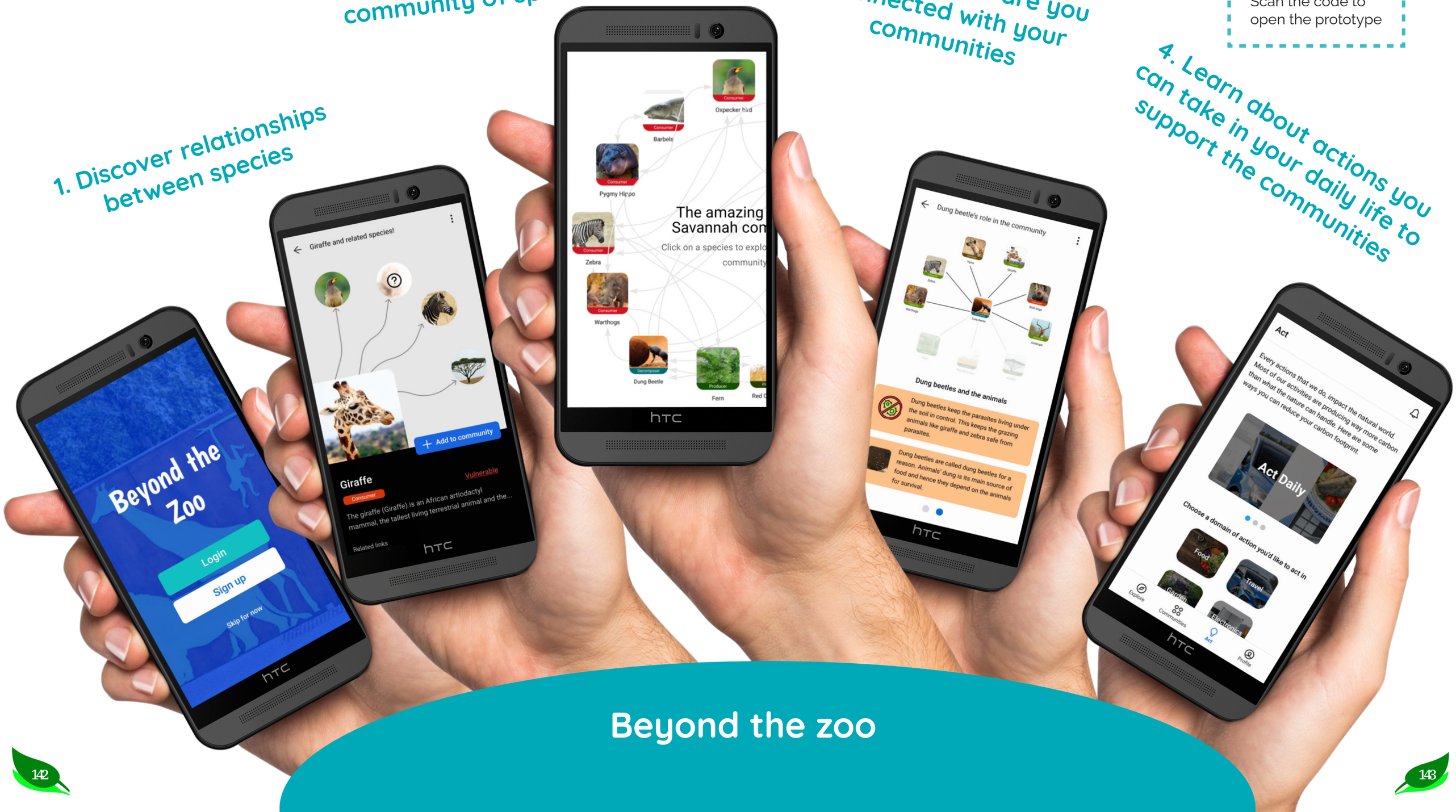
1. Discover relationships between species

2. Create your own community of species

3. Find out how are you connected with your communities

4. Learn about actions you can take in your daily life to support the communities

Scan the code to open the prototype



Beyond the zoo

9.1 Overview of the concept

9.1.1 What is “Beyond the zoo”?

As the name suggests, it is an app meant to:

- **take the users to the wild worlds beyond the zoo and**
- **be a part of the user’s life even beyond the zoo.**

Beyond the zoo is a mobile app developed by the zoos mainly for its visitors. The app is primarily meant to be used by the zoo visitors alongside their zoo visit to learn more about the wild.

The app is not limited to a particular zoo, but rather works for many zoos who are members of BIAZA. For the visitors, the use of the app is not limited to a particular zoo but rather it is designed to motivate its use in many zoos.

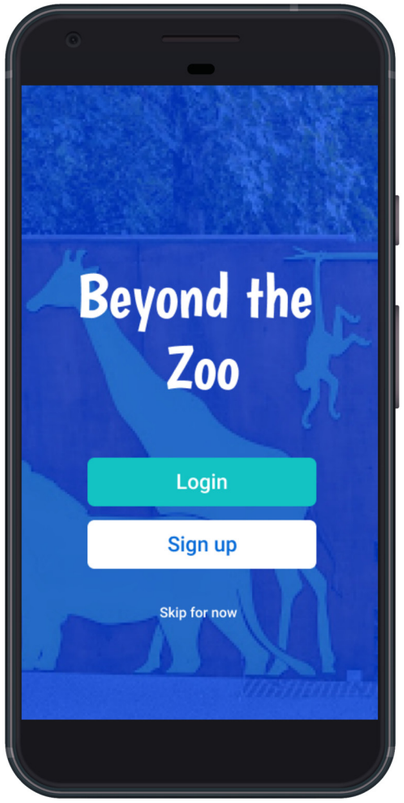


Figure 62: The first screen of the app that users will see when they download it.

9.1.2 What is the purpose behind “Beyond the zoo”?

The larger goal behind the app is to draw people’s attention towards the aspects of relationships and inspire them to see the world as a connected whole rather than individual parts.

As discussed in the research phase, the overall dialogue about the relationships is missing in the society and an individual does not really know his/her relationship with the animal world. With the sense of connection missing, an individual tends to form a worldview of nature as individual parts rather than a connected whole. Such a worldview limits one to recognize the direct impacts of one’s activities on the animal world. More so, it leads to lack of concern about the problem of loss of biodiversity as biodiversity is not seen as something connected to one’s existence. Hence, **the overall purpose behind the app is to strengthen the relationship between an individual visitor and biodiversity.**

As discussed in the brief, the app is meant to achieve four design goals namely:

- **The design shows people the relationship between the animals.**
- **The design sensitizes people about the relationship between humans and biodiversity**
- **The design educates visitors about the issue of loss of biodiversity.**
- **The design informs and inspires people to perform Pro-environmental behaviors that are relevant for conservation.**

9.1.3 Who is the app designed for?

Although the app is available to be used by all the visitors of the zoo, it is expected to be used by adults visiting the zoo with their friends and family. All a visitor needs is a curious attitude, basic knowledge to work with smartphones and a decent Internet connection.

9.1.4 How does it work?

To discuss how the app works, we will start by discussing core components of the app, followed by special features and additional components.

The **core components** of the app are:
A. My communities
B. Community health
C. Community web
D. How am I connected?
E. Act Today
F. Pledges and notifications

Core components

A. My communities

As the zoo visitors visit the animals, they are prompted to scan the animal they see or scan a QR code on the information boards(Figure 62). On scanning the animal or the code, the app fetches the correct animals from an online database and displays a variety of animals that the scanned animal is linked with(Figure 65). Each animal is a clickable button that leads to information about the relationship between those animals.

This animal can be added to their own community. Based on the animal scanned, the app automatically put the animal in its correct community based on the habitat the animal lives in. As the visitor visits the zoo, the visitor is meant to add more animals to his/her communities. Simultaneously, visitors can form many communities based on the animals scanned(Figure 64).

This section partially achieves the first design goal about "Showing relationships between animals and its importance". The second part about the importance of the relationships is discussed in the next section

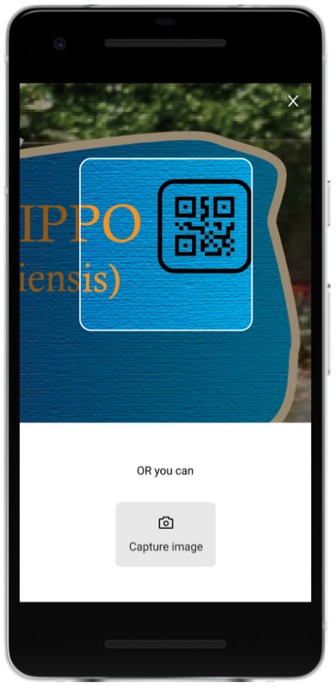


Figure 63: Screenshot of the QR code scanning screen of a Hippo information board

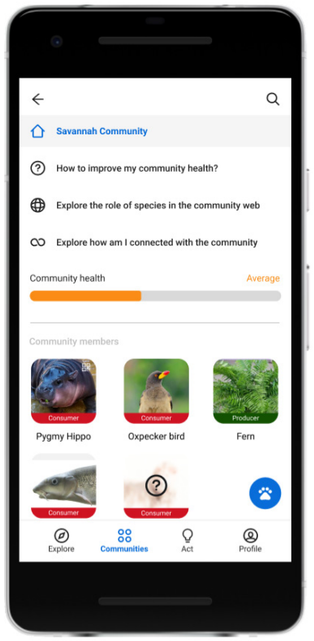


Figure 64: Screenshot of the screen with automatically created "My Savannah community"

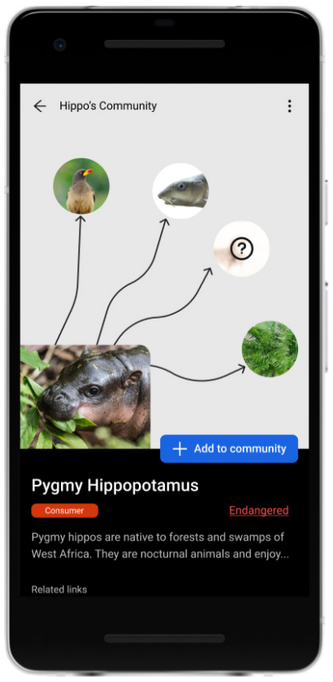


Figure 65: Screenshot of the screen showing interspecific relationships of a Hippo.

