TRANSLATING THE ‘MAN-MADE’

AN UNDERWATER OBSERVATORY

ON THE SHORELINE OF LAKE MALAWI

BY ADELINE GRUBER
04/12/2014
Figure 2, Head in Water
ABSTRACT

“That environment and those structures invest the vast differences of nature with meaning intelligible to, indeed imagined by, a mankind and they involve in the end all those complex relationships of human buildings with each other that shape within nature a man-made topography.” (Scully 1991: 1)

Humankind has forever been placed outside the realm of nature, peering in as a spectator through a frame. That which is organic is ‘natural’ and that which we create is ‘man-made’. A beaver’s nest would not exist if the beaver had not built it, yet it is ‘natural’. If humans are of earth then surely that which we build is ‘natural’ as well? Let us translate the ‘man-made’ back into the natural world.

Lake Malawi makes up one-third of its country. Local Malawians are dependent on this resource for livelihood, food, water and sanitation but overfishing threatens it. Cichlid fish native to the lake are a rapidly evolving species, they are also a rapidly depleting food source. The lake with its local fishing villages is nature with us in it.

I propose an underwater observatory on the shoreline of the lake, to address a species and a food source. Local Malawians inhabit the shoreline within a nature that has been adapted to meet the needs of human activity. Fishermen prepare their nets at sunset, go out at night with flickering paraffin lamps, and return at sunrise with a diminishing catch of Chambo while women make their way to the water’s edge to wash and collect water.

The chosen site is situated in Cape Maclear at the entrance to Lake Malawi National Park which is protected aquatic sanctuary. An established tourist industry supports the local community of Chembe village. The observatory is a threshold to the park and a liminal boundary between land and water, in and out, above and below. The programme is categorized within Science and Community. Communal facilities address alternative food sources, sanitation and education while science facilities document and record the rapid evolution of Cichlids.

If architecture can be viewed as a hybrid, a construct of both human culture and nature, then let an amphibious structure rest upon the water’s edge, partially submerged and partially elevated over water and land. Acting as a bathometer, climatic changes mark its surface as it modifies nature while nature modifies it. Designed to adapt to fluctuating water levels, the facility evolves as rapidly as its native Cichlid fish. By reframing the mindset of locals and visitors, we become part of an evolving ecosystem and may begin to truly acknowledge the part we play in it. We attempt to preserve a species and a livelihood, yet preservation may be viewed as the pursuit of stagnation. Our livelihoods, our food and our buildings are of this earth. Like nature, they must continuously adapt, modify and evolve.
DECLARATION

I, Adeline Gruber, 311090 am a student registered for the degree M.Arch(Prof) in the year 2014.

I hereby declare the following:

I am aware that plagiarism (i.e. the use of someone else’s work without permission and/or without acknowledging the original sources) is wrong. I confirm that the work submitted for assessment for the above course is my own unaided work except where I have stated explicitly otherwise. I have followed the required conventions in referencing thoughts, ideas and visual materials of others. I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my unaided work or that I have failed to acknowledge the source of the ideas or words in my own work.

ADELINE GRUBER
4 December 2014

This document is submitted in partial fulfilment for the degree: Master of Architecture [Professional] at the University of the Witwatersrand, Johannesburg, South Africa, in the year 2014.

Figure 4, Fish Skull
ZIKOMO KWAMBIRI*

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* Zikomo Kwambiri: The term used in Chichewa, the native malawian language, for 'thank you'
To translate the man-made back into the ‘natural’ world removes the separation that modernist ideologies have constructed between humankind and the land we live upon. It is this separation that renders the living inert and the natural artificial.

The first chapter in my thesis explores this separation through an exploration of artifacts. I unravel the blurred lines between the ‘natural’ and the ‘man-made’ and then support this notion by unpacking the literary work of Bruno Latour.

Along the tranquil shoreline of Lake Malawi (where my site is located), this translation between human activity and the changes occurring within the ‘natural’ context are intertwined. The lake is a livelihood, it is ‘nature’ with us in it. This relationship showcases how we modify the ‘natural’ to build a home to live in and the ‘natural’, in turn, modifies our buildings.

The second chapter introduces the relationships existing between people and nature within the broader context of my chosen site. Not least of all, this raises issues within the relationship such as the depletion of both a country’s food source and an endemic species.

In response to this relationship, my thesis proposes an Underwater Observatory on the shoreline of the lake to address a depleting food source and a rapidly evolving species, a facility which modifies the ‘natural’ context it sits within, while allowing for ‘nature’ to modify it.

In this third chapter, a programme develops within various conceptual frameworks. A design and a technical approach is proposed for an Observatory in Cape Maclear, Malawi, where architecture links people to their natural context.
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01.
TRANSLATING THE ‘MAN-MADE’

i. On Ontology  
ii. Artifact Through Modification  
iii. Framing The Living  
iv. A Fish in a Bowl Like a Bird in a Cage  
v. Speaking of Nature  
vi. Cruel or Kind  
vii. The Separation  
viii. Translation and Purification  
ix. A Quasi Object  
x. We Modify the Natural  
xi. The natural Modifies the Man-made  
xii. Reframe

Within this given thesis the term ‘man-made’ is used with the following definition:

“Made or caused by human beings (as opposed to occurring or being made naturally)”

(Oxford, 2014)
Nature is defined by the Oxford Dictionary as “The phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations.” This places humans and the man-made outside the realm of nature and categorically separates us from the physical world. However we do physically exist within this world and if not on earth then where? We are physical beings, as are animals and if we are not products or features of this earth, then what are we products of? In some arguments, humankind is placed above nature which suggests we may do with it as we please. Within this separation where does a relationship with nature exist? This begs the question, at what point does nature no longer exist in nature?

Through an exploration of artifacts, I will attempt to question the common understanding of the ‘man-made’ and re-interpret its existence so natural object and artifact may be one and the same, where the natural is constantly being translated into the ‘man-made’. Through separate studies such as the art of bonsai, the act of bird caging and fish keeping, and the collection of butterflies, I shall attempt to build an argument that shows how natural objects become artifacts produced through culture.

Following from this, I pose the question; is the artification of nature cruel or kind? I will explore both possibilities but shall leave the question as a rhetorical one.

To expand on this notion, I then follow with Latours principals of purism and translation from his book; We Were Never Modern to unpack the dualism which lies within our modern society.

Through this exploration I hope to interpret people’s relationship with nature and place that which is man-made within the realm of the physical world (nature). If architecture can then be viewed as a Quasi-object, a product of both nature and culture, a hybrid which links both realms, then that which we construct in architecture develops its own nature, and when exposed to the physical world, it is modified by the natural context into which it is placed.
I. ON ONTOLOGY

Ontology is a branch of metaphysics that studies the nature of existence or being as such. With the common belief that artifacts are inert objects which lack natural essence, their ontology (nature of being) is questioned and many philosophers such as Aristotle regard artifacts as “ontologically deficient”. Some may argue that this is what differentiates artifact from natural object. Others have gone as far as to say that man-made creations such as ships and hammers do not actually exist (Baker 2004; 10). Baker argues against this notion in his paper The Ontology of Artifacts. Baker points out that although an artifact depends on us (it would not exist if we did not create it), it also depends on nature with us in it (we could not create it without existing in nature) (2008: 6). Thus the natural is constantly being translated into the ‘man-made’.

The concept of ‘natural’ (a product of nature) and ‘unnatural’ (a product of humankind) becomes a duplicity. We may argue that the process of human modification renders a natural product unnatural as it would not exist naturally if we had not created it. When a beaver assembles sticks along a river bank to build its nest, the nest would not exist if the beaver did not create it (figure 7). We consider the nest to be of nature and not an artifact.

II. ARTIFACT THROUGH MODIFICATION

If we argue that humans, like animals, are part of nature and what we create through modification is an artifact, then that which nature modifies is rendered an artifact as well and that which we modify is of a genuine substance.

It is easy to understand the notion of artifact when we speak of an inanimate man-made object such as a clay pot (figure 8). Although the pot may be made from a ‘natural’ material (clay), the potter manipulates the material by molding it into a desired shape as shown in the adjacent image. Baking the pot in a kiln changes the clay,
making it resistant to both fire and water. The potter has modified the natural, and in doing so renders it an artifact. The artifact is inert, lifeless and has been created for our use and aesthetic pleasure. In the same way, we may say that a chair or a car is an artifact as well. Such things would not exist if we did not create them.

What about animate living 'objects'? The art of bonsai, dating back to 1133 AD, is a delicate art of modification through a process called nanization (artificial dwarfing). Great care is taken in pruning a specimen to grow as a miniature version of itself. The intended effect is to capture an aesthetic sentiment which may suggest, through a miniature replica, its true existence in the wild. “There is a living thing which goes farther and enables us to envisage a piece of scenery” (Kobayashi 1966: 6). The bonsai symbolizes - “a portion of the world in miniature” and simultaneously is a portion of that world.

The art of Bonsai teaches how and why nature behaves as it does and how we may modify this process to achieve a desired result (McDowell 1965:5-6). “A bonsai is not merely a plant in a pot, expected to put forth lovely flowers: its object is to express beauty or sublimity, it must have a magnetic charm and evoke poetic beauty” (Kobayashi 1966: I). By removing the tree specimen from its true context, placing it within the confines of a pot and delicately modifying its growth, the bonsai has been rendered an artifact. It is not an inanimate object as we commonly understand artifacts to be. It lives, is subject to its environment and changes over time.

Today, the bonsai allows for simple pleasure. One can suspend a moment in the world of imagination that is created within this piece of scenery that is a bonsai. “For a few minutes, walls can be made to vanish, an inch-high mound of moss can become a green meadow, a small rock a mountainside, a few seedlings an entire forest.” (Bonsai, 6). Although removed from its natural context, it can be perceived as a small pleasurable part of a whole. It may show a glimpse within an ‘other world’ so distant and apart from its reality.

This ancient art was born through a culture which aestheticised the form of a grand and ancient tree. The visual appreciation of nature lead to its re-creation in miniature form.
Allen Carlson expresses how “we must remove the object from its surroundings in reality, then we will be able to treat it like a work of art, perhaps a ‘ready-made’ but not as it is in itself” (Leddy 2008). Once removed, like this Antarctic Beech tree exhibited in the Gallery of Modern Art by Cai Guo-Qiang (Figure 10), the natural object, living or not, is no longer attached to the realities of its natural habitat. “The absence of [a] fixed, meaningful identity” (Malamud 2012: 3) allows us to indulge purely on its aesthetic beauty as it is laid in front of us to view.

“The aesthetic status of an object, whether nature or artifact, is dependent upon the cultural context in which it is experienced.” (Bourassa 1991: 11). Culturating an object modifies its definition and renders it part of the arts. Within the realm of visual culture, society addresses the world through graphic media such as illustrations, photographs and imagery. How we choose to depict objects through graphic media will affect our interpretation of it. A picturesque landscape may be interpreted from a billboard along an urban highway (Figure 11). We may associate animals with cartoon characters such as Mickey Mouse (Figure 12). Our closest interaction with the ‘wild’ may be through a 37 inch high definition television screen showing the latest nature documentary and our experience of the underwater world may be through a 6mm thick glass tank in a pet store (Figure 13).

Malamud explains, in Animals and Visual Culture, that visual culture becomes a framing mechanism through which we interpret that which we have framed. When we place nature and animals within such frames, our interpretation of them will differ according to the frame and the tableaux we place them in. “Just as we have come to prefer that so many other aspects of our lives should be transposed into visual culture, so, too, do we come to expect that animals should live in this realm, in this cultural context.” (2012: 2). Framing modifies the animals identity.

Regarding the places where animals exist, wherever it may be, they will always be
framed by us. The frame confines and defines where the animal may exist. “This framing privileges the space inside the frame – here is where we will acknowledge you, it says; here is where we expect you to be when we look – and it voids the space outside the frame as inaccessible. Irrelevant, out of bounds.” (Malamud 2012: 5). We may view the beauty of flowers contained in a vase within the comfort of our living room. This frame as Malamud explains it, may remove the living object from its context and place it in an easily accessible containment for our own instant gratification. The frame determines the boundary, and the glass is the lens through which we view its confined contents. Visual culture becomes a structured mechanism through which we may curate an artifact and collect various worldly delights (2012: 5). It may be argued that human perception is a frame, rendering all that we perceive as artifacts.

“Contemporary culture resituates animals by positing that they belong anywhere, which is to say, that they belong nowhere. They ‘go’ where people put them: ‘go’ not in the sense of having agency or active volition in the process, but as one might say a lamp ‘goes’ nicely with a particular style of drapery – as an accoutrement, a prop.” (Malamud 2012: 3)

How nature is translated through art and culture moulds our understanding of it. We may be captivated by a silver bracelet adorned in colourful crystals depicting an array of flowers and leaves (figure 14) or a finely detailed tattoo of a koi fish wrapped around the torso of an attractive body (figure 15). This transforms a fixed identity of nature, into a malleable and abstract one, which allows it to exist wherever one chooses to place it (Malamud 2012: 3).

### IV. A FISH IN A BOWL LIKE A BIRD IN A CAGE

Fish enthusiasts have created a booming industry through exotic fish exportation. The koi, a mutated species descending from the Common Carp, originated in the South of China. Like the bonsai, through breeding, the species was modified to achieve desirable colours, shapes and patterns. Koi became the subject of Chinese artworks.
and were kept in ponds as part of an ornamental aesthetic (figure 16). (http://www.uekoi.com/Koi-History-c-26.html. The Koi is man-made.

The keeping of aquariums can be dated back to 2500 BC. A display at the Monterey Bay Aquarium depicts jellyfish as ‘living art’ (figure 17) which may be argued to be just that. The visitors view the jellyfish through a metaphorical perception, “to see something in a category it does not naturally exist in.” (Leddy: 2012), nature as artifact. This has been achieved by removing the jellyfish from their natural environment and confining them within a glass tank. The jellyfish itself has not been modified like the dwarfing of the bonsai. The tank, like a frame, confines it and the glass is the lens that transforms it.

