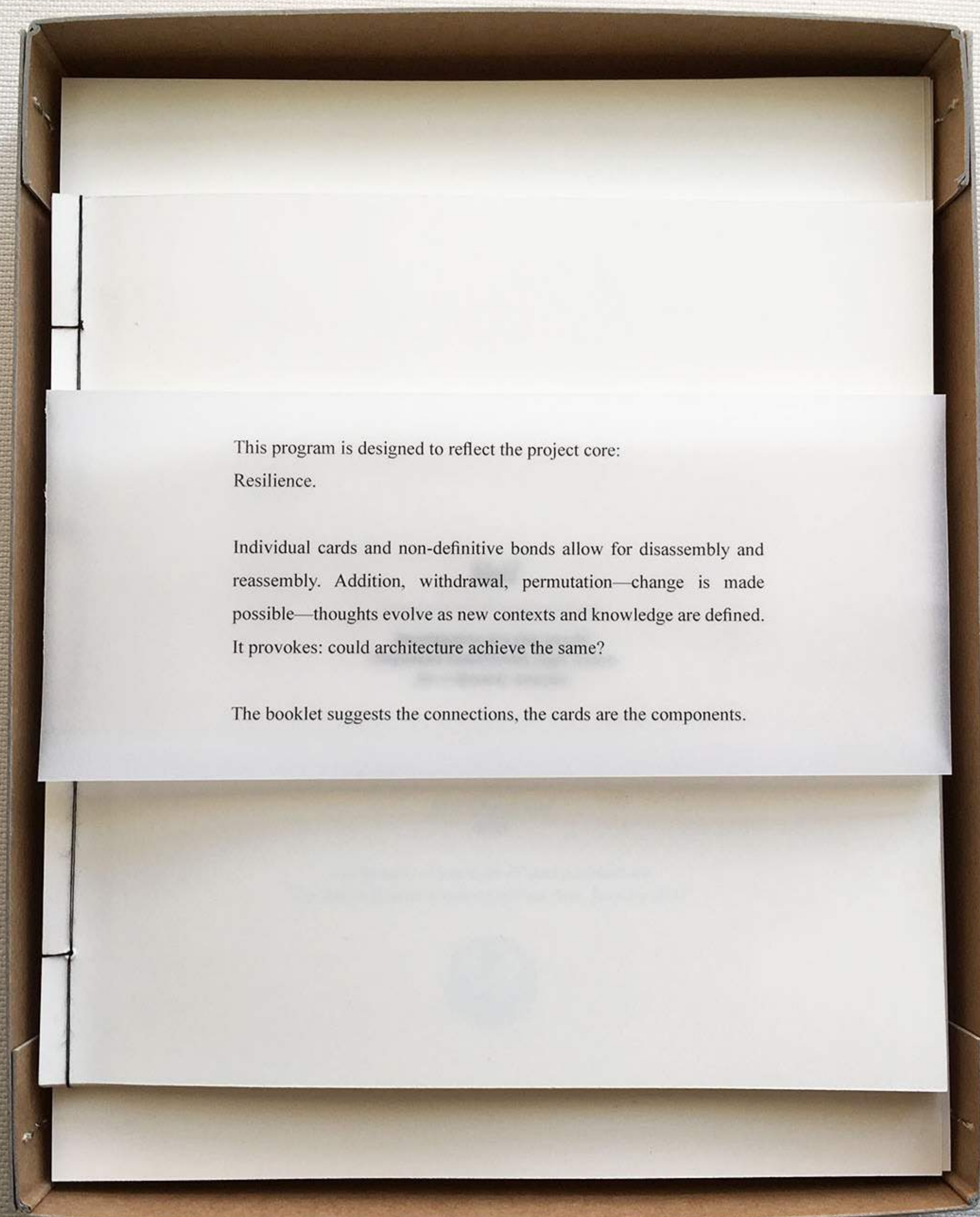
This program is designed to reflect the project core:
Resilience.
Individual cards and non-definitive bonds allow for disassembly and reassembly. Addition, withdrawal, permutation—change is made possible—thoughts evolve as new contexts and knowledge are defined. It provokes: could architecture achieve the same?
The booklet suggests the connections, the cards are the components.