B. Community health

This section has two purposes. Firstly to educate people about the importance of relationships between animals and how it plays a role in survival of species. Secondly, with increase in the number of species, the visitor's own 'community health' improves. Hence, to improve the health of one's own communities, the visitor is inspired to scan and add more species, leading him/her to make greater use of the app. The pictures of the screens about community health are shown below (Figure 66, 67)

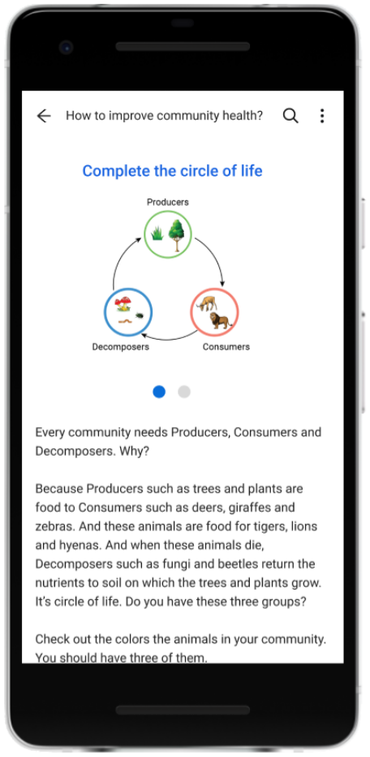


Figure 66: Screenshot of the screen with information about importance of types of species in a community

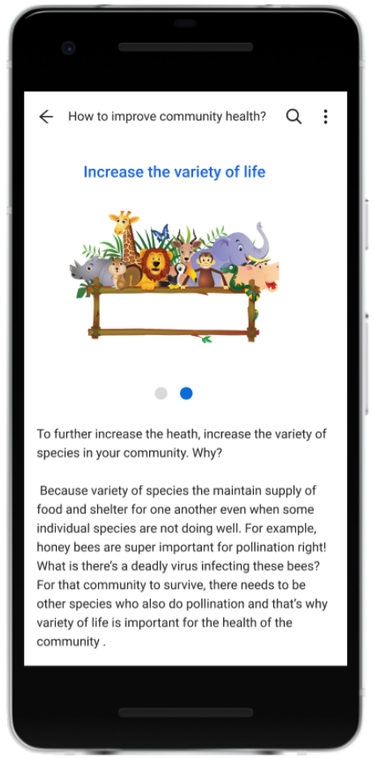


Figure 67: Screenshot of the screen with information about importance of variety of species in a community

C. Community web

This section is meant to show the relationship of each species with the rest of the species in one's community of species. With this, the entire community is shown to be related to each other and how each species plays a role in other species survival. The example screens are shown below (Figure 68,69,70).

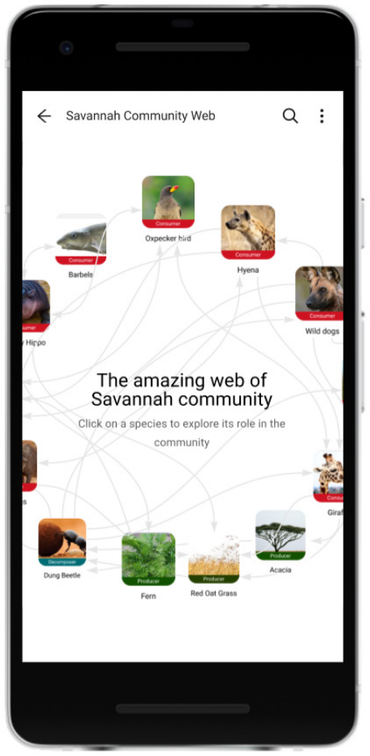


Figure 68: Screenshot of the screen showing the complex web of relationships among the Savannah community

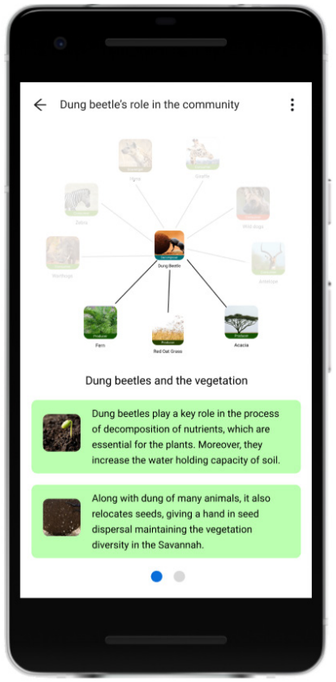


Figure 69: Screenshot of the screen showing the role of Dung beetles in the community

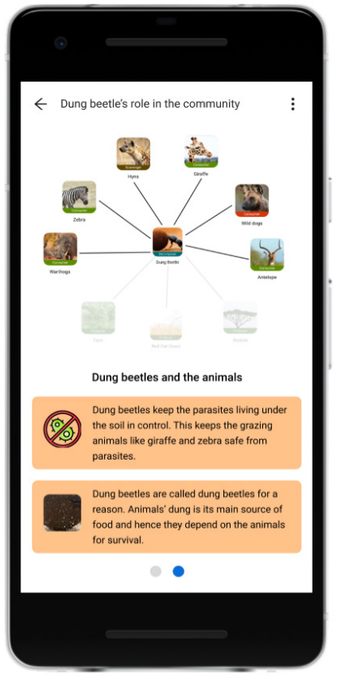


Figure 70: Screenshot of the screen showing the role of Dung beetles in the community

D. How am I connected?

This section achieves the second design goal of "sensitizing people about the relationship between humans and biodiversity".

This section is meant to be explored by the visitor on his/her own. However, if the section is not visited by the user in 24 hours of adding a community, the app sends a notification on the user's phone to check out this section. (Figure 71)

In this section, the far away communities are compared with similar local communities in order to make the connection relatable.

This section leads to two sub sections:
- **Why are the local communities important?**
- **And Why are they in danger?**

The first is meant to show how the community contributes to human's everyday life(figure 73) and second is meant to educate people about how these communities are in danger(figure 74). For the second part, the information is present in the form of different articles that one can read on the web browser. Following the design principles 1 (3.4.3), the screen offers an option that leads one directly to the section of Action.

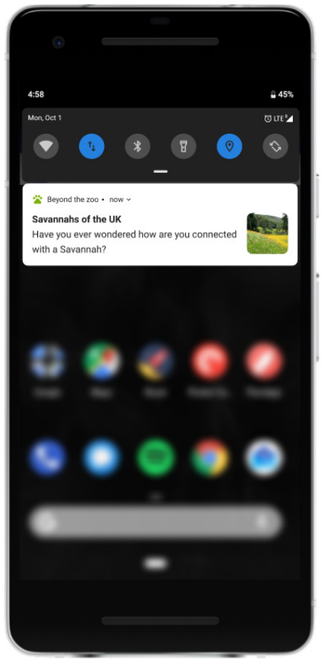


Figure 71: Screenshot showing a notification sent to users to check out a section of the app

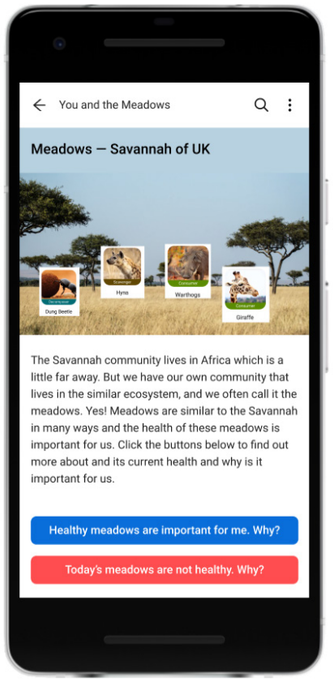


Figure 72: Screenshot of the screen comparing the local Savannah community to the local meadows.

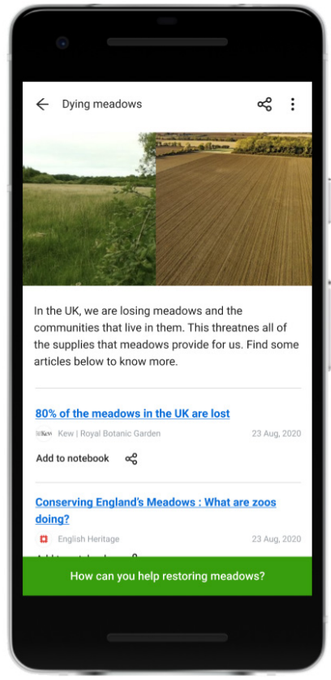


Figure 74: Screenshot of the screen showing article links about dangers faced by the local community.

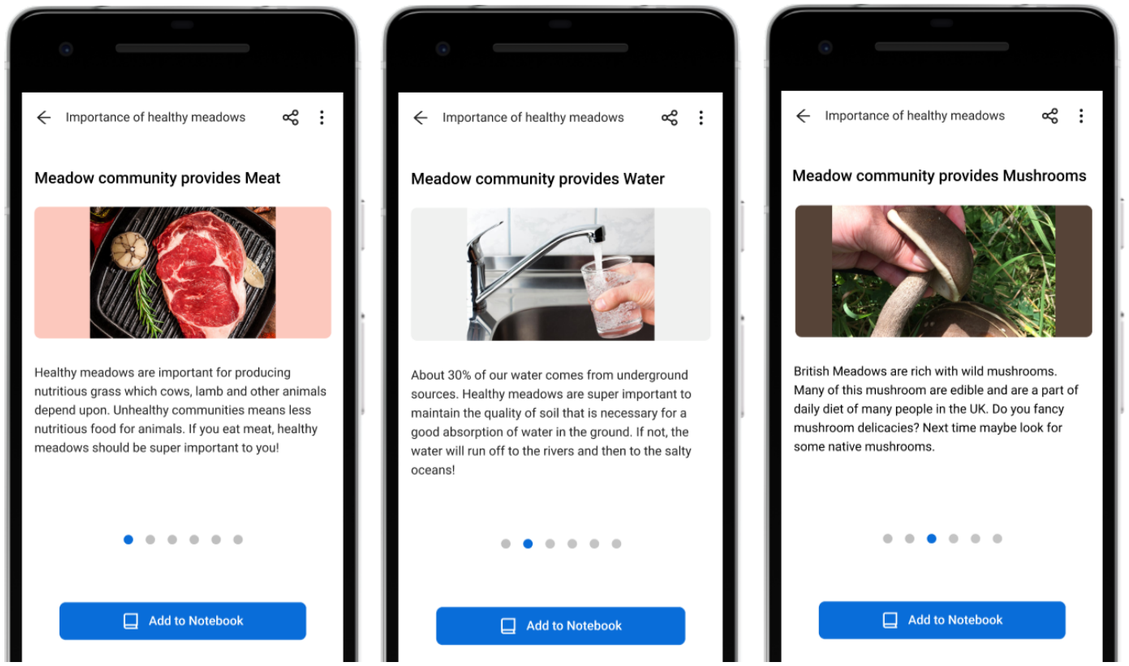


Figure 73: Screenshots of the screen showing the relationship between communities and our everyday life

E. Act Today

Act Today is a section that is dedicated to positive actions one can take to support the communities worldwide.