Although visitors are given quick facts about where these beautiful creatures come from and a brief break down on their evolution as a species, one does not require such knowledge to appreciate this natural object/artifact. A study conducted in 2004 revealed that people found the exhibition to be “relaxing, peaceful, colourful and beautiful”. The visitors said, “Jellies inspire art.” and that “art showed the beauty of jellies”. (Yalowits 2004, 5).

A rather more contentious tradition of living art is one of bird caging. The incredible beauty of this species has captivated the minds of the wealthy and left a life of captivity for the unfortunate living specimens. The bird, as portrayed in the adjacent image (figure 18), is placed wherever its captor chooses to view it. Dating back as far as 900 AD, Paquime Indians bred Macaws in captivity. “These ancient bird breeders harvested the birds’ feathers for use in their ceremonial religious rituals, a common Meso-American practice.” (Sund).

In the 17th century in England and France, bird caging became part of popular culture among the rich. The trend was not only in the exotic collection but also in their ornate and heavily decorated cages (Figure 19). In this example the frame does not simply confine the living art, it also becomes an artifact in itself. Easy to move from one room to the next, the caged bird became the very first portable entertainment system.
V. SPEAKING OF NATURE

Language as described by Spencer is man-made and is the result of the human condition to construct the world we live in. We attempt to achieve this by creating a set of rules which will enable us to “know what information to select, how to piece it together, and what interpretation to impose upon it” (Spencer 1980). Through language we believe we can classify and structure nature. Through this process of selection and pattern interpretation we may achieve a sense of order and understanding. She explains this as “our means of manipulating reality” (1980) through the ‘use’ and ‘structure’ of language. She goes further to say that to seek meaning an additional set of rules apply. Such rules are not discovered, they are invented and through them we frame our understanding of knowledge.

Language gives humans a superior advantage. It allows us to interpret nature through our own desired process to formulate a desired result. We then accept that result because through language we have defined it as such. But language does not render knowledge, it only creates a frame through words. Some may even say that knowledge is in fact constituted through language.

Entomology and the classification of species is a great example of how we have framed nature through language. Darwin’s taxonomy chart of an endemic butterfly species in the Caribbean displays this very classification (figure 20). The hobby of butterfly collecting has built a library of wondrous trinkets (figure 21), carefully pierced through their abdomens, pinned in geometrical precision and ordered in size and classification, specimens are preserved and displayed. Unlike the bonsai, the butterfly has not been physically modified. But, similarly to bird caging, the butterfly has been placed within a frame of language and framed within a transparent coffin. This is how the (no longer living) artifact is displayed. “Half of the histories of butterflies can be summed up as a passion for beauty and a lust for ‘curiosities’” (Salomon 2000: 25), the other half may be the noble quest in understanding these beautiful specimens as through the works of Charles Darwin and Gilbert White.
“Our relationship with nonhuman animals is rich, intricate, and troublesome. People are fascinated by nature and respond to them in ways that are at times full of homage and awe, and at other times oppressive and perverse. We are prone to appreciate, or fetishize, animals in isolation as discretely framed specimens (in a zoo, or as a pet, or a meal, or a toy) distanced from their groups, alienated from their contexts.” (Malamud 2012: 52)

Nietzsche suggests that “the best experiences we have in life are of art like experiences” (Leddy), then the search for art in nature may sound like a noble endeavor. When we place nature within a metaphorical perception of nature as artifact, the experience may be great but what are the conditions and consequences?

As through science, can we acquire a better understanding of nature through art? “Can the power of art implant a more powerful model of the landscape in the human psyche?”

VI. CRUEL OR KIND
(Tunnard 1978: 36) or is it merely a cruel and indulgent pleasure? One may argue that by modifying the natural and placing it within a confining frame we exert control over it. Artifacts are commonly seen as lifeless inert objects created for our personal use. If a living thing is placed, located and reproduced as an artifact it may result in our disconnection with it as a living being.

“Cages display birds, keep them safe from predators and prevent their escape.” (Sund). Today’s best cages are durable, easy to clean and cost effective. Some thought has gone into bird psychology “Manufactured with play gyms, today’s cages can provide enrichment, activity opportunities, a healthy, clean environment, and the security and serenity a roost provides in the wild.” (Sund). How true this may be is questionable if their wings have been clipped and their habitat reduced to an enclosed cubic meter of air.

The concept of the Zoo has been sold as a place where people are granted the chance to appreciate natural wonders which many would otherwise never see in their lifetime. Animals are resituated to places which make them convenient and easily accessible. (Malamud 2012: 3).

In Britta Jaschinski’s Zoo Series, animals in captivity are photographed within their convenient frames (figures 24 - 28). The Zoo Series displays the harsh juxtaposition of isolated animals within the stark confines of their new habitats. The photographs capture precisely where and how we have chosen to view these animals; conveniently, with a clear unobstructed view and removed from any context. The man-made environment into which the animal has been framed may define the animal as a ‘floater’ (absent of any true time and place).

“Where are we positioned as we look at these animals? Where are we literally, spatially, physically?” (Malamud 2012: 56)

We cannot deny our aesthetic attraction to the beautiful and sublime. The success of aquariums and zoos are largely dependent on those beautiful species we are attracted to.
Such species are the spectacle of the show; the exotic tiger, the elegant Manta-ray and the jellyfish. It is through our imagination that we may render it beautiful / fascinating.

Rolsten describes in Beauty to Duty that we appreciate beauty through our aesthetic “capacities for experience that are only in beholders” (2002: 132). Similarly Kant (1911) explains that aesthetic is the product of our consciousness. To appreciate it we must take it, imagine it and make it our own, like a child observing a bird (Figure 29). Hence beauty is created in the imagination. Love is also produced through the imagination. Without this imagination of nature that renders it aesthetic, we cannot ‘love’ it. When nature resides in our imagination, it enables us to emotionally connect with it. Framing nature as artifact is a response to our consciousness. It is our ability to translate our imagination into something tangible.

We are compelled to care for that which we love. When something beautiful is at the risk of being destroyed, a common reaction is the desire to save it. Eugene Hargrove claimed that environmental conservation historically began this way “with scenic grandeur: ‘The ultimate historical foundations of nature preservation are aesthetic’” (Rolsten 2002, 127). Similarly people have a greater sense of responsibility for that which they claim to be their own. If we place ownership over natural things we feel responsible to care for them.

By modifying a natural living thing we render it an artifact. We alter its meaning and its natural existence. In doing so, an interesting relationship develops between man and nature. In one way we exert control over it and in doing so disconnect with the living art and render it inert. In another way this act is a response to our imagination, through our imagination we are able to emotionally connect with natural objects. We must also note that nature itself is not stagnant. Just as we modify the bonsai, it is consistently modifying and changing itself as well.

Although there clearly lies a liminal space between nature and humankind, where similarities blur our generic understanding of the two, and natural things are translated into ‘man-made’ artifacts, there still exists a clear separation framing us outside of our natural world.
Modernism has often been defined in terms of human nature and the constructs of society and culture “… it overlooks the simultaneous birth of non-humanity- things, objects and beasts.” (Latour 1993: 13). Modernism, as defined by Latour in We Were Never Modern, comprises of a constitution which separates the natural “constructed never the less by man” from human society “sustained nevertheless by things” (Latour 1993: 31).

Cronon describes this separation in The Trouble with Wilderness by confronting the general perception of wilderness as wilderness being the last frontier, pure and true to the correct form of life on Earth.

“If one saw the wild lands of the frontier as free, true, and more natural than other, more modern places, then one is also inclined to see the cities and factories of urban-industrial civilization as confining, false and artificial” (Cronon 1995: 77)

The wilderness perception places the natural world on a pedestal as an untouched land. It is portrayed as an exemplar of how things should be as depicted in the photograph adjacent where society has not yet “fully infected the Earth.” (Cronon 1995: 69) It is existence separated from human intervention.

In the Manhatta Project, Sanderson portrays how New York would have looked like in 1609. The image adjacent showcases a wilderness which was once rich is biodiversity, now rich in cultural diversity.

Natural science and social sciences have forever been separated by this constitution. This dualism forever places humankind outside the realm wherein we actually exist.
Figure 31, Manhatta Project, New York
from: http://aplusarchitecture.wordpress.com/2014/02/24/the-mannahatta-project/
The search for differences of fundamental contrasts between the phenomena of organic and inorganic, of animate and inanimate things, have occupied many men’s minds, while the search for community of principles or essential similarities has been pursued by few.” (Thompson 1966:7)

The Online Clothing Study looked at natural and man-made fibers through a microscope. It displayed the molecular composition of wool, mohair, and other natural materials and compared it to synthetic fibers such as nylon and polyester as shown in the figure above. Does there exist a true separation between the two?

Does there exist a middle ground where objects - artifacts, products of humanity and even architecture - are neither natural nor a product of culture but a construct of both?
The natural and the man-made are both products of matter originating from Earth. By definition humans are placed outside the realm of nature. As described by Latour, in his book *We Were Never Modern*, modernists have pursued purification which removes anything 'non-human' from humanity and culture thus separating humans and 'non-humans' into “two entirely distinct ontological zones” (Latour 1993: 11).

Beyond this separation we attempt to understand that which is non-human through the practice of translation. The word ‘translation’ is used by definition as the conversion of something from one form or medium into another, from natural to artificial. This “creates mixtures between entirely new types of being, hybrids of nature and culture”, like bonsai’s, butterfly collections and zoo animals.

The first (purification) establishes “a partition between the natural world.” (Latour 1993: 11). The other (translation) “links in a continuous chain” (Latour 1993: 10) human and non-human. These two practices are portrayed in the adjacent figure; nature and culture are clearly depicted as separate entities on the one hand while on the other they are intertwined by a network of links and connections.

Latour warns that if we should attempt to simultaneously purify and translate, we are no longer ‘modern’. We cannot separate and link ourselves to the natural world simultaneously. However, this is in fact what we do. If we say “nature is a world constructed by human hands”, modernists will argue that science is simply a frame through which one can observe nature without interference. If we argue that people are free to do as they please, the modernist would say “Nature is transcendent and its laws infinitely surpass us.” (Latour 1993:37)

Therefore the modernist is able to apply its logic to anything without being limited or opposed. We can corrupt a world within culture because what is out there, in the wilderness, is ‘pure’. All of this occurs while we manufacture, confine and modify that very wilderness (Latour 1993: 32).

“So long as we consider these two practices of translation and purification separately, we are truly modern - that is, we willingly subscribe to the critical project, even though that project is developed only through the proliferation of hybrids down below” (Latour 1997: 11)
Everything happens between nature and culture but this liminal space has been rendered a 'non-existent, “unconscious” place' (Latour 1993: 37). Latour defines a hybrid object, manufactured from both nature and culture, as a quasi-object: An object that links a non-human object to a person, “they do not belong to nature or society” (Latour 1993: 65) but are a product of both. Let us use the bonsai in figure 34 as an example. A person has created its form through careful pruning. It is a person’s activity of watering, placing it within the confines of a pot and nurturing it which has transformed its existence. Without this human activity, the bonsai is just a tree, an object of physical matter. Therefore this object actually represents the very relationship modernists attempt to deny.

It was Serres who originally posed the theory of the quasi-object in his literature work; The Parasite. Here he compares Society to a parasitic organism (Figure 35 & 36). “We have domesticated the Ferret and no longer know about the wild variety. We make it run for us, like the buzzard, like the Kestrel; we parasite them.” (Serres 225). He also poses the question, “What is the collective?” (Serres 224) and attempts to explain it through the relationship between the individual, the collective and the object. Serres explains a quasi-object using a ball in the caption adjacent. Let us view architecture in the same view, as a quasi-object. Architecture like the ball, is what it is only if a subject holds it. Out there in the landscape it is merely a form with ‘no meaning’. It does not function alone. If used exclusively by one kind of being (humans) it will be separated from the whole (nature). We can say that a building isn’t there for people, the people are the object of the building, continuously moving in and around it.

If we treat an architectural work as an artifact, we say that it has been created through the modification of nature by humankind. Like the bonsai, natural resources are moulded and modified to form its building blocks. We thus transform existing physical matter into a shape and form desirable to house other human activities. Without this human activity, timber is just a tree and clay is just earth. In fact, it is my belief that architecture is the most extensively used and vastly spread quasi-object which directly links civilisation to the natural realm.

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ix. A QUASI-OBJECT

A ball is not an ordinary object, for it is what it is only if a subject holds it. Over there, on the ground, it is nothing; it is stupid; it has no meaning, no function, and no value. Ball isn’t played alone. Those who do, those who hog the ball, are bad players and are soon excluded from the game. They are said to be selfish [personnels]. The collective

*The ferret is the animal, the ferret, as well as the marker in a game somewhat like hunt-the-slipper or button, button, who’s got the button?—Trans.

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Figure 34, Bonsai Cutting. from: http://www.fukubonsai.com/4a6.html
Figure 35, Humanity
Figure 36, Organisms

Figure 37, Quasi Object, Serres, M. 1982. The Parasite. Baltimore: The John Hopkins University Press
X. WE MODIFY THE NATURAL

In reality, the bonsai is no more inferior or less deserving of our respect than its ancient ‘untouched’ counterpart in the ‘wilderness’. (Cronon 1995: 88) Mankind’s modification of nature is in fact as much a natural occurrence as a bird’s modification of the grass it will use to build its nest.