This section offers users three main ways to support:
1. Daily actions
2. Donating/Volunteering
3. Taking a stand

Daily actions are everyday behaviors that one can imbibe in their own lifestyle. These actions are categorized in different domains and one can choose a domain they'd like to act in to see the actions one can take. The whole list of these behaviors based on their domains can be found in appendix Q. The example screenshots are shown in figure 75..

Donating/Volunteering section provides a direct way to support a particular project undertaken by the zoo to support the communities in the wild. These actions can be directly linked with the online pages of the zoo that have more information on donating and volunteering(Figure 76).

Take a stand section provides opportunities to play an activists role for conservation. Zoos and other local organizations do campaign around the signing petitions and appealing to the government to drive certain changes. These can be included here. Furthermore, it also provides resources for encouraging others to do certain behaviors and reporting illegal wildlife activities. Both of these can be linked to the website pages of the zoos (Figure 78).

About every selected action, the impact of the behavior on the environment is shown to the user, as shown in the figure 77.

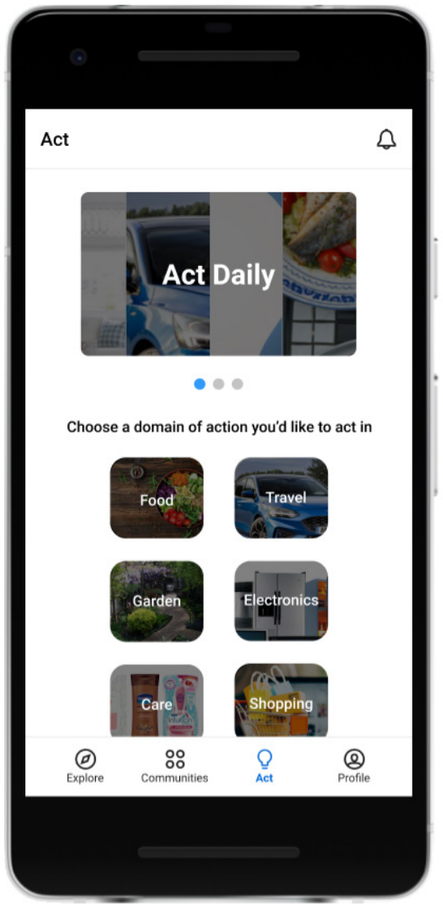


Figure 75: Screenshot showing a daily life domains of positive behaviors to choose from,

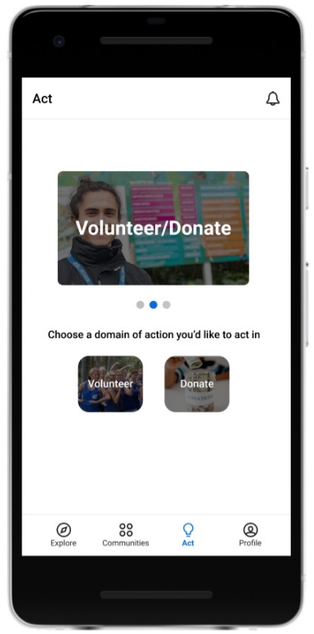


Figure 76: Screenshot showing options to volunteer or donate,

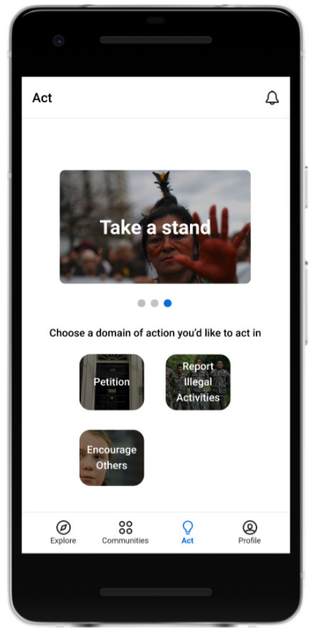


Figure 78: Screenshot showing options to activist like behaviors for highly interested users.

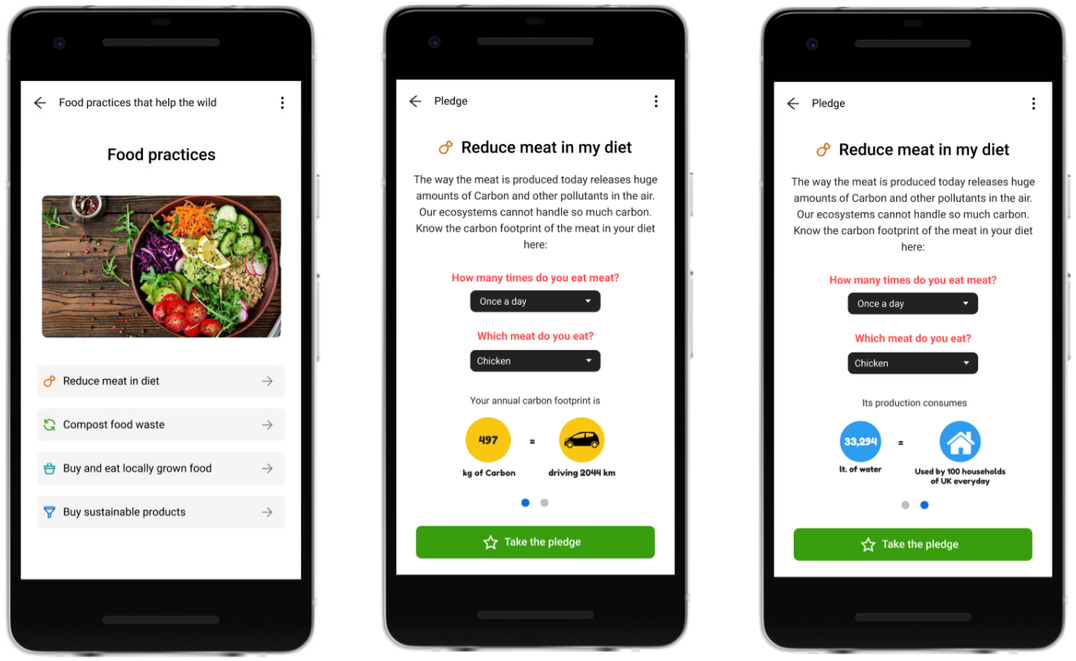


Figure 77: Screenshots of the screen showing the relationship between communities and our everyday life

F. Pledges

Inspired by the literature of behavior science which suggests that actively taking a pledge or signing a commitment about a behavior increases chances of one following the behavior.

Every action allows one an option to take a pledge and subsequently gives option to share the pledge as well as joining the communities. Through research it was found that there's a huge culture around meetups and hobbies. This information is leveraged here. Sharing of the pledge option is available for one to share their pledge within their circle of friends and family, in order to inspire others to take the pledge as well. The pledges also offer an option to set a reminder and add the pledge to their calendars in order to make it a part of one's daily life (Figure 79,81).

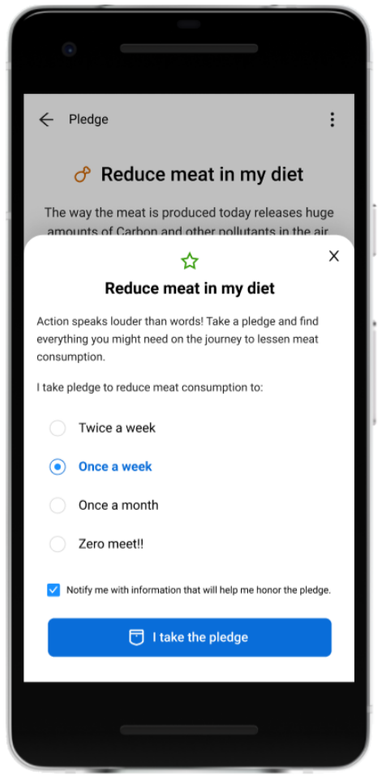


Figure 79: The screenshots showing different options for the pledge.

G. Notification

Notifications are a crucial component of the app. Their main function is to help the users in providing with motivation, information, inspiration to follow the pledges they have taken as well as take up new pledges. Apart from the pledge related content, it is a way for zoos to actively engage with their visitors. Examples of some of the notifications are shown in the image below (Figure 80,82).

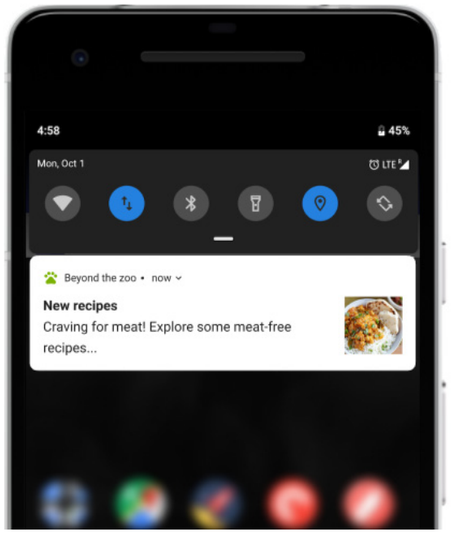
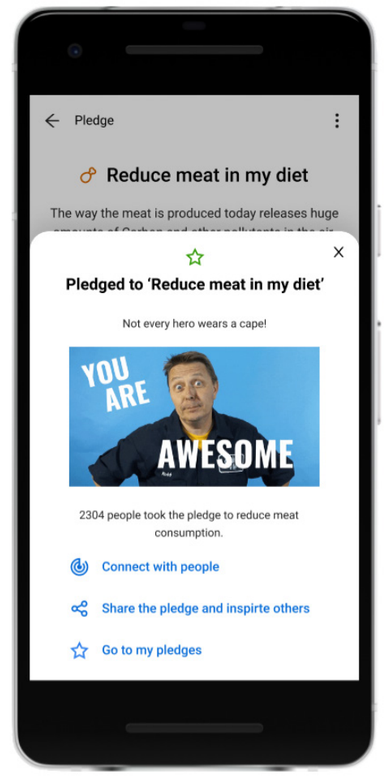


Figure 80: The screenshots showing examples of push notifications sent to the users



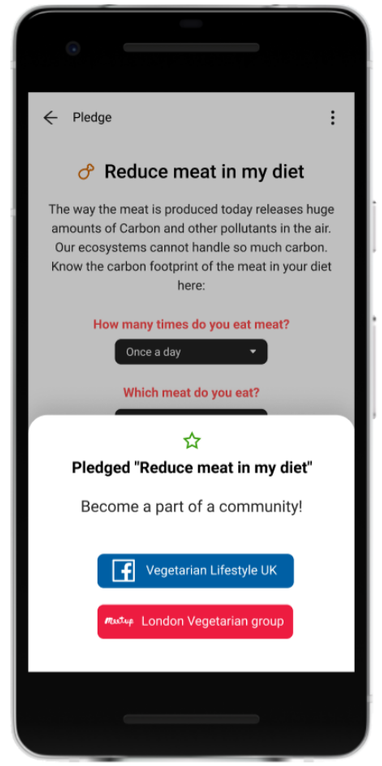


Figure 81: The screenshots showing examples of push notifications sent to the users

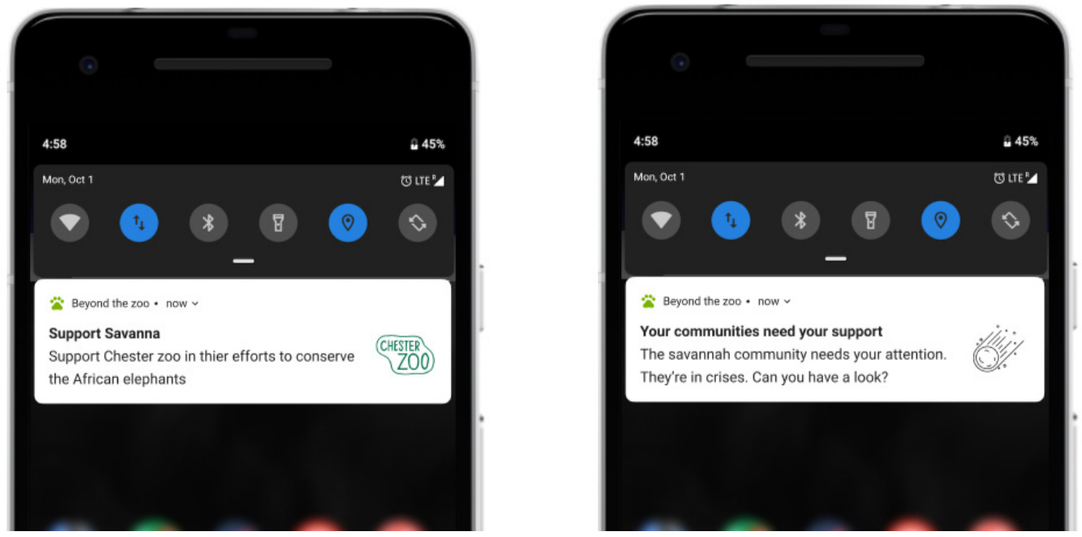


Figure 82: The screenshots showing the screen followed by taking a pledge.

Other important features

A. Missing species

Missing species are certain species that are hidden behind the question marks on the community screen as shown in the image. These species are species that are related to already discovered species, but are also present in that particular zoo. The idea is to nudge the user to discover more of the zoo and scan more of the animal and hence use more of the app by generating a feeling that their communities are missing something (Figure 83).

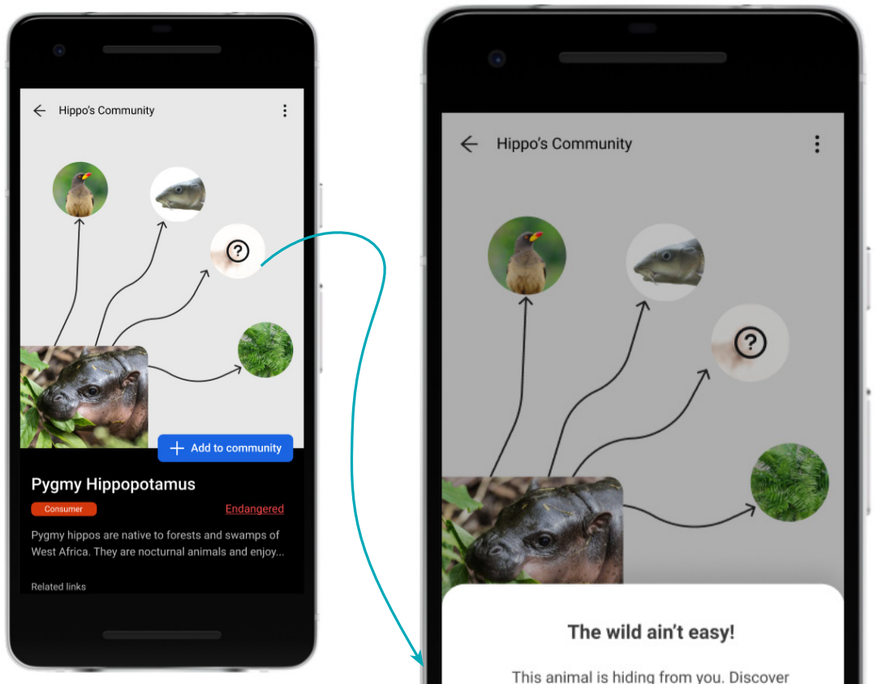


Figure 83: The screenshots showing the screen for informing the user about missing species.

A. Secret species

Secret species is a strategic feature of the concept as it serves many purposes. Basically, these are QR codes that are in a way 'hidden', meaning that they are not obvious to find on the information boards (Figure 84). They are placed on the walking routes of the zoo so they can be discovered by those who are vigilant. The purpose of these codes are many folds. As we discussed, community health is one of the components built to motivate the users to visit more of the zoo animals. Some zoos might not have a lot of variety of species which can improve the community's health. This may demotivate the visitors to collect the species. In such cases the secret species can significantly increase a community's health and can be motivating to the visitor. Moreover, the idea of secret species also serves the curiosity to learn and discover the wild. Figure 85 shows an image of the screen.

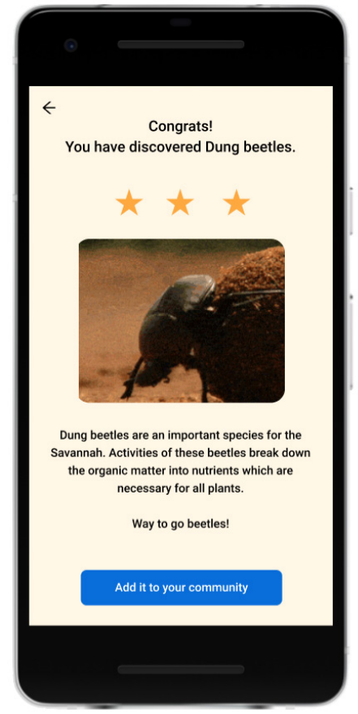


Figure 85: The screenshots showing the screen after discovering a Secret Species.

Figure 84: An example of placement of Secret species QR code at the bottom of a pole at London Zoo.

Additional components of the app

Apart from the core components and special features described above, the app has some additional features that are meant to improve the user's experience of the app. These are discussed as such because during testing it was found that they might not be necessarily used by all users. They are discussed as below:

A. Ecology Notebook

Ecology notebook allows users to save certain pieces of information that they come across in the app or during the zoo visit. As the nature of the content on the app is very different, users may like to have a feature where they can 'favorite' some information for quick retrieval later after the visit. It could be well utilized by educators and parents who visit the zoo to facilitate educational purposes (Figure 86).

B. News feed

News feed is the feature of the app that is meant to keep the users updated about the Conservation related news such as new projects taken up by the zoos, events happening around one's location to support local biodiversity, positive news about species being saved and pledges being taken. For zoos, this can be a way to share positive information about their conservation projects and appeal to users for required donations. Examples are shown in figure 87.

The design considerations taken in designing the app are elaborated in appendix P.

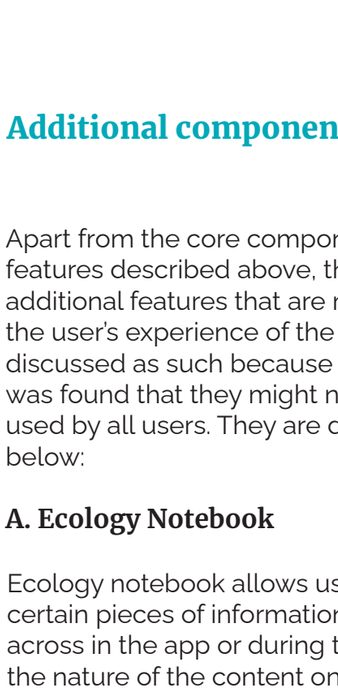


Figure 86: An example of a user's ecology notebook

Figure 87: Examples of type of articles and informations on feed. On the right shows eg. of inspiring news are shown to inspire users to act.

9.2 Implementation Guidelines

In this section, we will discuss some key points about how this concept can be brought to reality.

To understand the implementation aspects of the app, Nicky Needham and Cerian Tatchley who are currently acting as Joint Acting Director at BIAZA were interviewed.

The concept was presented to them and their initial thoughts on it were discussed. Later a questionnaire was sent to them asking open ended questions about particularities of the implementation. Based on their inputs, the implementation guideline is presented. It is a guideline and not a plan because developing a plan needed more inputs from BIAZA and their members which was not possible in the scope of the project.

Phase A: Proposing to the members

The first steps towards bringing this concept to reality is proposing the concept to BIAZA members and generating their interest. Since the members could not be involved in the design phase of project, their feedbacks are needed before the concept is fully developed.

To do this BIAZA could introduce the concept to their members through education conference or standing committee meetings and via emails and generate initial interest get member's buy-ins. With the interested members, another round of research should be performed to find out their concerns about the content and the design of the app. Naturally, the app will need a round of iteration to include the member's concerns.