The reality is that human existence is intrinsically dependent on the very nature it separates itself from. “In Aristotle’s parable, the house is there that man may live in it; but it is also there because the builders have laid one stone upon another.” (Thompson 1966: 5) Nature has in fact, for at least the past 200 000 years, been earth with us in it. Our presence is constantly modifying and moulding the ‘wilderness’ we claim to be untouched. “The shape of architecture is the shape of earth as it is modified by the structures of mankind.” (Scully 1991, 1) Through this symbiotic relationship, humankind has constructed a home to live in, an environment manufactured to accommodate our way of life and a product of our very own culture. Latour compares it to life in a laboratory as depicted in figure 38 adjacent, “despite their artificial construction inside the vacuum pump”, men construct their own cultural world durable and solid, massive and powerful. “Constructing nature artificially and stating that they are discovering it.” (Latour 1993:31) This cultural civilization has to be manufactured, built, “And out of what material could it be built if not out of non-social, non-human resources?” (Latour 1993: 65)

Thus nature exists within and around this very construct. It is not an untouched realm but a product of our society and the very culture we attempt to deny. (Cronon 1995: 69) We modify nature or ‘mobilise’ it as Latour would say, “To transfer thousands of objects from nature into the social body while procuring for this body the solidity of natural things.” (Latour 1993: 37) By admitting to this process of modification we reframe man into the natural realm, to say our presence on earth moulds its form. “The first fact of architecture is the topography of a plane and the way human beings respond to it with their own constructed forms” (Scully 1991:1).
“That environment and those structures invest the vast differences of nature with meaning intelligible to, indeed imagined by, a man kind and they involve in the end all those complex relationships of human buildings with each other that shape within nature a manmade topography.” (Scully 1991: 1)

Architecture not only modifies the form of the earth, it shifts the ground upon which it is placed, redirects an existing movement path, re-channels a gravity fed water flow and alters an existing biosphere. “the planes parallel to the Earth and in buildings themselves, do most to make the buildings belong to the ground” (Wright 1970: 1). Scully believes, as he emphasized in Architecture: The Man-made and the Natural, that it is through this relationship of manmade and natural being, that architecture can produce a rich physical and intellectual experience “and it is the one that is most neglected. The blindness of the contemporary urban world to everything that is not of itself, to nature most of all” (Scully 1991: xi)

**xi. NATURE MODIFIES THE MAN-MADE**

This relationship undeniably acts both ways. After all our attempts to become the master over natural existence, humans remain at the mercy of natural phenomena. It “…dominates us in an equally global fashion and threatens us all.” (Latour 1993: 9)

All we need to do is look at the great temples of our past, built to represent the power and strength of civilization, now crumbling stone by stone. Weathered by the suns’ heat, dismantled grain by grain from the wind and washed away to further regions by water. Temples of strength such as the Acropolis (Figure 39) and the pyramids, are now defined as the great ruins of our existence. It is the law of nature to deconstruct the very structures of power we claim to place in hierarchy over the natural realm.
“Every nesting bird, every ant hill or spiders web, displays its psychological problems of instinct or intelligence. Above all, in things both great and small, the naturalist is rightfully impressed and finally engrossed by the peculiar beauty which is manifested in apparent fitness of adaptation— the flower for the bee, the berry for the bird” (Thompson 1966: 3)

This very ability to adapt to man’s intervention surpasses any man-made boundary or limit we attempt to place upon it. Eroding walls become nesting grounds for cockroaches (figure 40), an cave becomes the perfect perch for a cooing pigeon and crumbling walls provide a sturdy structure for creeping plants (Figure 41). Even discarded plastic becomes a floating biosphere (Figure 42) for a diversity of aquatic species. Modifying its environment and adapting to a constantly changing earth is a practice nature (with us in it) has forever been actively involved in.

Climate change, believed to be humankind’s ultimate cause of disaster, is destroying natural biospheres. Is it really a disaster or merely change, a change to adapt to? Ecologist have been reporting a shift in natural phenomena. Birds and butterflies are simply moving to higher altitudes “11 m per decade” (Marris 2014). Nature’s clock has shifted. Birds nest and flowers bloom earlier in the season. Reports from the National Park of American Samoa show that coral reefs are becoming resilient to warmer water and European snails are lightening in colour to lower body temperature. (Marris 2014) Nature is simply adapting and modifying.

Thus humans construct and in doing so we greatly modify the earth we live upon. In turn, nature adapts itself and modifies that which we construct to co-exist upon the earth we all live in. Nature and the man-made is translated as it continuously modifies in shape, form and medium.
The Dualism presented in modernist thinking which places humans on the one side of a partition and nature somewhere 'out there', defines us as observers looking through a frame. It is within this frame that modernist thinkers are granted power to “mobilise nature at the heart of social relationships, even as they leave nature infinitely remote from human beings.” (Latour 1993: 37)

Nature has not merely been modified by the buildings of our civilisation, it has also been tamed “by those who most celebrated its inhuman beauty”. (Cronon 1995: 75) The wilderness as explained by Cronon has become the spectacle. Tourists, with their urbanized ideas, look upon the ‘uninfected’ land as a place for consumption, to fulfill a craving for adventure, relaxation and recreation as illustrated in figure 43 adjacent. It offers an escape from an ‘artificial modern’ society. “The irony, of course, was that in the process wilderness came to reflect the very civilization its devotees sought to escape.” (Cronon 1995: 78)

It is precisely this modern idea that removes humans from our context and makes nature, the spectacle. In a modernist society where food comes packaged from a shop, where plants are what you prune in your garden and the houses in which you live have no resemblance to the natural material they were built from. In contrast, this is not the view of those who have “worked the land to make a living”. (Cronon 1995: 80) This romanticised view of nature un-spoilt, leaves no place for us to survive off the land. (Cronon 1995: 80) Many are dependent on the land to support a community. This is a reality in most third world countries such as Malawi, where artisanal fishermen are dependent on the lake for their livelihood as shown in the photograph adjacent. A modern idea that seeks a nature with humans removed from it, will not solve the “massive environmental problems and deep social conflicts” (Cronon 1995: 82) they face. This idea will not aid us in forming a culturally ethical and naturally sustainable existence for us within nature. (Cronon 1995: 81-82)

Latour, speaking of the constitution of the Achuar (Amazon region) by Descola 1993,
describes a tribe who has no notion of nature and humans immanent as two separate entities.

“Yet the achuar have not completely subdued nature by the symbolic networks of domesticity. Granted, the cultural sphere is all-encompassing since in it we find animals, plants and spirits which other Amerindian societies place in the realm of the nature. The Achuar do not, therefore, share this antinomy between two-closed and irremediably opposed worlds; the cultural world of human society and the natural world of animal society.” (Latour 1993: 14)

Can we reframe our modernist perception in a way that places that which is man-made within the natural realm, where the man-made is a product of nature and nature in turn is a product of human kind? Can we accept that we live within an environment that is ever changing and adapting and “altered by our own activity”(Cronon 1995: 82)?

Latour expects that an anti-modernist may attack its practice in one of three ways; Mix nature and society to produce a hybrid, Naturalise society through integration or Socialise nature. (Latour 1993) If architecture is a Quasi Object, a hybrid construct. May it stand as an earthly form built from non-social, natural resources and moulded by a rich social culture.

“If wilderness can stop being just out there and start being also in here, it can start being as human as it is natural.” (Cronon 1995: 90)
IN CONCLUSION

Currently we are placed outside the realm of nature. This separation is an act of purism constructed through a modernist ideology. Nature is what exists out there without us in it but this division is in fact an illusion. We frame nature into our cultural society while we cannot deny that society is a product of nature.

Through modification, nature is translated into the man-made, and by the laws of nature, our man-made construct is modified and translated back into the natural. This produces a vast collection of hybrids, quasi-objects and artifacts, which are neither a product of culture nor one of nature but a construct of both.

If architecture is treated as a quasi-object, we can say that it is a product of nature and formed by the constructs of culture. In creating architecture, we modify an existence of being by manipulating a given site and changing the molecular structure of ‘natural’ materials, yet it still remains subject to the natural phenomena of rain, sun and wind. It is also subjected to changing culture. In so doing, it is transformed to meet the needs of its human inhabitants.

Let us reframe humankind back into the realm of nature by using architecture as a tool, a mediator, to link the natural to our cultural society. We must accept that our man-made architecture will alter the natural context and in so doing, we claim responsibility for it. Architecture should allow nature to modify our man-made structures to accommodate for its non-human inhabitants.

Therefore nature is not just out there but in here, with us in it.
02. ON THE SHORELINE OF A LAKE

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i. LAKE MALAWI

Lake Malawi rests on the fracture line of the East African Rift Valley, reaching an incredible depth of 700m (indicated in the isobath map adjacent). The rift is created where the tectonic plates are actively moving apart. Several cracks in the earth’s crust have created a series of African Great Lakes; Lake Tanganyika, Lake Victoria and Lake Malawi being the southernmost lake in the rift (refer to map adjacent). Due to faults in the rift valley, the lake bottom can drop steeply to a depth of 200m close to shore. Following the gap in the rift it reaches a length of 560km with its greatest width being 75km. Its unique creation has produced an unmatched ecosystem with more species than any other in the world.

By stretching layers of different materials, which we can say imitate the layers of the earth, the adjacent study explores the surface deformation which occurs as the rift (creating Lake Malawi) gradually widens and deepens. The study illustrates the substrate conditions within the lake by exposing various surfaces, the study shows the geological formations from Rocky outcrops to sandy beaches.

Malawi, situated just south of the equator, experiences seasonal changes with a maximum summer and minimum winter temperature of 30 degrees Celsius and 13 degrees Celsius respectively. (Eccles. Delvaux 1993: 732) Rainfall varies between locations from 65cm to 250cm annually. As additional water enters the lake from the north and flows out from the shire river in the south. All these factors, including evaporation, contribute to a seasonal fluctuation in water level between 0.07m and 1m. (Eccles. Delvaux 1993: 731) A barrage constructed in 1965 along the shire river helps to maintain a general constant minimum water level. Although there are no tides in the lake, short term fluctuations in levels account for a 12cm change over a 6 to 24 hour period. (Eccles. Delvaux 1993: 732)
Deformation of the earth's surface as tectonic plates pull apart. Fractures in the substrate cause portions of rock to push upwards as others are pushed down.


Exposing layers Synthetic Breakdown Surface Deformation Pattern Manipulation Strained Edge Condition
ii. A LAKE | A LIVELIHOOD

Malawi, bordering Mozambique and Zambia, is a landlocked country with little to no trade in marine produce with neighbouring Mozambique, yet the country has a high nutritional dependency on fish and artisanal fishing is a livelihood many Malawians depend on. This is not surprising considering that a quarter of the country is covered by water (Lake Malawi). The country is largely dependent on agriculture, yet fishing is also on top of the list. (Alison, Mvulu 2002: 2). “85% of the population are primarily subsistence farmers or fishermen” (McKay et al. 2008: xvi)

40,000 tons of fish are caught from the lake annually which supports the livelihood of over 45,000 fishermen. Typically Chambo (Tilapia Cichlidae), Utaka, Kampango (catfish) and Usipa (small silver lake sardines), are caught daily to feed the population. (McKay et al. 2008: 6)

The fishermen go out at night and return with their catch at dawn. Bartering takes place on the shore where locals can claim a portion of the catch for a given price (A). Buckets are filled with fish (B) and taken to the racks for drying, the ovens for smoking or to trucks for transportation to inland villages (C). The fish is then sold in the market within the village.
A Nyasaland Nutritional survey stated that 70% of protein in a Malawian’s diet comes from fish. (Alison, Mvulu 2002: 20). Over the past few decades the lake’s biomass has been rapidly depleting due to overfishing to meet the needs of a growing population. Fishing restrictions and regulations have been put in place to address the crisis. Fishing is not permitted during breeding seasons and the size of fishing nets is regulated to allow for smaller fish to escape capture, but with the large circumference of shoreline to regulate, restrictions are seldom followed or controlled.
Out of an estimated 1000 endemic fish species in Lake Malawi, only about one-third have been classified. The Cichlid species make up the greatest family of fish known to science. They are found in freshwater lakes and rivers of the tropics and care for their young in an unusual manner (maternal mouth brooders). “Lake Malawi harbors more species of Cichlids alone – about 875 – than all the freshwater fish species of North America together” (McKaye, et al. 2008: xxix)

What makes them resilient is their ability to adapt to different environments. Their jaw structure allows them to employ various food gathering techniques. Depending on their habitat, subspecies evolve rapidly to suit the space they live in. The various habitats in the lake are separated by long stretches of sandy shorelines and openwater. Thus each habitat acts as an ‘island’ allowing for a colony to evolve in isolation from neighboring colonies. As a result, a sub species from one location will look very different from one found in another location. (McKaye, et al. 2008: 13)

This rapidly evolving species has been compared to the Finches found by Darwin on the Galapagos Islands. With their unique ability to adapt and evolve, they are the cause of much of interest among biologist worldwide, but they are also a vital protein source for local Malawians. Mbuna (pronounced “boo-nah”) is the local name for the small and colourful rock dwelling cichlids. They breed easily in captivity, making them highly sought after among aquarists. (McKaye, et al. 2008: 5) These fish are captured and exported all over the world. Naturally they are found along the rocky outcrop of the shore, within 5m of the water’s surface. (McKaye, et al. 2008: 5) “Human population growth and overfishing pose the greatest threats to the cichlid species. Continuous fishing has reduced fish populations to sizes that are no longer viable.” (McKaye, et al. 2008: xxix)

“Preserving species diversity is critical. Besides the unique fish being of interest to aquarist and evolutionary biologists – their presence or absence has a practical impact on human health, as well as the economic growth of a developing nation” (McKaye, et al. 2008: xxix)
Aquatic User Group of Lake Malawi

CICHLIDS

LARGEST FISH FAMILY
KNOWN TO MAN

ENDEMIC TO:

OTHER SPECIES:
SPINY EEL
MOTTLED EEL
KAMPANGO
MASTACEMBELUS

HABITAT

THE SURGE ZONE

DEPTH

OPEN WATER

DEPTH

SHELTERED PLANTED BAYS

3 - 5m

THE ROCKY OUTCROP

10 - 25m

THE INTERMEDIATE HABITAT

2 - 6m

2 - 25m
Lake Malawi is nature with us in it. The lake supports a diverse ecosystem which is constantly adapting within a continental rift which is continuously modifying the earth we live on. The lake supports a civilisation which depends on it for water, food and sanitation, a civilisation which has constructed a home to live in along its vast and bountiful shoreline. There exists no separation between people and nature, except for the one seen through a tourist’s gaze of an ‘untouched’, ‘unspoilt’ wilderness, which it is not.