Along with iterating the design, two important questions need to be answered:
1. Who will play what role in development and maintenance of the app?
2. Who will contribute what type of resources to develop and maintain the app?

Based on these considerations, **BIAZA can design an initial proposal** for all of its members about the implementation of the app and start with the ones who are ready to invest their time and resources. This proposal will mostly answer the questions about roles and responsibilities of BIAZA and the participating member zoos in realization of the app and maintaining it.

From all the interested members, BIAZA should ideally select two of its members for piloting the app.

Preferably these members should be in close vicinity, so that the zoo visitors have opportunities to visit two different zoos and experience the same app at both the places. Piloting it in this way gives an opportunity to explore the feasibility and desirability to have a common app for more than one zoo.

Phase B: Piloting and the app

For piloting the app, the required content can be curated by BIAZA with support from the two members. The Working Groups and Standing Committees in BIAZA , along with the BIAZA office has the capacity to curate this content.

The responsibility of technical development of the pilot app,if BIAZA should do it or the two member zoos should do it, is not clear yet. None of them possess the capability within their organization to develop the app, so it is something that should become clear in the proposal made in the earlier phase.

For piloting, the zoos also need to reach out to the visitors and do marketing for the app. Zoos already produce marketing content for their locations, so they're capable of doing this with already established marketing channels. Compared to online marketing, offline marketing at the zoo may be effective as the app is designed to be used with the zoo visit.

Guidelines for piloting

•. **Produce** marketing content showing interactions between two different species with one preferably a flagship species to attract visitors to download the app.
• **Start** with the content about flagship species and the most interesting relationships it holds with other animals to generate interest within visitors.
• **Place** information about how to use the app at various parts in the zoo along with attractive content that makes the visitors download the app.
• **If** not all animals, include various animals from different habitats to allow users to form more than one community.
• **Ask** feedback about the app from the visitors in the form of interviews and feedback forms.

Based on the reception of the pilot by the Zoo visitors, the design can be iterated and be made ready for integrating it with other member zoos.

Phase C. Internal Launch

Based on the feedback from of the pilot and iterations in the app, it can be internally launched for all the member zoos inviting them to get on board for the first release.

With the members interested in becoming a part of the app, the content development can begin. BIAZA, as mentioned above can curate content. Meanwhile, the zoos can modify their physical infrastructures and create marketing content for the app. Once the app is developed with the curated content, it can be released for the visitors along with marketing content developed by the zoo.

9.2.1 Visual roadmap

A visual roadmap based on the three phases discussed above is shown in the figure below.

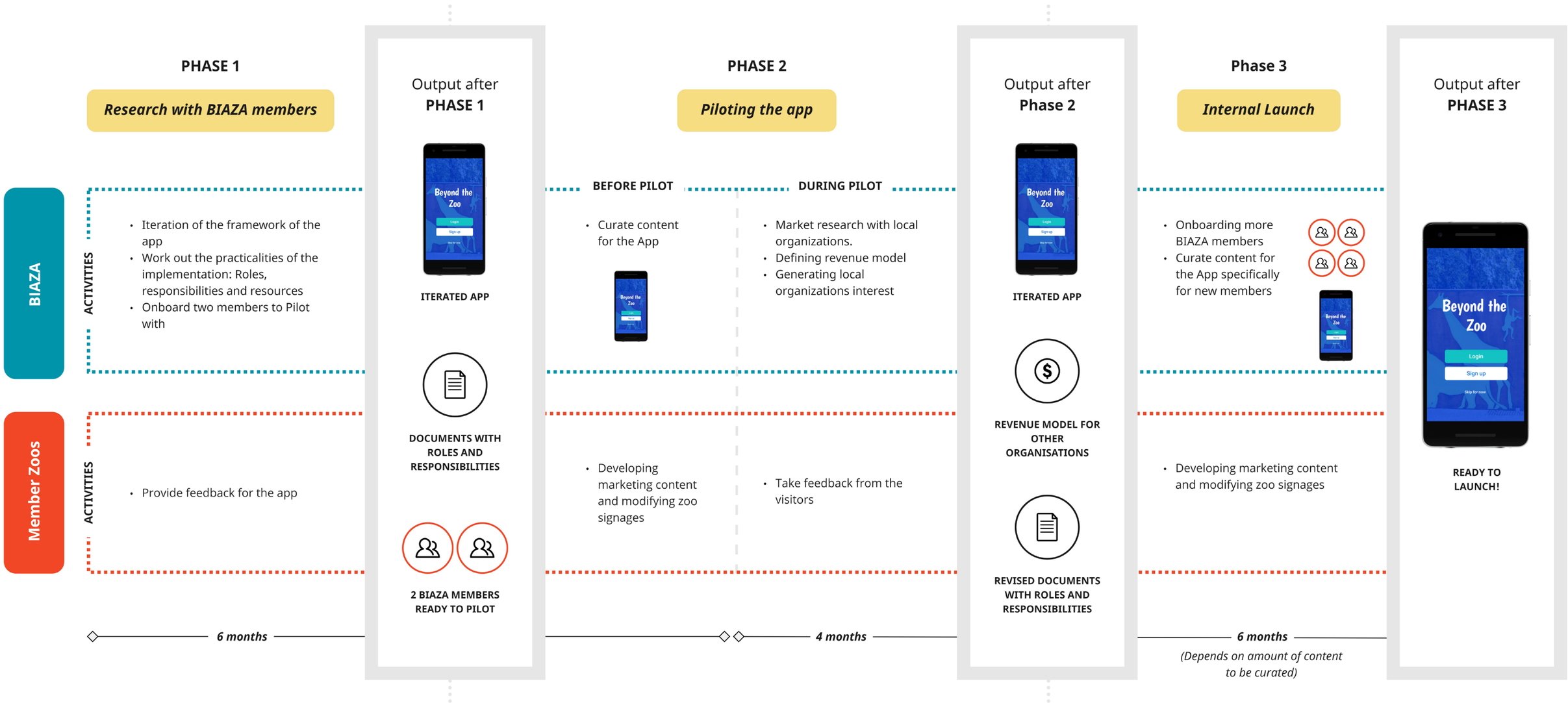


Figure 88: Road map to implementation of "Beyond the Zoo" for BIAZA.

9.3 Speculations on the final proposal by BIAZA

The proposal that BIAZA makes to their members of course needs to be made after understanding the members' concerns and interests with regard to the app. However, based on my current knowledge, I speculated on potential implementation details. My speculations are is discussed below.

Who should develop the app and why?

I propose to BIAZA takes the responsibility of developing and maintain the app on their own, or facilitate collaboration between their members to come together and develop the app. The reason behind this is that the strength of the concept lies in the fact that for visitors, it is a journey of discovering more and more species and their relationships with them. A single zoo has a limited number of animals, and the discovery can come to halt pretty fast, but with more BIAZA members adopting this concept, the discovery suddenly expands drastically. Moreover, the app can potentially influence the visitor's motivation to visit different zoos resulting in a greater revenue for the members.

During an interview with BIAZA office, a potential issue related to the brand of the app was discussed. BIAZA member zoos have their own brand and their own priorities about education and conservation messages for the public. More light can be thrown upon this issue during the initial research as discussed in Phase A. However if BIAZA develops the app, the brand can follow common guidelines around conservation education messaging.

Moreover, it is an opportunity for BIAZA to establish itself among the general public, which is in line with the new strategic direction about becoming more "Public facing" that BIAZA is exploring.

In a nutshell, **developing the app under collaboration from multiple BIAZA members promises a greater experience to zoo visitors, more visitors for the members and public recognition for BIAZA.**

Who finances the app?

Considering BIAZA as the main organization that develops the app, the members who wish to be a part of the app, subscribes to this app paying an extra membership fee. In return, BIAZA includes the member's animals in the database repository and includes the zoo specific information (such as donation/ animal adoption) in the app. BIAZA members on the other hand modify the signages by adding QR codes to them and produce physical marketing content to be placed in the zoo(Eg. Advertisement board).

Possible revenue streams

With this app, BIAZA has the potential to reach millions of zoo visitors in the UK. This is a great opportunity to promote local conservation organization's work. Local organizations in different parts of the country such as London Wildlife Trust (London), Wildlife aid(Surrey), The conservation volunteers (All over UK) can be given a marketing space for their events on the 'News feed' section in the app. This can potentially become a paid services.

Details in a nut shell

Key Activities by BIAZA

- Development and maintenance of the app
- Curating the content for the app based on the subscribed members
- Securing revenue stream through local organizations

Key resources

- The content related to species, pro-environmental behaviors and zoo specific information.
- The physical infrastructure with in the zoo such as QR codes.
- Cloud based servers for storing user information.

Cost structure

- App development and maintenance are the key costs involved.

Key Activities by member Zoo

- Getting feedback from visitors
- Marketing for the app.
- Placing QR codes in the zoo and maintaining it.

Key Partners

- Member zoos.
- App development consultancy
- Local conservation organizations and other zoos.

Revenue Streams

- Local organizations for marketing their content on the App.

Chapter 10

User testing and Validation

In this chapter we will discuss the user tests and validation interviews conducted for the initial design concept.

10.1 Objectives of the user test

The objectives for the test are three fold:
1. To test if zoo visitors would actually want to use the concept - **Desirability**
2. To test if the Zoo visitors can use the concept - **Usability**
3. To check is the concept achieves its design goals - **Functionality**

The participant using the prototype in his phone as he virtually visits the London Zoo.

10.1.1 Desirability

Desirability of the concept means how willing users are to use this concept during their zoo visit.

The desirability of the core actions necessary for the app:
A. Scanning the QR code to know about the relationships in the wild
B. Adding animals to "My communities"
C. Looking for secret codes for secret species.
D. Pledging about actions to take and receiving notifications based on that.
E. Exploring rest of the app

The desirability of the additional actions of the app.
F. Ecology notebook
G. News feeds based on the community
H. Sharing the information
I. Joining various community

10.1.2 Usability

Usability means "how well a specific user in a specific context can use a product/ design to achieve a defined goal effectively, efficiently and satisfactorily". As pointed in the definition, there are mainly three components to usability: Effectiveness, Efficiency and Satisfaction.

For the concept presented these three things are translated into three parameters:
A. Understandability of the content on the screen: If the visuals, information and phrases used in the app are understandable
B. Understanding the navigation: If the users are able to navigate well through the app.
C. Ease of learning and using : If learning or using the app is easy and comfortable.

10.1.3 Functionality

Functionality here is referred to the ability of the design to perform its function. In other words, does the design achieve what it is meant to achieve?

Based on the four design goals, the concept is designed to achieve the following functions that are tested as a part of the user test:
A. Visitors learn about the interconnectedness between the animals and the importance of this interconnectedness.
B. Visitors learn about the importance of biodiversity for their own survival.
C. Visitors learn about the problem of loss of biodiversity.
D. Visitors are informed and inspired to perform behaviors that are relevant for conservation.

10.1.4 Research question

To test the Desirability, Usability and Functionality, a set of research questions for each were decided to be as follows:

A. Desirability

1. How desirable is the app "Beyond the Zoo" by the zoo visitors?
2. What are the features that visitors like about the app that will motivate them to use the app?

B. Usability

1.How easy it was to understand the content provided in the app?
2.How easy it was to navigate around and use the app?
3.How easy it was to learn to use the app?

C. Functionality

1. Does the app achieve the four functions it was meant to achieve?

10.1.5 Participant criteria and Test plan

Participant criteria

The participants criteria for user tests are as follows:

- The participant must have visited a zoo in the last 5 years.
- The participant should be in the age group of 18 to 40 years.
- The participants set should be diverse in their age.

Based on these criteria, **six participants (User A,B,C,D,E,F)** were recruited. Due to the limitation of time, the pool of the recruited participants consisted of all students or graduates of Industrial design faculty. Their profiles based on their fascination for animal and concern for environmental problems is shown in figure 89. The third criteria could not be satisfied well as the diversity of the participants was limited to 22 years to 28 years old. Ideally, I would have preferred some older participants too to test the concept.

Test Plan

As the app works in tandem with a zoo visit, it was essential to replicate this experience. Because of the ongoing pandemic, it was not possible to test the concept in the real zoo environment. To compensate for the unavailability of a real zoo, Google Maps Streetview was used to take the users on the journey of the London Zoo. The participants were given the app "Beyond the Zoo" on a smartphone and were asked to use it alongside the journey. While using the app, they were encouraged to think aloud.

After finishing exploring the app alongside the zoo journey, a 30 minute interview was conducted to explore the aspects of Desirability, Usability and Functionality in detail. The details about the zoo journey, the interview questions and the Test set-up can be found in Testing Plan in Appendix R.

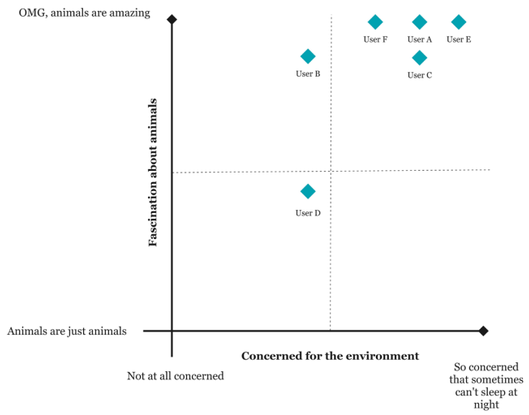


Figure 89: User test participant's profiles based on their fascination about animals and concern for the environment

Data collection and analysis

The entire test session was audio recorded and during the Think Aloud section, short physical notes were taken. Immediately after the session, the notes were elaborated and concluded.

For analysis, parts of the audio recordings was transcribed and were re-listened. The audio recording was also used as reference when the interview notes were unclear. The insightful things were listed on another piece of paper along with their frequency of occurrence in the test sessions. Based on these, recommendations for the concept were distilled and the design of the app was iterated upon.

10.2 Results

The results of the analysis described in the previous section are discussed below. As the objectives of the test were three-fold : Desirability, Usability and Functionality, we will discuss the results obtained one by one.

10.2.1 Results about desirability

A. Scanning the QR code to know about the relationships in the wild through mobile screen

All the users liked the idea of scanning QR codes and learning more about the animals and their relationships on their phones. Relationships that animals share with other animals was particularly a novel knowledge for the user and they like the idea of learning about it during the zoo visit. They compared it with their general experience of the zoo visit where they learn about the animals and not really about the connections between them and this app provided them with that extra information that they'd like to know.

However, user A speculated that this might lead to a greater phone use which the user wouldn't like as he/she believes that in the zoo people should not be stuck to their phones.

B. Adding animals to "My communities"

The idea of forming one's own community of animals was liked by all the users as **it gave them the feeling of making something of their own.** Also as they saw that with each animal, the number of animals in their community was increasing, they felt the motivation to grow their animal community too.

"I think it was nice to get information about the connection between two animals. Normally when you go to the zoo you assume there's only information about specific animals"

User B

"Oh this[the information about relationship] is super cool"

User A

"I get to create my own community, nice!"

User D

C. Looking for secret codes for secret species.
The feature of secret species was explicitly mentioned as an interesting feature of the app by all the users during the post test interview. Some of the users compared it with treasure hunting and said that it gave them a feeling of discovering something new. One other user also mentioned how this feature will motivate him/her to look for such codes and visit more of the zoo.

"...scanning the QR codes in combination with missing animal so you're really motivated to find more QR codes and expand your community and also you want to know more about animals, so yeah, you actually want to get more [codes]."

User B

"So it's a real treasure hunt. That's exciting."

User F

D. Pledging about actions to take and receiving notifications based on that.
The response regarding the pledge was not conclusive as some users explicitly mentioned that they liked the feature and some did not say anything about the feature. However, with regard to the actions that one can take, most of the users repeatedly pointed out that they don't understand how taking these actions actually help the wild communities.

Receiving push notifications related to the animals they visited at the zoo and the communities they formed at the zoo were welcomed by the users. User F explicitly mentioned that he/she would not like notifications that are not useful for him. This user was positive about receiving notification that may help in keeping the pledge (eg. meat free recipes), but would not prefer any other type of notification.

"[I] don't really get why I should change my diet for the wild community."

User B

"With the action of eating less meat, show what you're doing directly. Like if you do this the consequences will be that Giraffe we'll be able to get the nutrients"

User C

" There was a notify [button]. Yeah. So that's I think that's nice because otherwise I would not [follow the pledge]."

User C

E. Exploring other parts of the app
Apart from scanning and adding animals to communities, the other components of the app such as "How am I connected?" and "Act Today" are sections that users are not prompted to check as a part of their zoo visit. However, it is important for the visitors to check these components for the design to achieve its goals. All of the users emphasized on the fact that during the visit, they would keep the usage of phones limited to exploring things about the animal as their priority is to be at the zoo looking at animals and not in their phones. But the rest of the parts of the app was liked by all as it was informative and they suggested that they will check those parts either when they are taking a break during the visit or after they have left the zoo.

F. Ecology notebook
The feature of Ecology Notebook received a mixed acceptance in users. For some the feature was redundant as they felt that they can already find the information they need through the communities so they won't need a notebook as a separate feature. Whereas the other users liked the feature as it gives them freedom to save some information they might want to revisit. Overall, the feature is not something that is a must but it may potentially lead to people saving information, sharing it and in this way stay engaged with the app.

"Perhaps I would like to do this after my visits to the zoo, because while I'm there, I would probably just do the most of seeing animals and then like adding them to the communities. But then I think I would like dive deeper into the information Perhaps afterwards because once you're there you also just want to see them in a moment"

User C

"I already make screenshots for the things that I think are important, but then they get lost in your [picture] feed. So yeah, if you think oh, this is interesting. I want to save it, [that] could be nice....And then you can add your own writing perhaps like okay, this is why I saved this"

User C

G. News feeds based on the community

The feature of news feed about recent information was not very interesting to the users. The users emphasized that they will be using the app only when required and not something they'd visit regularly. So the app will mainly be used in the zoo and if they get a notification on their phone through the app when they're home. Otherwise it'll be idle. Hence this feature is not necessary for the users, however, it is still a way to let users in on the news and updates about the wild world. Hence this feature is not undesirable but its desirability is not clear at the moment.

H. Sharing the information

During the entire test, hardly the users pressed on the icon of sharing information. When explicitly asked, they said that they perceive this information as more for their own sake rather than something they'd like to share. One user pointed out that there was something about a particular text she wished she could share with the user's partner who was also at the zoo. This indicates that people who visit the zoo together may want to share information about the animals they visited at the zoo at a later time when they discover it in the app. However, the actual usefulness of the feature is not well understood. It is not undesirable but also not desirable.

I. Joining the community

The test participant did not show an interest in this feature about the app. On explicitly asking the reason, they were hesitant to join because the communities felt like a group of strongly opinionated people and the users were not comfortable to be a part of it. However, one of the user pointed out that if he/she knows someone in the community, then he/she would be willing to join.

Other insights

The visitors would like to see the related animals in the zoo

The related species displayed in the app interested the users and some of them wanted to be able to see it at the zoo. For the app, it means that if the related animal is at the zoo, it provides information about its location in the zoo.

The digital information can be the new way of education at the zoo

Some users mentioned that many times the information signages and the animals at the zoo are difficult to see because of the crowd of visitors. In such a scenario, having something to read and learn at the tip of their fingers would be very useful. Moreover, because of the ongoing pandemic, users described their hesitation in standing near other people who might be reading the information board at the zoo. In such a case, this app would be very useful to have.

Images about 'Predation' can be sensitive

For User D, the images and information about the Predation relationships were not what she expected from the app. The user emphasized that the zoo is a happy place and knowing about such things makes him/her sad. While this was said by only one user, it indicates the sensitivity that certain zoo visitors might have towards such information. For the design, it means that particularly to this part of the app may need extra attention towards the content.
User D enjoyed the overall experience with the app and did not particularly comment about this later in the interview meaning that it might not be a big issue.

Signing up can be a turn off.

Initial signing up was questioned by all the users. They did not understand the reasons why one must sign up if all they want to do is learn about the animals. However, later when they learned about more features of the app such as pledges and notebook, they understood the necessity. This indicates that signing up may be a turn off for many visitors if they only want information about the animals.