If the lake is overfished, the cichlid species will not survive and if the fish die, Malawians will go hungry. If the lake is nature with us in it, then the two are interdependent.

If we consider a food source (a product consumed by people) and a species (cichlids endemic to the natural lake) as an issue that is one and the same, then a research facility situated along the shoreline may help address the issue by accommodating the needs of both an existing fishing village and a diverse fish population.
iv. SITE SELECTION

To address both a depleting food source and a species, 
- a research facility must be located within close proximity to the water’s edge. 
- Water quality and protection from wind and rough water must be considered. 
- To create an ecotourism attraction and draw from an existing tourist industry, the facility must be situated within an established tourist zone. 
- To address the needs of fishermen, a local village should be within walking distance from the establishment. 
- To support fish diversity, a surviving cichlid population must be present within close proximity from the facility.

Three potential sites were considered: Senga Bay, Monkey Bay and Cape Maclear. Cape Maclear was chosen.

All sites are situated on the southern end of the lake which is situated close to Malawi’s major cities, Lilongwe and Blantyre (refer to map adjacent). Both cities have international airports and well-developed industrial sectors. The University of Lilongwe’s Bunda College houses the Department of Fisheries and Aquaculture which is an important institutional link to the facility. To ensure adequate accessibility and movement to and from the facility, a short traveling distance from these cities is essential.

Senga Bay was excluded because it is not protected from the wind, often has choppy water which disturbs the shore front and brings up sediment from the lake bottom.

Monkey Bay’s port operates as a transport zone, ferrying both passengers and goods across the lake. The port covers most of the small bay, leaving very little space for additional facilities.

Cape Maclear was chosen for its well established fishing community in Chembe Village, its calm and protected waters, a thriving tourism industry and its location within Lake Malawi National Park.
SENGA BAY;
Located closest to Lilongwe, it has a well-established fishing village and good tourist accommodation, but situated along the open shoreline, the water's edge is exposed to the elements.

MONKEY BAY;
Located near the Cape Maclear Peninsula, it is the country's major port with a ferry that disembarks every 5 to 8 days. It is conveniently situated halfway between Blantyre and Lilongwe. The bay is well protected from winds and calm waters, providing an adequate site for a floating type structure. A small tourist industry and a local village are established. Rocky outcrops make good habitats for an existing cichlid population.

CAPE MACLEAR;
Located within LMNP, the waters are protected from fishing, yet it has a well-established fishing village. The two offshore islands shield the bay from wind. Several lodges fill the shoreline to accommodate a growing tourist industry.

Above photographs are taken at location by author
Cape Maclear is located 24km from Monkey Bay within an established freshwater nature reserve in Lake Malawi National Park. During an expedition in the 1850’s explorer Dr. David Livingstone travelled the African Rift valley, he set up a mission station in Cape Maclear in 1974. It was chosen for its calm waters, and a friendly local village. The station was relocated in 1881 as Malaria and black water fever endangered the lives of the settlers. Many visitors were still drawn to the area for its unusual beauty. A flying boat service, BOAC, docked in the calm waters of the bay during 1949-1950. (McKay et al. 2008: ii)

The site is situated within a bay on the South end of Cape Maclear (refer to map adjacent). Sheltered by two nearby islands; Thumbi West and Domwe, the shoreline is protected against North Easterly wind. The water is characteristically calm and clean. The current flows South-West towards the Shire River, keeping away any contaminants from the village.
1. MARINE RESERVE
100m No Fishing Restriction
Activities: snorkeling, swimming, washing

2. CAPE MACLEAR RESERVE
Activities: hiking, collecting firewood

3. CAPE MACLEAR BAY:
Activities: snorkeling, swimming, kayaking, sailing, day fishing

4. CHEMBE VILLAGE LAND
Activities: Agriculture

5. LAKE MALAWI, SOUTH
12km radius
Activities: Artisanal night fishing

6. CHEMBE VILLAGE & LODGES
Activities: Tourist accommodation, Local livelihood

7. SANDY SHORELINE
Activities: washing, fish drying, repairing nets, sun-bathing
Fishing boats anchored off shore
Drying racks fill the sandy shoreline
Access: a dirt road runs parallel to the shore
A labyrinth of walkways merge with local households
Cultivated land supplies the village with corn

CHEMBE VILLAGE

The village forms a strip along the shoreline with rows of cultivated land behind it. It spans 3km and is only 200m across at its widest point. The village infiltrates the water with fishing boats anchored near the shore.

The shore is filled with racks for drying fish (Usipa), dugout canoes and fish nets, while set back 50m inland, a dirt road runs parallel to the shore. Foot paths connect the shore with the village households.

The community revolves around a fishing livelihood, dependent on the lake for sustenance and survival.

CAPE MACLEAR

The Cape Maclear Peninsula is a designated National Park, but within it several villages exist, Chembe Village was established long before Dr Livingstone started a mission station in the area. It also accommodates the largest tourist area in the country with several lodges filling the shoreline.
ON THE SHORE
The shore is not only used for fishing but for the washing of pots and clothes as well.

A LABYRINTH OF WALKWAYS
Most of the village is accessed by foot along paths that weave between the houses.

A DIRT ROAD
A sand road runs parallel to the shore. Accessible by car, it links the various lodges and acts as an activity strip with shops selling vegetables, local bars and curio shops.

STORING FOOD
Food is stored within individual households. Elevated above the ground, grain is protected against water and scavenging animals.

All adjacent images were taken on location by author during a site visit 3 April 2014.
vi. CHEMBE VILLAGE

“The shape of Earth as it is modified by the structures of mankind, out of that relationship, humanbeings fashion an environment for themselves, a space to live in” (Scully 1991, 1)

Community is fundamental to the lakes future as people inhabiting the water’s edge call this natural lake home, they are dependent on it for water, food and livelihood. A symbiosis is needed for a balanced ecosystem.

Chembe village sits in the heart of Cape Maclear and its livelihood revolves around fishing and the lake. A restriction has been enforced to ban fishing within 100m of the shoreline of the mainland and adjacent islands to protect an existing cichlid habitat along the rocky outcrops. Daily activities occur along the shoreline. The fishermen go out at night and preparation for their trips begin from late afternoon with the repairing of nets and the equipping of boats with lanterns.
At night the lake fills with hundreds of flickering lanterns seen several kilometers offshore giving its nickname: Lake of Stars. They return at sunrise with their gradually depleting catch. The shoreline bustles with activity as fish are auctioned off while others are laid out on drying racks or smoked in clay smokers. Local women come down to the water’s edge to wash cooking pots and clothes while children play in the shallow water.
The art of artisanal fishing is in the construction of gillnets and the carving of dugout canoes. Fishing nets are spread across the sandy shore as men repair any damages. During the night, fish are lured towards flickering paraffin lamps, like a moth to a flame, and unknowingly follow the light into a waiting gillnet as illustrated in the figure adjacent.

The net defines a porous edge condition. Although it entraps its prey it also allows water and smaller fish to escape through it. It acts as a filter which constantly expands and contracts, changing shape and adapting to its aquatic environment.

Dugout canoes are carved out of potato trees, Long and slender, the opening is very narrow, only allowing one's crossed feet into the hull (refer to image right below). Fishermen balance on the rim and propel the dugout with a small paddle. A row of paraffin lamps are secured to a plank on its bow. Larger motorised wooden boats carry the nets, paraffin fuel and the night's catch of Usipa. Wood has been carved to transform a tree into a boat and in this way nature has been adapted for human activity.

Shelters are built using local resources. Clay bricks are made locally and compacted earth is used for the floor. Roofs are covered in thatch although newer shelters make use of corrugated sheeting. Window frames are free of glass with only a mosquito net and a timber lattice to define the edge condition.

Every dwelling has a shaded ‘stoep’ and a recessed entrance where daily activities of mending clothes and preparing food take place. The interior space is open plan with various functions are clearly designated to certain spaces.

All ‘man-made’ structures have been weathered down by tropical heat. Plants, adapting for survival, use these structures to support their own growth and form.
Local Vernacular of Chembe Village, Compilation of photographs taken on location by Author

Typical Malawian Household

Dugout Canoe  Larger Motorised boats
Tourism is Malawi's 3rd largest income generator with Cape Maclear at its epicenter. With a UNESCO world Heritage site, Malawi was on the top 10 list for travel destinations in 2014 (Sawubona June 2014). The calm tranquil waters and activities make Cape Maclear the greatest tourist attraction in the country. Over 20 lodges fill the shore front, offering accommodation as simple as backpacking dormitories and camping to luxury en-suite cabins. Visitors enjoy the unique aquatic landscape with kayaks, sail boats, scuba diving and snorkeling activities on offer. Tourism is a vital and growing income generator, “The United Nations World Tourism Organisation (UNWTO) has described it as the fastest growing industry and the third largest next to manufacturing and oil.” (Magombo 2011: 1) The adjacent graph, by the Department of Tourism Data in 2009, shows a yearly increase of international visitors yearly with vacationing purposes to visit, growing the most rapidly.

An interesting dynamic occurs in the layout of the lodges in Cape Maclear. To take full advantage of the view of the lake, all lodges are situated on the shore front (map adjacent). A dirt road runs parallel to the shore behind the lodges and serves as the edge condition between Chembe Village and the lodges (as portrayed in the photographs on the left). The road bustles with both tourist and local activities with basic necessity shops for local villagers and curio stalls for tourists. Along the shore front the line of lodges is occasionally broken to allow for direct access of the lake from the village where rows of drying Usipa, gillnets and dugouts fill the gap.

The shore is then animated by a mixed use of locals and tourists. Curio shops and water activities such as sailing and kayaking as portrayed in the photographs to the right, while local women wash their clothes and men prepare for the night’s fishing excursion.
The above map illustrates the tourist lodges in relation to the site. Set along the shoreline, the lodges open up to the lake and visitors walk along the waters edge.
A Visual 24 Hours

A Visual 24 Hours is a mapping of both local ( ) and tourist ( ) activities within a 24 hour time period. The 3 primary zones of activity are lake ( ), shoreline ( ) and land ( ). By mapping activities in response to location and time, you may see where various activities overlap. What is most apparent is the concentrated activity occurring after dawn ( ) and before dusk ( ). At Dawn the night fishermen return to shore with their catch ( ). This creates various other activities such as bartering ( ), drying ( ) and smoking fish ( ). In addition women come to the shore to wash clothes ( ) and pots ( ) while children play in the shallow water. During the middle hours of the day Tourist activity becomes more prevalent with recreation such as snorkeling ( ), kayaking ( ), sailing ( ), swimming ( ) and sunbathing ( ). In response to tourist activity, locals sell various hand made curio's ( ). Just before dusk the shoreline bursts with activity as fishermen prepare for their night excursion. Local men are found repairing nets ( ) and preparing the boats ( ), while others wash themselves in the shallow water ( ). During this time tourists are mostly seen in beach bars along the shore ( ). At night the shore empties out but the lake is lit up with the parfin lamps of the fishermen. Thus giving the name; 'lake of stars'.

Other Activities Include:

Collecting water ( )
Playing Bowe ( )
Preparing mielies ( )
Collecting fire wood ( )
Learning ( )
Selling produce ( )
With the highest vertebrate diversity in the world, Lake Malawi National Park (LMNP) became the very first freshwater park to protect and conserve the unique and endangered fish in the peninsula. The very first recorded underwater photographs, taken by scientist Dr. Kenneth McKay, displayed the fish in their natural environment, convincing the UN to designate LMNP as a UNESCO World Heritage Site in 1984. (McKaye. et al. 2008: iii) The cichlid diversity is “over 60 times greater than the famous Darwin’s finches found in the Galapagos Islands, another World Heritage Site.” (McKaye. et al. 2008: iii)

With the aid of WWF Finland, the Malawian government is working to conserve this natural resource by improving the lives of those living and depending on the lake. “this mission is not simple. Besides the preservation of the lakes riches there is also the need to alleviate poverty of the people that presently live along its shores” (McKay. et al. 2008: 1.) Their objectives are:

• To improve well-being through education, awareness and “understanding the relationship between the environment and human health”

• Increase the people’s nutritional status through alternative food sources, “the creation of fish ponds and sustainable horticultural practices.”

• Reduce deforestation through “alternative sources of energy”

• Better education through producing learning materials and building facilities.

• The promotion of tourism as a “sustainable economic development”

(McKay. et al. 2008: IV)
The Freshwater reserve makes up the most part of the Nankumba Peninsula and controls the waters which lie within 100m of the shoreline, covering an area of 7km². Most of the shoreline is a rocky outcrop which makes a suitable habitat for cichlids. The reserve protects a cichlid population within a diverse habitat. Rocky outcrops East and West of the bay and along the edge of the two islands offer a protected sanctuary against both predators and fishermen.

Otter Island lies 50m offshore and is made up mainly of large boulders. This island is the spectacle of the reserve harboring many colourful and interesting fish beneath its clear turquoise waters. Thumboi West is 950m from the sandy shore of Cape Maclear and harbors several different habitats; boulders, rocky shores, sandy shores and reeded areas. Domwe Island is the largest in the park with a narrow channel separating it from the mainland. The shore is made up mostly of boulders with some small rocky areas. (McKay, et al. 2008: 17-21)
If you refer to the adjacent map, the entrance to the reserve is situated inland along a dirt road (B) and foreign visitors are charged $5 while locals are charged $2. Local villagers are allowed to circulate throughout the park, collecting firewood and water. Most visitors to Cape Maclear will stay overnight at one of the lodges along the water’s edge. The most direct access to the park is along the sandy shore (A) as the dirt road is poorly maintained. This poses a current control problem as many visitors enter the park without paying the reserve entrance fee.