Recommendation for the final design

Based on the discussion about the desirability, the following recommendations are distilled for the next iteration:

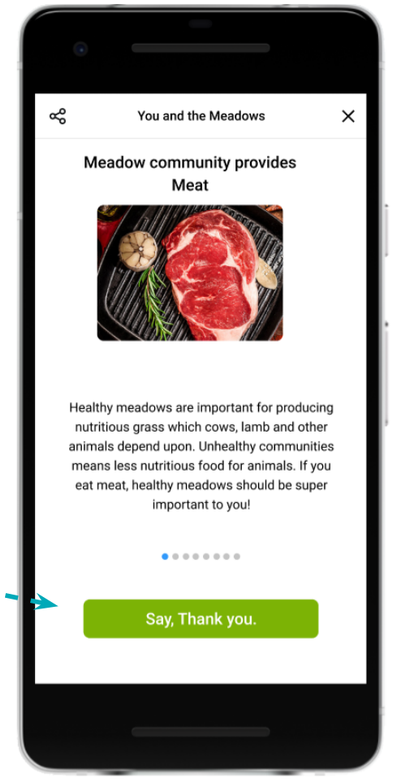
- **Integrate the information about the consequences of the action suggested by the app on the community of animals created by the users.**
- **The feeds in the app should be relevant to the communities created by the user as a part of their zoo visit. Otherwise they will lack relevance and users won't use it.**
- **The app must offer an option of choosing the types of notification one may want to receive. Example category of the notifications can be 'Pledge related notification', 'Zoo related notifications', and 'Event related notifications'**
- **The users may need to be nudged to explore other parts of the app such as "How am I connected?" and "Act Today" later after the visit.**

10.2.2 Results about usability

A. Understandability of the content on the screen

Most of the information, visuals and phrases in the app were understood by the users. One user initially speculated about the ambiguity with the phrase “community” used in the app, but it wasn’t found to be ambiguous in other tests. There were other minor things that were ambiguous or unclear. They are listed as below:

- **“Thank You” button (figure 90)** - it was unclear what the button was about. When clicked, when it led to the Actions, users did not understand that transition.
- **“Savannah community” (figure 91)** was confused with the actual Savannah community in Africa and so was the phrase “community health”. User A perceived it to be the health of actual communities in Africa.
- **‘14/540 species’ (figure 91)** did not make sense to the users as a measure of community health. By some it was mistaken as a measure of species one needs to collect at the zoo.
- **“Why is the zebra also red?”(figure 91)** The color code of the animals was unclear for some users as User B asked the question mentioned in the heading.



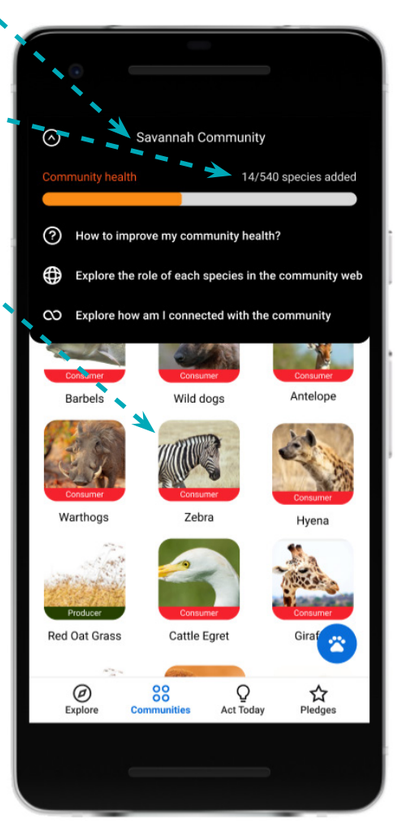


Figure 90: (Top) The screen of the initial concept design with “Thank you” button,

Figure 91: (Bottom) The screen of the initial concept design with the top drawer open.

B. Understandability of the navigation

The main navigations in the app such as scanning a QR code or an animal, finding one’s own relationship and finding actions one can do were clear to the users. This was tested by giving them individual tasks to perform these actions at the end of the test. However there were some minor problems with navigation. The bottom bar was very clear to all the users in terms of navigation. They are described as below:

- **The “Symbiosis”,** “Predation” and similar relationship tags looked as if they were buttons to be clicked, while in reality that wasn’t the case, they were simply tags.
- **The top bar** looked like a static bar rather than something that can be expanded. The button that signified that it can be expanded was almost always missed.
- **On scanning** the QR code screen, the button about “capture image” confused the users if that was to be tapped on to capture the QR code. However, this was mainly the limitation of the prototype rather than the UI, as in real life, the code will be automatically scanned without having to press anything.

Figure 92: (Top) The screen of the initial concept design showing relationship between animals.

Figure 93: (Bottom) The screen of the initial concept design showing the Savannah community.

C. Ease of learning and using

Regarding the ease of learning, the users found the onboarding experience which instructed users to 'scan and add animals to the community' very helpful. Overall, the users were satisfied with learning to use the app and using it afterwards. Some problems with navigation are discussed in the previous section.

User D pointed out that the app felt like a lot of reading to do and kind of an information overload. The user later suggested that more images and videos would be much better than reading. While no other participant indicated this and mostly they felt it was an OK amount of information. This indicates that the amount of information on the screen may be too much for certain users, however because of the limitation of time, this could not be tested further.

"It became very clear how it worked after doing it just once, like just seeing one time and animal QR code and then you kind of knew Oh, it's gonna build up like this. And I always have to scan or take a photo of new animals. So I was like, I didn't have to think much of how to interact."

User C

Recommendation for the final design

Based on the discussion about usability above, recommendations are distilled for the next iteration:

- **Remove the button "Say Thank you" from the UI. It does not add value to the experience in any form.**
- **Clearly signifies the difference between information about the user's own community and the actual community in the wild.**
- **The numbers about total species -14/540 are misleading. To indicate community health, use a clear indicator alongside the bar.**
- **Add information about the reason behind the color codes of the animals in the community.**
- **Change the UI containing "Symbiosis", "Predation" to clarify that they are not buttons, rather a part of the information.**
- **• Make the top community bar recognizable as a drawer.**

10.2.3 Results about functionality

The four functions that app is designed to serve are discussed one by one:

A. Visitors learn about the interconnectedness between the animals and the importance of this interconnectedness

The interconnectedness between species was very clear to the users. The screen about the interconnectedness between the entire community was liked by all the users as it offered an overview of all the connections and each species connections could be explored further.

The screen about 'How to improve community health' made it clear to the users that the three types of species and the variety of species is important for the overall community's health.

"Nice. This looks nice. This is super clear. Yeah. That this is super nice because then you can see which plants that the plants benefit from the Beatles."

User F referring to the screen of beetle's role in the community

B. Visitors learn about the importance of biodiversity for their own survival.

Importance of a variety of life(or biodiversity) for one's own survival was unclear to some of the users. Although the screens about "Meadows provide us meat", "Meadows prevent flood" etc. were read by them, the connection of them with the actual meadows was not very clear. One participant pointed out that he/she knew that the meat comes from cattle farms where these animals are raised by humans, so it was difficult to see the link with the actual meadows.

Rest of the participants said that they had learned from the app that humans are dependent on these communities. Interestingly, when they were openly asked 'What did you learn out of using the app?' only a few explicitly mentioned the importance of communities for our survival. This indicates that the human dependence on the communities is probably explained but not emphasized enough in the app and hence users don't notice learning it.

C. Visitors learn about the problem of loss of biodiversity.

The users during the user tests hardly clicked on the button that would lead them to the information about the loss of biodiversity and how it is in danger. This indicates that this particular goal is achieved only if the user wants to find information about it through the app. Unlike the other parts of the app where the information was readily available as a part of the app, this part contained links to articles(that will open in the phone browser) that would provide the information. The users were fine with this way of interaction and it wasn't required to be made part of the app.

"I have all these images of, again, animal farms where they grow the animals that we eat. And then it's totally different from what I see"

User D

D. Visitors are informed and inspired to perform behaviors that are relevant for conservation.

The app definitely helped users learn about the positive behaviors they can do to support the communities that they depend on. The actions were clear. However there was one important missing link for the users to be inspired to take action:
How does undertaking a positive action positively influence the community of animals?

Moreover, in the overall experience of the app, User C pointed out that the link between the Savannah community and the local meadows was not clear and hence it was not clear why suddenly the app suggested behaviors that one can help restore meadows.

On one hand the users like the idea of being able to choose a certain domain of action, on the other hand User F pointed out that there were so many behaviors one could do, he/she would have rather preferred to know one or two behaviors that are directly impacting the communities of animals.

Recommendation for the final design

- **Clarify the role of communities in the everyday items we use such as meat, water, fresh air.**
- **Emphasize the human dependence on the communities in the experience of the app.**
- **Actively draw attention of the user towards the problems of loss of biodiversity locally as well as globally.**
- **Show the connection between the positive actions suggested in the app and its positive consequences on the communities.**

10.3 Concept validation from a Zoo educator

So far we discussed the desirability, usability and functionality of the app for the end users who are the visitors. As the implementation of the app has to be done by the zoo, specifically the education department, it was important to find out their perspective on the feasibility of the concept.

10.3.1 Objective of Validation

The main objective of the test is to find out feasibility of "Beyond the zoo" for the zoos.

10.3.2 Research question

For the purpose of the project, a semi-structured interview was chosen as a method to interview an expert. This method was chosen as it provides enough flexibility to ask open-ended questions that bring our perspectives relevant to the topic. Interview guide can be found in Appendix S.

The interview guide was made with two main research questions:
1. How does the concept fit to the context of the informal education at the zoo?
2. How practical is it for the zoos to implement this?

To ask these questions, it was important to understand the concept fully. Hence, the expert was shown the concept through the use of storyboarding taking them on a journey of virtual zoo visit and simultaneously showing the mobile app on the researcher's screen. After the presentation of the concept, the interview was conducted. The entire session was video recorded and relistened for extracting insights out of the interview. The session took place online through Zoom video call.

10.3.3 Participant

Because of the ongoing pandemic, only one expert could be interviewed: Mr. Colin Stevenson. Colin is the Head of Education at 'Crocodile of the world' for the past five years. He is responsible for both the formal as well as informal education that happens at their zoo.

10.3.4 Results

RQ 1: How does the concept fit to the context of the informal education at the zoo?

The content of the app that connects one animal with other animals and shows the relationship was very much appreciated. It mirrored the content of the educational talks that the zoo did and as per Mr. Colin, the app did it very well. Connecting the Savannah community with the local communities and then to the pledges about actions was particularly recognized as the strength of the concept. With QR codes and smartphone use being common amongst the visitors, he was also positive about the visitors welcoming the concept.

When asked about adding or removing something from his expert viewpoint,he recommended having some form of link with the IUCN Red list species or information about the conservation issues that particular animals are facing in the wild.