A current administrative building and Welcome Centre (C) includes a museum and an aquarium. It is situated 50m inland from the shore and is hidden from view by thick vegetation. It is often missed by visitors and is currently poorly maintained. The aquarium is no longer functional and the museum receives few visitors, but the reserve is frequently visited by those wanting to swim and snorkel at Otter point (D) or climb Nkunguni Mountain (E) for a better view of the lake.
**x. UNESCO WORLD HERITAGE SITE**

Nominated in 1984, Lake Malawi National Park stands as a site with "outstanding universal value" or as abbreviated by the World Heritage Organisation, it is an OUV. As set out in paragraph 172 in the Operational Guidelines, this area has been chosen as an exemplar for its exceptional beauty, geological uniqueness, bio-diversity and evolution.

To ensure the protection and preservation of the site as an OUV, any proposed development must abide by strict regulations and undergo a rigorous approval process. An ESIA (Environmental and Social Impact Assessment) must be undertaken and meet the standards of the World Heritage Impact Assessment Principals (Section 4.2). All plans for development must be submitted to the World Heritage Committee. The process is illustrated in the flow diagram below.

It is made clear that any proposed development must not negatively affect the site or threaten any of its 'Outstanding Universal Values'. Thus the proposed design must be site sensitive and balance with a local vernacular. Non-toxic materials must be used to encourage the growth of an existing ecosystem. The building then serves as an exemplar of this unique site, displaying its exceptional beauty, biodiversity and geology.

The programme must allow for research and education into the evolution of the area while addressing current social issues affecting local communities.

By considering various alternatives, a final proposal should be put forward which is the least damaging to the site whereby any negative effects caused by construction may be mitigated and the effects reversed as the site adapts to the building and vice versa.
Lake Malawi national park is a part of ‘nature’ which human society has marked as having Outstanding Universal Value. It has become a spectacle, an examiner of nature unspoilt by humankind.

It is nature ‘out there’, to be preserved in its present beauty. It is a ‘wilderness’ attraction for visiting tourists to enjoy, relax and take in the natural wonders they would not otherwise experience within their ‘man-made’ ‘artificial’ cities.

A site which ‘should’ remain untouched by human intervention and a sanctuary wherein we allow nature to exist, where we expect it to be when we look for it, where it must continue to thrive without change.

But is it really?
WITH US

Within this site exists a duplicity.

Lake Malawi is a part of nature that exists with us in it. It is not nature ‘out there’ but nature in here. Where people depend on it for food and a livelihood.

‘Man-made’ structures are constructed out of the very nature that society has separated itself from.

Yes, it is a place with Outstanding Universal Value because within it lies a symbiotic relationship between people and their physical context.

This relationship is continuously changing, modifying and adapting.
03.

An Underwater Observatory

Design Brief

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iv. Design Analysis p 102
v. A Technical Study p 112
vi. Design Drawings p 132
DESIGN BRIEF

The water line, an edge condition, is a liminal threshold where a human’s habitat ends and an opposite reality begins, where gravity no longer pulls and gas becomes liquid. This state of transition stimulates the subconscious and separates that which lies above and below, in and out. Creating a desire to connect with a foreign world. Do we try to submerge ourselves in this otherwhere orottle it for transportation to places where we can comfortably access it? To say, this is where I expect to find you? Conventionally this world is framed as a convenience to be exploited for our needs and desires, a resource to be used.

Lake Malawi is a large water body where inhabitants live along the water’s edge. It is the greatest natural resource for a country dependent on it for water, food and livelihood. The water’s edge makes up the vessel that contains another world which is rapidly evolving and depleting.

Overfishing has brought on a crisis. Local communities suffer from malnutrition as unique and bio diverse ecosystems sparsely survive. If we change the mind frames of locals and visitors can we translate the man-made back into the natural?

An underwater observatory is needed to reframe the mindset of local communities and visitors through an imagination that may be evoked through science.

The design brief is divided into two programmes; science and community. Let science address a species (cichlids) whose rapid evolution may help find the answers to our own gradual adaptation to the natural world and reframe what is currently perceived as merely a food resource into a valued asset to be protected and respected.

Let a community be uplifted by addressing basic needs of hygiene, nutrition and livelihood through alternative solutions to healthily coexist within this unique context.

Let ecotourism be a driver for both community and science, facilitating a means to an end.

A structural mass may be juxtaposed along the shoreline in the way a river cuts through a landscape. It modifies a natural environment and in time is modified by nature, like a rapid evolution, as one adapts to the other and vice versa.

The building, situated at the edge boundary to the nature reserve, needs to act as a liminal threshold between the people from Chembe village and the nature within the park to accommodate an existing relationship between the natural and the man-made.
i. Programme

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2. Learning from Existing Facilities p 68
3. Facilitating a Fish Habitat p 70
4. Why a Moringa Nursery? p 72
5. Lavoit? p 73
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8. Programme Massing on Site p 78

Developing a programme for Malawians and cichlids

To accommodate both people and nature the programme addresses issues of a depleting food source, sanitation and education through a community programme while science based programmes address a rapidly evolving species (cichlids). This two way approach takes people and that which is ‘man-made’ and translates it into the ‘natural’ context.
In order to taxonomise the 700 sub-species of cichlids in the lake, a research laboratory needed as current facilities at Bunda College are located in Lilongwe, (over 300km from the lake).

A wet laboratory containing isolation and observation tanks and a dry laboratory will enable biologists to track the evolution of the cichlid. In conjunction, accommodation is needed for biologists staying overnight at the facility.

The space also acts as a teaching area for tertiary students and visiting school children to display the biological importance of the fish.

As species are caught in nets by artisanal fishermen, captured and exported for private aquariums around the world and their habitats are infringed upon, cichlids are placed under threat and their numbers are diminishing. An initiative started by Stuart Grant Fish House in Senga bay, an exporter of cichlid fish, has experimented with breeding subspecies and reintroducing them into the lake at the specific locations they had been taken from. (Image below)

This experiment has, thus far, been a great success. The species is resilient to disease and can therefore be reared in small confines without the risk of spreading diseases.

To stimulate population growth breeding pods are needed which are simple, easy to maintain and low cost in construction and running operations.

Professor Todd Streelman has been documenting the evolutionary process by cleaning and staining specimens. Various coloured stains are injected into the cartilage (blue) and bone (red), illuminating the morphological changes in the skeletal structure while keeping the cichlid specimen intact. Soft tissue is gently digested leaving the skeletal structure exposed for study.
Public lavoir

Existing infrastructure does not support the need for running water. With fresh water from the lake being directly accessible this has not been a system perceived as a necessity. As a result, human activity along the shore has caused a negative impact on its surrounding environment. The water’s edge is the kitchen sink, the shower, the tap and the laundry. Although basic detergents are used, leftover food and bits of clothing are scattered along the water’s edge.

The lavoir meaning ‘wash house’ in French, is traditionally a public wash area for clothes and cooking utensils. The space becomes a place of social interaction among villagers while daily chores are seen to. A public lavoir will give the village a space to wash while removing this activity from the water’s edge, thus preventing water contamination.

Moringa Nursery

Fish make up 70% of the protein and fat in a Malawian’s diet (Alison, Mvulu 2002: 20). As population increases and overfishing threatens the lake, people must look for protein alternatives. nsima, mielie meal, eaten with every meal is low in both energy and nutrients. Many Malawians suffer from malnutrition and protein-energy malnutrition affects many children stunting their growth and lowering their resilience to disease.

The Moringa Oleifera tree is very high in nutrition, oil and protein. It is a good substitute for fish. The Moringa Nursery will supply tree seedlings to local villages, giving Malawians an alternative food source.

Dug Out Port

Dugout canoes carved out of Sausage Trees fill the water’s edge. Native to Malawi’s local vernacular the canoe is used for night fishing along with other motor propelled boats.

To tap into an established tourist industry, local fishermen use their boats during the day for boat trips to take visitors around the two nearby islands and Otter point. This unique experience acts as a community incentive and an alternative livelihood to fishing.

The dugout port serves embarking and disembarking passengers and regulates the entering of the marine reserve while ensuring the reserve fee is paid by all visitors.

Film Room

Chembe village does not have any electricity and operates at night under candle light. The villagers happily find their way through the dark and cook on open wood fires or paraffin. Technology such as television and computers remain a novelty. HEED, a WWF funded organisation, currently holds a weekly movie night but the space is small and many locals cannot fit into the existing projection room.

A multi-functional pavilion will act as a briefing space for visiting schools during the day and a video projection space at night to capture the minds of local children. Conservation documentaries will be shown as the weekly event becomes a unique and exciting activity. By changing the frame, one’s perception of the lake and its resources is changed as well.
2. LEARNING FROM EXISTING FACILITIES

Meeting with David P Nkwazi
At
Stuart Grant Fish House Senga Bay, Malawi
29/04/2014

Collection of Fish
“We collect during the August to November Season and we have stock of between 100 and 200 fish at any time. It is important to record the genus and location of each fish caught as the same sub species may differ depending on location.”

Running the Facility
“The Pump and Water system is our biggest concern and greatest monthly running cost. We have two pumps which pump water directly into a 30 000l reservoir from the lake. After the water has circulated through the tanks it is fed into a rice paddy behind the facility.”

Breeding
“I’m having success in breeding Malacopteryx Chiops and Pseudotropheus Genus (Sauvage) which are rare species, I then reintroduce them back in the location they were originally sourced.”

Cause of the Depletion of Species in the lake
“Local fishermen are the biggest problem. They have taken too much out of the lake, and they fish tropical fish like Cichlids”

Exporting for Aquariums
“After collecting the fish we transport them by truck in oxygenated water bags during the night because its cool. They are then sorted according to taxonomy classes and exported by plane all over Hongkong, Germany, Canada….”
Stuart Grant Fish House is an exporter of cichlids in Senga Bay, Malawi. This facility holds several hundred fish which have been sourced from the lake as shown in the images on the left.

The University of Lilongwe's Department of Fisheries and Aquaculture has to date been researching cichlid evolution at their Bunda College laboratories (image adjacent) but situated far from the lake, the process is tedious and stunted by inefficient equipment and facilities. A facility in close proximity to the lake for physical monitoring of the species is needed to track, record and taxonomies the current evolution of the species.

Visit to Bunda College & Meeting
with Wilson Wesley Lazaro Jere, PhD
Head of Department and Senior Lecturer in Fish Genetics
at Lilongwe University of Agriculture and Natural Resources

Regulated fishing
“For 2 months (Oct-Nov), no person is allowed to fish as it is Breeding season.”

Greatest threat to fish in the lake
“Fishing rare species,
Introducing exotic fish,
Lack of Taxonomy research, lack of concern for conservation,
No one to enforce regulations”

Possible Solutions:
“Breed threatened species & reintroduce native fish into the lake,
Aquaculture practices to address food source,
Reduce exports of tropical fish,
Record stock levels on Government level”

Why Taxonomise?
“You cannot conserve something that you don’t know exists, that doesn’t have a name”

Teaching the community
“Students in 1st and 2nd School must learn about the species and be taught how to identify them.”

Studying the Fish
“Fish genetics is offered to 3rd and 4th year students”

CURRENT FACILITIES

Room 1:
4 x blowers
1 x generator
4 x filtration tanks
1 x temperature controller
1 x smoking machine

Dry Lab:
Bomb Calorimeter
(measures energy)
Water bath
Incubators
UV light stabilizer

Wet Lab:
For feeding, water and soil analysis
Isolation tanks
Oxygenation system

Water System:
Borehole water tank – for tanks, wet lab and dry lab
Filter
Compressor
UV Stabiliser
Generator

Aquaculture Ponds:
26 x cement tanks
Accommodation
Overnight staff and researchers.
Lecture room
2 x Classrooms

Existing Dry Laboratory, Bunda College, Lilongwe, Malawi, Authors Own
3. FACILITATING A FISH HABITAT

To accommodate an aquatic user group (cichlids), the programme facilitates a ‘man-made’ fish habitat. As cichlid habitats have reduced due to climate change and population activities, biologists suggest expanding their habitat within the protected waters of the reserve.

Over the past century artificial structures placed in both freshwater and oceans have been explored as habitable attractions to aquatic flora and fauna. The image on the right shows various artificial structures deployed for this very purpose. There has been growing interest in the use of artificial structures for the rehabilitation of species.

In a study conducted in Lajes Reservoir, Brazil, artificial structures were deployed and aquatic activity recorded. The structures imitated aquatic plants, providing a textured surface for algae growth and a labyrinth of synthetic branches to protect fish from predators (as illustrated in the images 54 & 55 adjacent). The study recorded that Cichlids accounted for 99% of the total abundance of species occurring in the artificial structure. (Santos 2008; 12) “Cichlids overall are characterised as non-migratory diurnal fish with a high affinity to submerged structures” (Santos 2008; 13).

Imitating a habitat:

The majority of the lake consists of sandy beds and deep water. Although the cichlids ability to easily adapt to its environment has created a variety of predators, scavengers, algae eating and plant dependent sub species. They are dependent on two main habitats which are not prolific in the lake; rocky outcrops and aquatic flora beds.

Both are characterised as protective spaces against predators and provide a source of nutrients from either plants, algae or smaller fauna such as snails. To accommodate a fish habitat, the programme must be designed to house artificial structures which imitate existing habitats.
Fig. 3. Pictures of some artificial structures deployed in the European Seas. a) Languedoc-Roussillon, France; b), c) Nienhagen, Germany (manhole rings, from NICKELS et al., 2006); d), e) Greece; f) Sicily, Italy; g) Larvotto Reserve, Monaco (www.gouv.mc); h) Nordfjorden, Norway (from HARTVIG, 2007); i), j) Algarve, Portugal; k) Odessa, Ukraine (from COLLINS, www.soos.soton.ac.uk ); l) Pool Bay, United Kingdom (from COLLINS, www.soos.soton.ac.uk).

Figure 56, Artificial Fish Habitat, 2008, Santos, Compilation of images, Artificial Structures as tools for Fish Habitat Rehabilitation in a Neotropical Reservoir. Wiley Interscience (www.interscience.wiley.com DOI: 10.1002/AQC.931)
4. WHY A MORINGA NURSERY?