RQ 2: How practical is it for the zoos to implement this?

The expert showed very positive response towards the practicalities of the app. He was very keen on implementing the concept as the zoo is already exploring different opportunities to use QR codes at their zoo. According to him, the challenge this concept might face in becoming a reality is lack of mechanism to make sure that the visitors make use of the app. Apart from this, other necessary activities such gathering necessary information about the species and maintaining the app with an app development partner was not seen as a big challenge for the app.

Near the end, he showed willingness to support in development of this concept if it was to be taken up by BIAZA, which is a great validation about the usefulness of the concept.

Recommendation for the final design

- **Integrating the information about IUCN red-list in the app**
- **Information about the conservation issues of certain species in the app.**

10.4 Conclusions

Based on the recommendations, the final design concept is iterated and presented in the earlier chapter. However, due to the limited scope of time, it has not been tested. Hence before moving towards the next stage of development, it must be tested with the users.

Chapter 11

Conclusion

In this chapter we will conclude the report with a short conclusion, limitations and recommendations and a personal reflection.

11.1 Answering the initial question

We began this project with a broad question: "**In this time of almost mandatory sustainable transition of society, how can zoos leverage their capacity of reaching millions of people and become agents of positive change in society**?

To answer this question, two research questions were answered through the project:

1. What is the change to aim for?

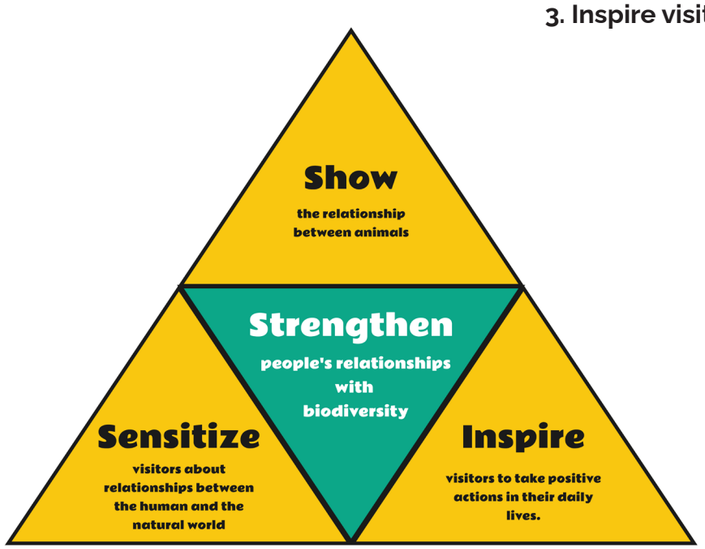
The change to aim for is the change of perception of people about nature **from being a sum of individual parts to an interconnected whole** and subsequently, change of people's identities **from being separate from nature to being a part of nature in their everyday lives**.

It should be noted here that identities are developed over time and the proposed concept here is one step closer to the goal.

2. How can zoos pursue this change?

Zoos have a unique capability of attracting visitors to learn more about wild and feel closer to it. This interest and emotional involvement can be used as a basis to show people the interconnectedness of the natural world and subsequently show one's own connectedness with the natural world on a daily basis. Zoos can pursue this goal by:

1. Showing the relationships between animals
2. Sensitizing about human's relationships with the animal world
3. Inspire visitors to act on a daily basis.



11.2 Limitations and Recommendations

This project was carried out in one of the strangest possible times for the entire world. The time when the pandemic Covid-19 took over the world. The guidelines to stay safe in the pandemic was to maintain a certain physical distance. The consequences of this were travel restrictions, a global shift of work culture and for the project, it meant limited access to the people from the context of the UK and the BIAZA members. Moreover, many designerly activities were limited because of the restrictions by the law. These limitation are discussed below:

Limitations of the design concept:

The design concept is designed based on the vast scientific literature about zoos and zoo visitors available online. Since the research could not be done in close contact with the BIAZA members or any zoo in particular the design concept may lack some consideration with regard to organizational priorities and capabilities. Moreover, the concept was designed being isolated from zoo educators. This means that an educator's considerations integrated in the design are limited to those that surfaced in the research. An active back and forth with an educator during the design phase would have been very valuable. It is also important to note that the iterated concept was not tested with users due to limitations of time and must be tested before moving further with the design.

Limitations of user testing:

The user testing was done either online or in person at an indoor place and not in an actual zoo setting. Although a story was created to give users a feel of the actual zoo environment, it was certainly not a substitute for an actual zoo. Testing it at an actual zoo with an actual visitor would have truly helped recognize the concept's positive and negative aspects. Moreover, the diversity of participants of user tests was limited in age and the results may be positively biased because they were mostly my friends or friends of friends.

Limitations of concept validation:

The concept was validated with only one Head of Education from one of the BIAZA members via an online interview. Definitely the concept can use more perspective from a diverse set of educators to increase its feasibility in various different member organizations. Moreover, the interview validated the overall idea, however the details about its content may require some more reflection from educators.

Recommendations for the zoos

Although the design concept is a tangible deliverable out of the project, **the future story created in the process should be considered as valuable (6.1).**The design concept is simply an example of how that future story may become reality, but of course there is more than one way forward. The future story can be used as a guiding star to inspire new activities and reform the current practices at the zoo one step at a time.

Through the research I came across many opportunities where I could see a designer add value to the zoo as organizations. These opportunities may inspire future projects for the zoos or for BIAZA. They are:

• **Developing** an organizational process where conservation education informs the exhibit design, rather than being an additional component that is added later.
• **Exploring** opportunities to support the large number of volunteers and employees who are motivated and driven about wildlife conservation in driving a mega scale societal change.
• **Collaborating** with organizations who are actively working for local conservation programs to draw people's attention towards the urgency of the problem and strengthen an individual's beliefs in local actions.
• **Developing** organizational capacity to strategically inform and inspire people to perform daily life actions for biodiversity beyond donations and volunteering.

Recommendations to BIAZA towards implementation

Although the implementation guidelines provide a good overview towards making this concept a reality, I have a few additional recommendation for BIAZA:

• **As** I mentioned earlier, the future story and the direction I laid out in the section 6.1, is a powerful and an innovative way to drive a deeper change in the society. BIAZA may reflect on it, revise it and appeal to their member organizations to adopt it within their organizations in a way that it is central to all the organizational activities (starting from a small detail on the zoo website to large structural changes in how the zoo animals are organized.)

• **The** design concept lacks an organizational perspective. Hence before presenting it to the members, a reflection about its potential barriers and how can they be overcome is recommended. In this way, the design concept is internalized within BIAZA and when presented, it would look like a well thought proposal rather than just another idea. Presenting it to the right people may help nurture the concept and find it's acceptance within the zoos.

• **From** an overall research I believe that there is a gap between the literature of behavior change and the educational practices at the zoo. I recognize that filling this gap and making the behavior change strategies accessible to all the zoo educators could be a valuable support from BIAZA for their members.

11.3 Contribution to the field of zoo education

The report presented contributes to the field of zoo education by recognizing that **acknowledgment about the interconnectedness of nature, which is core to 'biodiversity' is missing in society.** Recognizing a problem is the first step towards solving it. Although this may not be called a traditional problem, it is a state of the society which, if altered positively, may create a significant difference to the field of conservation. It is important to note that although the research is contextualized in the UK, I believe it is true for many countries and societies.

The human mind is cognitively limited to understand the complexity of nature. Hence the design concept presented here is an attempt towards simplifying the complexity and making it digestible by the visitors in an interesting and engaging way. It may serve as an inspiration to great ideas which may bring our urban society one step closer to nature and activate people to become biodiversity friendly.

11.4 Reflection on the design process

For the project, in the very beginning I decided not choose any particular methodology with an intention of facing the uncertainties and learning to navigate through it. At the end I am confident about my ability to navigate through the complexity. I remember a phrase I learned in my DTM course that "Design methods are like life jackets" and I can really agree to it. During the project, when the times got tough I regretted not choosing a particular process. Today, I don't. I'm rather proud to have survived the harsh waters without a life jacket.

With regard to the project context, in retrospection, I see ViP as a methodology that would have fit well. Initially, I was determined to use the tools from Systems Oriented Design such as Giga-map. However, over the course of the project I realized that the project did not have a complex challenge involving various stakeholder. Or the pandemic limited the involvement of various stakeholders whose perspective would have added complexity to the project.

11.5 Personal reflection

Finally, I will end this report by sharing my personal reflection with you.

Doing this project was a journey of confronting myself as a designer, a professional and a human. I have discovered parts of me I had never known existed. I have seen my strengths and weaknesses as clearly as a reflection in calm waters and above all I have learned to accept them in me and in others. Hereby, I would like to share my discoveries, re-discoveries and learnings throughout the project.

I discovered my love for storytelling and inspiring people in the form of narratives. This is also where my creativity naturally flows. I am curious about people and like to listen to their stories and experiences. It enchants me and inspires my creativity. This project was devoid of such open conversations with people. Truly, I see the value of such conversations for my own creative flow.

I discovered my inclination towards digging details, to an extent where I forgot why I was digging in the first place. It showed me my natural ability to micro-think but I also learned that it could also blind me towards the bigger picture. Moving forward I wish to maintain a balance between micro and macro.

I rediscovered my love for knowledge and research but I also experienced how it constrains me from acting on it or making something tangible out of it. Moving forward, I aim to remain aware of this fact and actively try to pursue more action.

I learned about design as a process and what teachers and practitioners really mean by it. In simple words I would say, earlier I knew what design is, but after the project, I understand what does it mean to design. The discovery of the difference between the two was a revelation I loved witnessing.

I learned the meaning of synthesis and how valuable it is. My love for knowledge drives me to gather ingredients, but the true power lies in mixing some and leaving out others to produce something that generates value. Moving forward I aim to actively pursue it.

I learned the value that a domain expert could add to the project. As a designer, it makes me accept my own limitations of expertise and helps me listen to the experts with an open mind.

Reflecting over the course of the project, I feel I have come a far way from where I stood at the beginning of the project. I have become humble towards the complexity of the context and the limitations of my own knowledge. I have become accepting of uncertainty about circumstances and sometimes even about myself. I have realized the importance of a healthy state of mind for a joyful life. And most importantly, 'biodiversity' taught me the importance of the relationships and bonds that I share with people as the key towards a peaceful and resilient life.

With this, I end this journey; excited to embark on the next one!

11.6 References

A.

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