The Moringa Olifera is natively an Indian tree brought across many years ago by settlers. (Coote 1997; 1) The leaves of the tree are very nutritious with high levels of vitamin A and C, protein and calcium. In addition the tree is used for various medicinal purposes. The leaves and flowers, ndiwo, are pounded to a pulp and then cooked into a porridge. This is a commonly prepared during dry seasons and when fishing has not been successful (Coote 1997; 2). The seeds of the tree offer a possible source of oil which may supplement the fats and energy otherwise attained by eating fish (Coote 1997; 3).

Villagers have attempted to plant Moringa seeds but few survive as seedlings are eaten by grazing goats. The trees, with their long thin trunks, make ideal posts for fences and are successfully planted in rows to attach a thatched fence between households while creating additional shade (Coote 1997; 4). Although the Moringa tree is well known among Malawians and grows well in its climate, it is not used to its full potential in the lower Shire region and has the potential to be widely used as a nutritional supplement to the current Malawian diet.

Therefore the facilities programme includes a Moringa nursery where trees are grown from seeds, nurtured as seedlings and once grown to a sufficient height may then be distributed and planted within Chembe village.

In addition to the nursery, the facility also acts as a structure onto which gourd plants (pumpkins, sweet potato, lablab beans and passion fruit) may climb, acting as a display of alternative food sources to help change the mindset of villagers to favour alternative food sources.
5. LAVOIR?

A ‘lavoir’ is an unfamiliar word, although French in origin, the lavoir was a common public facility in many villages in Europe, North Africa and India in the 19th century. Before running water, villagers would wash their goods in this public wash area.

Often connected to an existing river, stream or lake and gravity fed, this wash space has a constant flow of clean water. Although such facilities are perceived to be redundant in modern times, Chembe village (with no running water infrastructure) would greatly benefit from such a space, as captured in the photographs below.

On a visit to France I studied the public lavoir in the town of Saint Gengoux le National. The drawings and photographs illustrate how the lavoir is gravity fed by an adjacent stream. An aqueduct channels water from the stream into a shallow pool. The pool is covered with a monopitch roof, shading the space from sun and rain. A slanted and grooved parapet wall allows one to scrub clothes upon its surface while allowing excess water to run off back into the pool. A water outlet is placed near the top of the water level, to rid the water of scum and dirt.
6. PROGRAMME MASSING

3855 m²

**Community**

- **701**
  - **Communal Lavoir**
    - 178 Water Troughs
    - Wash space
    - Water Tanks
  - **Film Room**
    - 285 Hall
    - Stage
    - Projection Room
  - **Reception**
    - 169 Waiting area
    - Info desk
    - Office
    - Ablutions

**Community & Science**

- **1497**
  - **Observatory**
    - 216 3 x Observation Huts
  - **Museum**
    - 478 Exhibit 1
    - Exhibit 2
    - Exhibit 3
    - Circulation
    - Deck
  - **Port**
    - 283 Arrival/Departure waiting area
    - Walkway
    - Sheltered dock
  - **Restaurant**
    - 396 Tables
    - Bar area
    - Kitchen
    - Dry store
    - Cold store
  - **Laboratories**
    - 425 Dry Lab
    - Ind. lab
    - Store
    - Library
    - Pump Room
    - Isolation tanks
  - **Researchers**
    - 425 Accommodation
    - Ablutions
    - Kitchenette
    - Office
    - Deck
    - Circulation
  - **Breeding pods**
    - 357 2 x Pods
    - Circulation
    - Deck
  - **Fish Habitat**
    - 332 6 x Submerged Habitats
    - Floating Dock
  - **Observatory**
    - 118 Inspection Deck
    - U.W Observatory
The Adjacent table defines the programme in relation to location and technical specifics.

Through this process it has been determined:

- where programmes must be located (on land or on water),
- whether they are to be submerged below water level or elevated above,
- if activities are conducted outside or inside (requiring a roof),
- their proximity and accessibility to public circulation (private or public),
- any high tech requirements for a sterile environment.
PROGRAMME & SITE

The adjacent figures depict two main access routes through the site and the LMNP boundary.

In response to this the various programmes must be located along these access routes while forming an edge boundary between the park, Chembe village and the lodges.

By determining which programmes need road access and which can simply be accessed by foot, the building footprint is created.

SHORELINE AND ROAD

The shoreline acts as a circulation route for both tourists and locals. The sand road provides motor access for servicing and maintaining the facility.

VILLAGE FOOT PATH

The existing village footpath is used by locals on a daily basis for collecting water and washing clothes and pots at the waters edge.

LMNP BOUNDARY

Although the entire Cape Maclear peninsula sits within the marine reserve, official access into the park is shown in the illustration adjacent. The boundary line restricts further tourist development and village encroachment.
ACCESS

Accessibility must be achieved by foot (village path), water (shoreline) and road to the various programmes.

ACCESSIBILITY BECOMES KEY IN DETERMINING LOCATION OF PROGRAMMES
Located along the shoreline, at the threshold to the park, visitors enter the marine reserve and pay their entrance fee.

The port floats above the water level and passengers taking trips on the dugout, are controlled to ensure entrance fee is paid.

Partially submerged in the water, the observatory is accessed along a pier. Located 25m offshore, it floats above the water with a 6m depth to the lake floor.

The ‘Fish Out of Water’ Museum is elevated above the water by piles and accessed along the shoreline.

Breeding cichlids are contained within nets submerged in the lake, enabling breeding without the costly expense of water pumps and circulation systems.
FILM ROOM

The film room is located inland along an existing village path. It acts as a briefing space for visiting schools and a film projection space at night.

PUBLIC LAVOIR

Easily accessible along the village path is the lavoir. Water sourced from underground is used for the washing of clothes and pots without contaminating the lake’s water.

MORINGA NURSERY

Situated below the lavoir, grey water from the lavoir is used to irrigate the Moringa nursery.

RESEARCH LABORATORY

Located at the end of the road, the laboratory is privately accessed by researchers and staff while still having access to the shoreline and breeding pods.
A conceptual design is developed through the exploration of an amphibious architecture that is immersed within and elevated above, one that may capture a wandering imagination, adapt and evolve to the laws of nature and contain both a human and an aquatic habitat within a porous skin.
ADAPTATION: Around 390 million years ago, fish adapted to air and land. Gills became lungs and fins became clawed limbs, interestingly their geometric form remained the same.

STRUCTURE: In water, roots anchor a plant and a malleable skeletal structure allows for the leaves to bend and sway with the current, on land their stems stiffen to counter gravities downward pull.

FORM: By comparing the fish to a simple reptile such as the lizard this adaptation in mobility, yet similarity in form and movement, is most apparent. Both land and water forms are thus similar yet on land, the mechanical structure stiffens to act in compression to support its own weight and in water the structural system acts to anchor in tension. The outer skin thickens, darkens and hardens on land to withstand the harsh varying climate (sun, wind and rain), in contrast to the translucent and reflective scales of its aquatic counterpart.
AN ARCHITECTURAL FORM: By applying these adaptations to architectural design, one architectural form should be applied to both land and water. Similar in appearance, a structural system serves to anchor a form that does not need to support its own weight in water yet stiffens to support its weight on land.

FACADE: The skin distinguishes the land forms from the water ones. On land, a façade must be breathable to allow air to flow freely through it while being structurally robust and durable to endure heat, wind and rain. On water the façade forms a water tight seal yet remains translucent.

ADAPTING FOUNDATIONS: Fixed foundations on land like the claws on feet, fix the architectural form in the vertical plane. Whereas a floating foundation like the fins on a fish allow the architectural form to rise and fall with changing water levels.
2. **IMMERSE**

The concept of ‘immerse’ explores the various phenomena that occurs as one is transported from one medium (air) into another (water). The liminal line that is the water’s surface divides not only two atmospheres but also our perception, understanding and visualisation of objects, forms, colours and shapes.

Through a simple experiment using a bowl of water, various objects of different sizes and surface textures and a light bulb, I was able to explore such phenomena. The photographic images adjacent capture these phenomenon’s, depicting a world of illusion where nothing is quite what it seems.
i. LIGHT & WATER

As the sun's rays penetrate the water line, colours in the spectrum begin to fade:
- 4.5m depth: **red**
- 7.6m depth: **orange**
- 10.6m depth: **yellow**
- 21m depth: **green**

ii. REFLECTIONS ABOVE & BELOW

The surface of the water acts as a centre line of symmetry, mirroring objects above and below it. Thus it creates an illusion of another space. One only tangible to the seeing eye.

iii. REFRACTION & THE ILLUSION

The bending of an object as it enters the water creates a trick of the eye, angles appear where there aren't any. By morphing the physical into the fantastical, the world below becomes an illusion of the world above.

iv. DISTORTION OF FORM & MAGNIFICATION

Just as we peer through the looking glass, objects are magnified through a water medium, abnormally larger than in reality. Through this phenomena forms are distorted to appear more powerful than they seem.
FROM SITE:

- Distortion
  - Beneath Looking Above
- Distortion & Reflection
  - Sand and Water Level
  - Above Water Level
- Light Filtration
  - Below Water Level
- Above and Below
  - Water Line
- Distortion & Reflection
  - Sand Reflected on Water Surface
- Surface Distortion
  - Above Water Level
- Distortion & Refraction
  - Below Water Level
- Image & Light Reflection
  - Below Water Level
3. IMAGINATION

A VISIT TO USHAKA MARINE WORLD

On a visit to Ushaka Marine World in Durban, I took to capture imaginative space enveloped within the fascination of the underwater world. By photographing the aquarium walls, visitors are captured in silhouette, reflected against the glass.

Ambiguity is portrayed as the realm between nature and mankind is blurred. The aquarium is more a place for the imagination than one of education and learning. It is this creation of a fantastical space that continues to draw visitors. A space that allows one’s subconscious to explore within the liminal boundaries of manmade and natural phenomena.

It is within such creative spaces that we form a connection with the natural and in awe we develop a sense of respect and need for guardianship over it.

The reflection of objects and colour, the penetration of natural light within a dark space and the framing of people inside the manmade yet encompassed within natural phenomena all enriches this experience.

Transparent materials allow the light in while solid walls darken a space and create mystery. A shiny surface reflects both light and imagery, blurring the line between tangible and illusion. Water both magnifies and distorts both living and inert objects.

Let an underwater observatory facilitate an Imagination, reframing the mindset of visitors and changing our perception of the natural.
Reflections blur the frame that separates the observer from the spectacle. Distortion creates an illusion of an intangible imaginative space.

The observer becomes the spectacle. Multiple figures make the imaginative world visual.
The Golden Sands Hotel in Cape Maclear was once a prestigious place for wealthy tourists whom arrived by flying boat. Today it lies derelict through our eyes. But it is not ruined, it has merely changed, adapted and evolved to fit the needs of its new inhabitants. Nature has modified a ‘manmade’ structure.

This is a consistent phenomena where nature, with us in it, modifies that which we create. In the same way we take natural resources, and modify them to meet our human needs.

If we accept this phenomena, then architecture must be designed with this in mind, to accommodate a synergy where both nature and people may inhabit a space adapted for both our needs.

4. MODIFY

[ADAPT\ EVOLVE]
GOLDEN SANDS HOTEL

An adaptation from what was once habitated by us, now home to Flora & Fauna
[A POROUS PROTECTION]

A Trap

becomes protection

[A POROUS SKIN]

water

air
A POROUS PROTECTION: The rocky habitat in Lake Malawi contains small niches and gaps between the rocks. These gaps protect cichlids from predators such as the kapango cat fish. This form of protection can also be achieved artificially with the use of a fishing net. The fish net is traditionally designed to trap fish which find themselves caught within the confines of the net. To reduce overfishing the holes in the net are wide enough to allow the smaller fish to escape. If the fishing net is placed as a second skin on the underwater observatory, holes in the net which are large enough to allow cichlids to pass through easily while inhibiting larger predators, this creates a protective shield for cichlids living within the 'man-made' habitat around the observatory. The net may also act as a support frame for aquatic plants and algae growth. In the sketches on the right, I have explored the fish net as a second skin which acts as an artificial fish habitat below water and a shading screen above water.

A POROUS SKIN: Situated close to the equator, Malawi has a relatively hot climate throughout the year with a small temperature variation between summer and winter months. To address a consistently warm climate, adequate air ventilation is a necessity. If we look at the fish net as a concept, then in the same way water is able to filter and flow through a fishing net, the external skin of land structures should be porous and allow for air to naturally ventilate through an internal space. If the external skin of the building is a type of lattice, it will shade the internal space from direct sunlight and prevent any driving rain from penetrating the space while allowing for any trapped warm air to escape. This is not an unfamiliar building method, most local dwellings make use of a thin bamboo weave as an external wall (Figure A). Brick dwellings keep their windows, glass free, with only a mosquito net and timber lattice as a barrier between inside and outside (Figure B).
iii. Design Development

Through Form

The various concepts explained were then translated into form through the development of a series of models which was then resolved through sketches to construct an architectural typology which works on both land and water, above and below, in and out.

1. Modelling 1 \hspace{1cm} p 95
2. Modelling 2 \hspace{1cm} p 96
3. Modelling 3 \hspace{1cm} p 97
4. Early Sketches \hspace{1cm} p 98
1. MODELLING 1

Through initial modelling, I explored the concept of ‘amphibious’ where structures on land and on water are linked by elevated walkways like beads on a string. On a research visit to Durban to view the coastal piers, it became quickly apparent how elevated piers obstruct direct movement along the shoreline and disconnect the user from the waters edge.

The kink created along the water’s edge played on the notion of reflection similarly to the way reeds reflect upon the water surface as illustrated in the image 58 adjacent. The shift in direction brings attention to the change in medium from land to water.
2. MODELLING 2

The junction at the kink between land and water became tricky and complicated. In order to retain the notion of reflection while simplifying the junction, the form was then deconstructed. Land structures protrude over the water’s edge along parallel paths, while water structures encroach upon the land along parallel paths slightly shifted against the land forms. The water’s edge is then manipulated, recessed into the land to hold a structure which is pinned to the land and then protrudes upon the water’s surface.

At this stage an architectural typology was to be explored to achieve a cohesion between a land form, which must support its own weight and be fixed in the vertical plane, and a water structure, which may float on the lakes surface and rise and fall with changing water levels.

*Shifting on Parallel lines, juxtaposed along the shoreline*

*The waterline is manipulated, it is pulled into the land*

*A floating structure protrudes upon the water surface, while being tethered to land*

*Shifting on Parallel lines, juxtaposed along the shoreline*
A cohesive typology is then achieved by creating a horizontal plane which screens both land and water structures. This horizontal plane is a screened pergola which acts as a second roof, shading the buildings below while creating shaded outdoor areas in between. These areas cool daily activities such as washing in the communal lavoir and protecting the Moringa seedlings from harsh light in the nursery.

The buildings themselves are simple geometric containers, rectilinear and elevated above the ground. To respond to forces acting upward on a floating structure, I initially explored a hexagonal form that is partially submerged within the lake, although the hexagon occurs more frequently in nature than the square, it is an unusual form which holds a stigma in architectural circles, I thus explored an alternative in the final design.
By elevating the structure above ground, rain water runoff can freely flow without damaging the structure. But the building is no longer grounded and accessibility to users are impaired.

A sunken structure is easily accessed from ground level but creates costly construction concerns of damp proofing, especially within a water runoff zone along a shoreline.

By combining both ideas, sinking the building to a level accessible from the shoreline and elevating it just above the flood zone, the design both grounds the building and allows water runoff to flow into the lake unhindered.

A pergola acts as a second roof which shades structures below and outdoor activities while acting as an anchoring medium for gourd plants such as pumpkins, beans and passion fruit.

A cohesive structural grid creates harmony in the vertical plane. Columns elevate land structures above the flood risk zone while piles support a floating water structure.
A hot tropical climate requires a passive cooling system. A 2nd roof, overhangs and sinking the building into cooler earth helps address this issue.

The aquatic observatory has a fixed grid of piles connected by the pergola. A man-made structure which nature modifies for fauna and flora.

This locks the floating observatory in the horizontal plane while allowing it to rise and fall with changing water levels.

Partially submerged structures float on the surface

A mesh pergola shades structures below & supports creeping gourds: sweet potatoe, pumpkins, beans

Waters edge recessed
Early sketch design
### Design Analysis

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The final design is explained in this section diagramatically to illustrate how the building responds to its context, programme and conceptual ideas. Final drawings follow from this in the next section and it is best to refer back to this section when looking at the final drawings.
CHAPTER 03

A Fish Out of Water
MUSEUM

PORT

RESTAURANT

ACCOMMODATION

WELCOME CENTRE

FILM ROOM

OBSERVATION TOWER

LAVOIR

LABORATORY

ISOLATION TANKS

NURSERY

UNDERWATER OBSERVATORY

BREEDING PODS
1. AMPHIBIOUS

IN | OUT:
The structure sits partially in the water and on land, like negative and positive space. Earth is removed to accommodate land structures and water is displaced to accommodate water structures.

ABOVE | BELOW:
While the observatory lies partially below the surface of the water, the ‘Fish Out of Water museum’ is elevated above the waterline.

TETHERED:
Tethered to land, the structures are fixed in the horizontal plane by anchors, piles and cables, like the claws of a reptile digging into the sand with its tail immersed in the shallow water.
2. WATER

FREE FLOW:
Ground water run-off is not inhibited by the building, sunken in and elevated above the ground, water may freely flow underneath it.

A WATER CYCLE:
Water used in the lavoir is sourced from the underground water table, it is pumped into a water tank and gravity fed through the wash troughs and then into the nursery. Any excess water overflows into the sand and is naturally filtered before re-entering the lake.

CHANGING WATER LEVELS:
With an annual fluctuation of 1m, the underwater observatory, rises and sinks to changing levels while the Fish Out of Water museum remains fixed but elevated above the potential flood level. The museum and observatory is accessed along gangways which adapt accordingly.
The observatory must accommodate various usergroups, whom approach the building along different routes. Visitors staying in the lodges will walk along the sandy shore from the North, locals from Chembe Village approach from the East along an existing footpath and researchers arrive by car along an existing dirt road.

The programme is laid out accordingly with communal activities occurring along both sides of the village footpath, activities for visitors are accessed along the shoreline and research facilities are accessible by road and shore.

The road also serves to maintain and service the buildings (cleaning, food and laboratory supply deliveries and refuse removal).
4. A FISH OUT OF WATER

Elevated above the water, the museum plays metaphorically with the phrase ‘A fish out of water’. Various specimens are encased in glass bricks, displaying the cichlid evolution.

Figure 59. A collection of zoological species in the Natural History Museum in Berlin displays bottled specimens arranged on shelves from the floor to the ceiling, ominously back lit within a dark room.

5. A HUMAN OUT OF PLACE?

The glass bricks are placed within two parallel ‘walls’ running the length of the space, with various descriptions and classifications, similarly to the collection at the Natural History Museum in Berlin (figure 59).

Partially submerged in the water, a visitor stands eye level to the water level. The visitor observes the fish in their habitat through a transparent acrylic ‘hull’. Like a tunnel, you enter from the one side and exit at the other.
A porous skin is achieved on land using a bamboo lattice as an external skin in all areas that do not require a sealed and sterilised internal space. Bamboo is a ready available material in Malawi and often used in cladding walls and roofs. The lattice will allow air to circulate through the building as hot air escapes higher up. The below images illustrate two different methods of constructing the lattice, with a weave or by lashing the bamboo onto a support structure.

Within the water a porous skin acts as a security barrier for cichlids against predator fish. As shown in the images below, the net must have large enough openings to allow cichlids to swim through but small enough to hinder larger predator fish. The net also supports algae growth as shown in the image 63 below. A simple fishing net encloses the underwater observatory, both above and below the water. Rigged to a pulley system, the net may be easily removed for repairs and maintenance.
7. TRANSLATING THE ‘MAN-MADE’

A QUASI OBJECT
Like Serres ball, Architecture is a Quasi Object.

‘MAN-MADE’
The design is manifested within a human culture.

But once built, nature manifests itself within this ‘man-made’ construct

WEATHERED SURFACES
Materials are allowed to weather and change

PLACES FOR PLANTS TO INHABIT
sunken in, water is easier to access

GOURD PERGOLA
Pumpkins, lablab beans, passionfruit

A BATHOMETER
rust marks the steel piles, indicating changing water levels

‘ARTIFICIAL’ FISH HABITAT
algea grows on the net and rusted steel

Figure 64, Weathered Wood, 2013, Nyboe, from: http://inspirationsbykama.wordpress.com/2013/05/21/weathered-bus-step/

Figure 65, Marks On Rust, n.d, viewed 15 October 2014, from: http://www.freestockimage.co.ukfree_stock_image/piersupportsjpg
CHAPTER 03

1. The topography of the Earth, untouched

2. Topography marked by our own creations

3. with our own constructed forms

“The first fact of architecture is the topography of a plane and the way human beings respond to it with their own constructed forms... the shape of architecture is the shape of earth as it is modified by the structures of mankind.” (Scully 1991, 1)
As lake levels rise and fall with the changing seasons, the underwater observatory must remain accessible. Through an exploration of precedent studies which float, are elevated above and are submerged within, following the guidelines for environmental considerations and designing to Archimedes Principal, the underwater observatory is then technically resolved in a detailed section.
South of the lake, the Shire River drains into the Zambezi river. Over several decades, water level fluctuations have been recorded. Rainfall seasons impact annual water levels. The lowest change recorded was 0.08m in 1991, and rarely exceeds 0.9m. Exceptionally high rainfall periods such as the one experienced in 1978, recorded a record high fluctuation of 1.83m, ow lying areas along the shore were flooded. Due to climate change water levels are gradually decreasing over the years and the Shire River Augmentation Scheme seeks to normalize and control the lakes levels. (Osborne 2000, 2)

The amphibious facility must accommodate an annual fluctuation of 1m and address a potential flood level of 2m. Traditionally, changes in water levels have been resolved in several ways. Structures are elevated on piles or places on floating foundations which are accessed along gangways.

In a technological study, precedents taken from flood risk areas, shoreline structures and existing underwater observatories were explored. Various construction methods are used to adapt to changing water levels.

In addition I have explored ‘water objects’ in relation to Archimedes Displacement Principal to calculate the weight required of a structure to be able to displace a given volume of water and thus achieve neutral buoyancy when partially submerged.

The various methods, that have been researched, are then applied to the design to produce a technical detail section of the underwater observatory within the research facility.

2. STRUCTURES THAT ADAPT

An amphibious system has recently been explored following the greatly damaging effects of Hurricanes in the US and the rising water levels in the Netherlands. The structure is built on land but may adapt to an aquatic environment and rising water levels if the need arose. The structure is built on top of a floating foundation and fixed in place by guide masts or slip columns which allows for the structure to float up as water level rises.

With the growing concerns of Global warming such structures are being carefully considered and technical advances are making them cost effective. Such low technology strategies may accommodate many poor communities living close to the waterline. As global warming increases, fishing communities near Lake Malawi have already begun to experience a drop in fish quantity. Water levels have been decreasing over a period of 20 years with greater fluctuations between winter and summer levels. Any structure built along the shoreline will require an amphibious system.

Traditionally Thai houses have been built on stilts to deal with constant problems of flooding. Some even building “their homes as rafts on short pilings,” says Chuta. (Site Specific Experiment, 2011) On a flood plain in Bangkok, Architect Chuta Sinthuspans has proposed a building typology to benefit the local community which works with the rising water levels instead of keeping the water out. The innovation is in how the building is constructed. (Site Specific Experiment, 2011)

A prefabricated steel floatation system uses buoyancy tanks as a building pad. It is fixed in place with a slip-column (mooring pile) system which allows for the building to rise and sink with the water level. Set in a trough below ground level, when there is no water, the building sits on level with the street. This also allows for water to fill in the trough below, gradually elevating the building before major flooding occurs. The shelter is built from prefabricated panels and a steel framing, making the structure light and durable (Site Specific Experiment, 2011).
A mooring pile is drilled into the substrate. It anchors a floating structure in the horizontal plane. While pile guides allow for the structure to rise and fall with water fluctuations. Due to the nature of its function, fewer piles are needed than that required to support elevated piers and docks. Thus environmental impact is reduced.

Architect Gouden Kust designed a housing scheme of floating houses along a dike in Maasbommel Amsterdam, shown in the photograph below. The lightweight structure made predominantly from wood rests on a hollow concrete base. It remains fixed in place by two mooring piles with ring pile-guides which allows the structure to float upward as water levels increase, as illustrated in the diagrams adjacent. (Warren, 2011)

Electrical cables and plumbing pipes flow through flexible pipes inside the mooring posts. When the water in the dike runs low the houses sit on a hollow concrete foundation along the water’s edge. (Warren, 2011)

Figure 67. Floating House, n.d, Photograph, viewed 8 October 2014, from: Maasbommel from: http://www.metrohippie.com/as-modest-mouse-sings-float-on/
Built in the 1950’s the Deal Pier in Kent UK, still stands, looking remarkably like a “ribcage of a ship” (figure 68). It was built from steel and concrete-clad elevated above water level on concrete piles. It reaches a length of 311 meters and ends with a three tiered head of which the one lies completely submerged. The two top tiers hold a café, lounge and fishing deck. Enjoyed by both walkers and fishermen, the structure has a sublime quality. Architect Niall Mclaughlin, renovating the pier, embraced the problem of exposure to maritime climate choosing materials which would weather well while sitting in balance with the old pier. Hardwood and concrete both improve aesthetically and structurally with age. With a small budget, costs were met by designing the building as an extruded form with a repetitive timber rib frame. Ventilation is dealt with naturally drawing in the cool air below the pier and exhausting warm air through roof vents. (Mclaughlin, 2012)

Pile foundations transfer the load of a structure to the ground. Wood, steel and concrete may be used to make piles, and are either driven, drilled or Jacked into the ground. The depth of the pile (drilled into the substrate) is dependent on the soil condition and the size of the member is dependent on the span and load it will carry. Various aspects must be considered when marine piling which include distance from land, water depth, existing currents, and wind direction. (Duniya, 2011)

Installing a pile is done in one of two ways, with a tripod rig or rotary rig. To position the rig in place for drilling, a temporary movable gantry is erected along the proposed pier, which is removed after construction as illustrated in the figure below. (Duniya, 2011)
FLOATING FOUNDATION systems are not a new technology. It has been used for floating homes for over a century. Acting as a raft, floatation devices prop up the structure above water level while supporting the weight of it thus preventing it from submerging. However this can be done in various ways. A conventional method is a log float for a timber structure as illustrated below. (Marden, n.d)

CONTEMPORARY SYSTEM: Today, methods involve floatation tanks filled with expanded polystyrene or air which is then fixed to the underside of a structural bed upon which the building is placed.

PRECEDEHTS: Floating homes have been used in places such as the Netherlands as flooding zones have made this system better suited to such an environment. Floatating structures may be pulled along the water and relocated to a different site.

In the neighbourhood of Terwijdde, Architect Koen Olthuis and Waterstudio, designed 19 villas situated in a low lying channel. Connected to land by a quay, the structure sits partially submerged with sleeping area partially beneath the water and living area above water. Once placed a floatation system needs to be fixed to restrict movement. This may be done in several ways: mooring Lines, mooring piles or fixed to land (Water Studio, n.d)
The Underwater world has always been one of intrigue and wonder. Plaguing our childhood dreams and nightmares. To date the aquatic world still remains mostly unexplored and misunderstood. Attempts to explore it has resulted large submersible machines accessing the deep along with all its creature. Scuba diving and snorkeling has become a sought after adventure sport where any individual may call himself and explorer. Public aquariums take the wonder out of its depths and envelopes us within a wonderland for our imagination to thrive. Structures built air tight and caged in are designed with windows to another world.

The first underwater observatory was built in 1975 in Eliat, Egypt, for the marine park Coral World. Today there are two observation decks connected underwater by a tunnel. Made up of two towers which protrude 23m above the water line and submerged 12m below. The towers contain both an observatory and an aquarium. Placed deep enough off shore to access the existing coral reefs, the observatory is 100m off shore and is accessed along a bridge elevated on piles. (Coral World, n.d)

With over 20 windows one can observe the underwater world with a 360 degree view without getting your feet wet. A suitable structure for the observatory was a challenge which required extensive biological research relating to any potential damage to the existing coral reef and fish diversity. It is built using iron for its great weight and coated in an epoxy paint to prevent rusting. Constructed on land and transported to the location on a ship, the structure was then fixed in place with marine steel piles. (Coral World, n.d)

Transplanted coral were placed in areas where the coral reef had been damaged by the construction process. An environmental impact assessment examined the impact the structure had on the fish life reporting that in the beginning many fish had relocated to other areas but gradually the reef repopulated as corals latched themselves onto the new structure. (Coral World, n.d)

Figure, 71, Eliat Drawings, n.d, viewed 6 August 2014, from: http://www.hydrosight.com/underwater-observatory/
1974 - First Underwater Observatory is constructed out of iron with viewing windows made from glass.

Other parts are transported by tug boat and arrives at Marine Park Eliat.

Visitors wait to venture down into the 'underwater world'.

The upper tower is placed onto the observatory.

Parts of the observatory are transported by road and train to site.

Final Construction of Marine Park Eliat.

1991 - The Second observatory is built in the dock of a nearby harbour.

Transported by sea and positioned in place to be sunk and fixed onto the ocean floor.

Figure, 72, Eliat Construction Process, Coral World, n.d, History, viewed 9 August 2014 from: http://www.coralworld.co.il/en/History
In Milford Sound New Zealand, the fiord is home to many rare and unique aquatic species such as black coral. Situated within the Piopiotahi Marine Reserve, commercial fishing and interference with nature is not allowed. The Milford Underwater Observatory was built in 1995 to allow visitors a peak into a rare and unusual world. When designing the observatory, the site was chosen for it being adequately sheltered from wind and boats and drops to a steep depth close to the shoreline. The structure needed to contain the viewing chamber below water and a reception area above with a boat dock and generator room. Three hinged arms fix the structure to the face of the fiord while allowing enough movement for it to rise and fall with the tide. Access to site by road was not possible therefore all the structures were built nearby and brought in by boat to the location (Dorothy, 2000).

The construction of the viewing chamber consisted of 3 connected structures totaling 50 tonnes of steel with a height of 12m and a width of 9m. The observatory was built in a dry dock in the Bluff harbour and towed to site by tug through the Fjord. In addition to the viewing chamber, ‘Ledges’ like planter boxes were designed to hold indigenous aquatic flora which are lowered to deeper levels during the night where they grow better and are raised during viewing hours. Several years of experimentation was conducted with “boxes of plants and animal growing underwater at the proposed site” (Dorothy, 2000).

At the time acrylic products were not available, hence viewing windows were made from thick glass panes, which limited their size and a visitor’s potential view.
Figure 73, Milford Deep Observatory, Dorothy, 25-02-2000, viewed 9 August 2014, from: http://www.nzine.co.nz/views/underwater_observatory.html

Figure 74, Milford Deep Structure, 2000, Dorothy, viewed 9 August 2014, from: http://www.nzine.co.nz/views/underwater_observatory.html

Figure 75, Milford Observer, from: http://benjandclaudia.com/2014/02/
7. ENVIRONMENTAL CONCERNS

There is already an existing development in the reserve with several fishing villages and tourist lodges. The site is by no means untouched by humankind, but situated within the fresh water reserve, environmental concerns are to be carefully considered. For the design I followed the guides outlined by the Department of Ecology Washington as Malawi has only a very basic outline. For an environmental impact prevention strategy for water structures, chapter 12 of the SMP handbook outlines the following:

Overwater structures impact the local environment in 3 main ways; decreasing of natural light, damage to substrate and contamination of water.

DECREASING OF NATURAL LIGHT:
Large structures above the water cast shadows on the underlying substrate which may damage any existing aquatic flora and inhibit any future growth. Therefore an assessment is crucial to determine the current state of the local environment on site and what types of conditions are required for a species of flora or fauna to grow in that specific ecosystem (Department of Ecology 2011; 5). Cichlids make use of the shaded areas created by rocky outcrops but the algae they depend on needs natural light. Currently there is little aquatic flora and fauna within the immediate vicinity as the site is situated upon the sandy shallow waters. To increase light the walkway floors are made from expanded mesh grating to allow light to penetrate through.

Invasive species:
Another issue raised is the creation of conducive conditions for invasive species, (such as Bilharzia snails) (Department of Ecology 2011; 5), cichlids are known to eat Bilharzia snails and have been considered a preventative measure against the spread of this parasite.

Current biodiversity:
It is recommended that sites should be avoided which are currently rich in biodiversity. (Department of Ecology 2011; 5), Situated over 400m away from Otter point, the immediate site has little biodiversity and with the proposed ‘man-made’ fish habitat, biodiversity should increase due to the proposed project.

DAMAGE TO SUBSTRATE:
Depending on how the foundations are placed and their location in relation to water flow and current, the structure may behave in a way that redirects the water flow which may change migration patterns of fish and alter the substrate if the channeling of water flow is strong enough (Department of Ecology 2011; 5). Cichlids do not migrate and the site is situated away from the main channel near Shire River.

Piles:
The drilling of piles into the surface bed directly impacts local substrate therefore a substrate assessment must be done to determine negative impact on the existing local ecosystem within the pile vicinity (Department of Ecology 2011; 5). By design, the observatory supports its own weight and therefore the number of mooring piles required is drastically reduced.

WATER CONTAMINATION:
As drilling is required for piling, sediment is lifted off the substrate which may temporarily affect the local water quality. In addition the choice of building materials may too impact water quality when the material leachates therefore chosen materials must remain as natural as possible. Wood treatments such as CCA must be avoided (Department of Ecology 2011; 6). Therefore the structure must be built from natural materials such as steel, concrete and timber which is not treated with CCA and other chemicals and piling is reduced.

The SMP Handbook recommends the following to decrease environmental impact caused by over water structures.
- Natural light penetration can be increased through the use of glass inserts or grates in the flooring, Reflective panels, sun tunnels and prisms.
- Reduce number of piles by reducing size of structure or alternatively use mooring lines and anchors where appropriate
- Use natural materials that do not leachate into the water causing contamination.
Proposed Site, Cape Maclear, Malawi,
Authors Own
**FORCES:** When an object is partially submerged in water it is affected by two opposite forces; gravity acting down upon the object and a buoyancy force acting in an upwards direction. Depending on which force is greater, the object will float or sink.

**FORMS:** Buoyancy Forces in the water place a large amount of stress upon a form.

Rectilinear forms receive all the load caused by the force upon the bottom face. The structure on that face must then be thickened and reinforced.

By changing the form to a curve, the forces are displaced along the circumference as it distributes the load placed upon the form. For this reason the hull of a boat is curved.

**ARCHIMEDES PRINCIPAL** explains how an object partially submerged in a fluid achieves neutral buoyancy when the weight of the water displaced by the object is equal to the weight of the object.

### 8. DESIGNING TO ARCHIMEDES PRINCIPAL

#### WEIGHT OF STRUCTURE

<table>
<thead>
<tr>
<th>Structure</th>
<th>Material Density</th>
<th>Quantity</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish Habitat: Cast en Situ Concrete:</td>
<td>2500 kg/m³</td>
<td>5.2 m³</td>
<td>13 tonnes</td>
</tr>
<tr>
<td>Algae Beds Scrap Metal:</td>
<td>7000 kg/m³</td>
<td>3.1 m³</td>
<td>22.04 tonnes</td>
</tr>
<tr>
<td>Tunnel Acrylic:</td>
<td>1400 kg/m³</td>
<td>21.6 m³</td>
<td>30.24 tonnes</td>
</tr>
<tr>
<td>Dock Steel Grating:</td>
<td>24 kg/m²</td>
<td>126 m²</td>
<td>3 tonnes</td>
</tr>
<tr>
<td>Visitors person: avg</td>
<td>70 kg/p</td>
<td>50</td>
<td>3.5 tonnes</td>
</tr>
<tr>
<td>Skeletal Structure Steel IPE 200:</td>
<td>22.4 kg/m</td>
<td>842 m</td>
<td>18.86 tonnes</td>
</tr>
<tr>
<td>Skin Precast Concrete</td>
<td>2500 kg/m³</td>
<td>18.14 m³</td>
<td>45.36 tonnes</td>
</tr>
</tbody>
</table>

**Total:** 136 TONNES
Area of displaced water

\[ A = \pi r^2 \]
\[ = 3.14 \times (1.9)^2 \]
\[ = 5.62 \text{ m}^2 \]

Volume of water displaced

\[ V = A \times L \]
\[ = 5.67 \text{ m}^2 \times 24 \text{ m} \]
\[ = 136 \text{ m}^3 \]

Freshwater density = 1000 kg / m$^3$

\[ D = 1000 \times 136 \text{ m}^3 \]
\[ = 136 000 \text{ kg} \]
\[ = 136 \text{ tonnes} \]

Therefore displaced water volume equals weight of partially submerged structure.
i. Expanding Mesh Pergola
Multi functional, the pergola acts as a second roof shading the spaces below. It also acts as an anchoring medium for gourd plants such as pumpkins, beans and passion fruit.

Figure 76, Gourd Pergola, n.d, Korea.

ii. Fish Net
The net protects cichlids from larger predators such as Kampango and makes an anchoring medium for algae to grow on which is a main food source for cichlids.

Figure 77, Algae Net, n.d, Photograph.

iii. Observatory Hull
A 150mm thermoformed acrylic tunnel lets the visitor view the underwater world in 180 degrees. It is stronger than glass, is not brittle and can be shaped to form a curve. The curve reinforces the strength of the material.

Figure 78, Acrylic Tunnel, n.d, Hydro Sight.

iv. Algae Bed
As scrap metal rusts, its textured surface allows growth for algae. The scrap metal is very high in density (mass) therefore it also acts as a ballast, weighing down the structure. (Refer to Archimedes principal pg124)

Figure 79, Scrap metal Algae Bed.

v. Fish Habitat
Man-made, these concrete drums provide niches and holes for breeding cichlids, which protect their offspring from predators.

Figure 80, Concrete fish habitat.
IT’S IN THE DETAILS

D1: PILE GUIDE

100X75 CHANNEL
AS PER ENG SPEC

100X200 ANGLE
AS PER ENG SPEC

GUIDE ROLLERS
AS PER ENG SPEC

TENSION RODS
AS PER ENG SPEC

IPE 200
AS PER ENG SPEC
vi.

Design Drawings

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6. Conclusion p 158
PROGRAMME:

1. Dugout-Canoe Port
2. Underwater Observatory
3. A Fish Out of Water Museum
4. Breeding Pods
5. Isolation Tanks
6. Dry Laboratory
7. Welcome Centre
8. Film Room
9. Public Lavoir
10. Moringa Nursery
11. Restaurant
12. Research Accommodation
WEST ELEVATION
CHAPTER 03

Dugout Port
Lavoir
Arrival space
LABORATORY SECTIONS

DRY LABORATORY
Underwater Observatory
A fish Out of Water Museum
Breeding Pods
2nd ROOF
Expanded metal mesh on 100 x 100 angles on 8m span steel lattice beam

GRID STRUCTURE
305 x 165 Universal column placed at 4000 centres

MOORING PILES
350 dia marine steel mooring piles placed at 8000 centres and drilled into the substrate

POROUS SKIN
Bamboo Lattice external skin fit to 1m width panels and fixed to 75 x 114 SA Pine frame.

POROUS PROTECTION
Fish Net fixed in tension by mooring lines acts as second skin

ELEVATED FLOOR
Timber floor elevated above ground on lattice beams

FLOATING FLOOR
Expanded metal grating on 200 IPE marine steel on Heavy duty air tank where applicable
Cape Maclear

[ 1:1000 ]

The model on the left showcases the observatory in relation to the established fishing village and lodges on the left and Otter point on the right.

Context Model

[ 1:500 ]

The adjacent model places the facility in context with the lake and existing buildings within close proximity.
The facility is portrayed on the chosen site, partially submerged within the lake and elevated above land.

Sectional details depict how this amphibious structure adapt to changing water levels.
In Conclusion

“We celebrate nature as the measure with which we judge civilisation, we reproduce the dualism that sets humanity and nature at opposite poles. We thereby leave ourselves little hope of discovering what an ethical, sustainable, honourable human place in nature might actually look like.” (Cronon 1995, 81)
From a theoretical approach, the research in this document highlights the duplicity existing within modernist society, which separates the natural from our ‘man-made’ construct. It is a separation which places people outside their physical context like an observer peering through a frame.

In reality nature is not ‘out there’ but ‘in here’ with us in it. If we continue to view nature in this light, global issues of environmental concerns will forever be approached with the disregard of people within that very environment.

The preservation of wilderness will not benefit developing countries such as Malawi who depend on the land for food and livelihood.

We must approach nature with its human inhabitants as a whole. In order to address nature concerns, we must address social concerns as well and accept that neither can be preserved in its current state. Nature, culture and even architecture is constantly changing, adapting and evolving to meet new needs of both a ‘natural’ and ‘human’ kind.

The proposed design for an underwater observatory takes on this very notion as it changes the very context into which it is placed while allowing for modification and adaptation as it is exposed to natural phenomena.

If we look at architecture in the same light as a bonsai, as a hybrid construct that is a product of both nature and culture then architecture becomes a tool to link people to their physical context. It becomes a small part of a whole where the shape of architecture is the shape of the earth, where building materials are not ‘artificial’ but simply modified to suit a human purpose.

In so doing, architecture becomes a structure for nature to inhabit. Over time it will weather and breakdown as it becomes a part of its surrounding context, while supporting a human culture within and around its envelope.
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