Veil
Investigation of a site specific
component based textile logic system
for a dynamic museum
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Bego, France
The “Bego” is located in the southern part of Brittany’s largest coastal
dunes and beaches area: 26 km long by less than 1 km width, from
and bring forward the qualities of such an architecture.
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Dunes


Veil
Investigation of a site specific
component based textile logic system
for a dynamic museum

Alice Choupeaux
4653

CITAstudio - Centre for IT and Architecture
The Royal Danish Academy of Fine Arts, January 2017

Prologue

5

Traditionally, buildings tend to clearly define an outside and inside, creating an interface between uncontrolled and controlled atmospheric conditions. This interface is often expected to be strong, stable and impervious. By introducing solar panels or geothermic heating for instance, contemporary architecture starts to query this statement and creates buildings that more actively use their environment, becoming increasingly porous to it. Philip Beesley opens a new realm that goes further in this direction. His early work on geo-textiles suggests an architecture that would embrace and protect nature. Erratics Net, for instance, is a wire fabric mounted on a glacier-scoured terrain in Nova Scotia. This textile-inspired meshwork creates a "shallow film of still, sheltered air allowing delicate growth to emerge." It adapts to its surrounding as well as modifies it. Man-made structures and nature are informing each other. It raises the questions: could architecture begin addressing the active present instead of existing simply for static permanence? By which means could this transformation take place?

The idea of a ***dynamic symbiotic architecture*** that would ***work with nature*** — and not against it— has driven my work since arriving at KADK. As well, the notion of ***textile logic*** developed by Mette Ramsgard Thomsen and Philip Beesley in their research has been one of my main areas of investigation when trying to achieve such an architecture. With the development of this project I intend to test this vision of a dynamic symbiotic architecture against an existing site.

Table of content

Narrative

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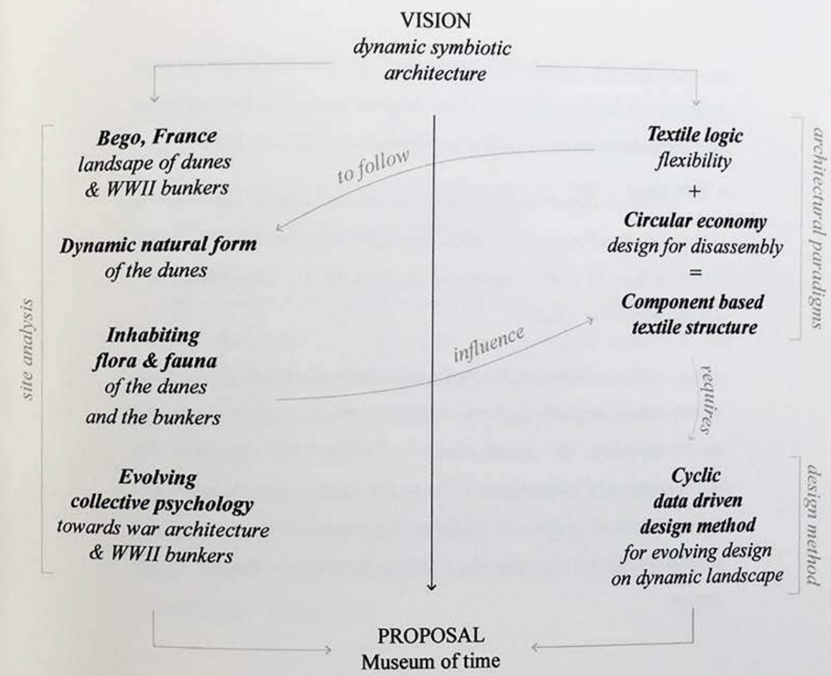
Genealogy of thoughts

Weaving site analysis, architectural paradigms and design method from a vision to a proposal



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WHERE. ***Dunes***. Southern part of the Gâvres-Plouharnel wild dunes site in Brittany, France. Dunes marked by profoundly embedded ***WWII bunkers***, part of the Atlantic Wall built by Hitler in 1942.

WHO. ***Passersby, visitors, explorers and nature***. The structure will guide passer-by in public paths, highlight historical artifacts, frame flora and fauna to visitors, make eroding bunkers safe for explorers and protect and follow nature.

HOW. ***Component based textile logic system & cyclic data-driven design method***. With site analysis through aerial pictures and on-site sampling, the computational tool created will determine the the ***repartition of components*** in the textile logic system designed and later will indicate changes to be done. This method will encourage site specificity and will involve the architect ***throughout the life*** of his design.

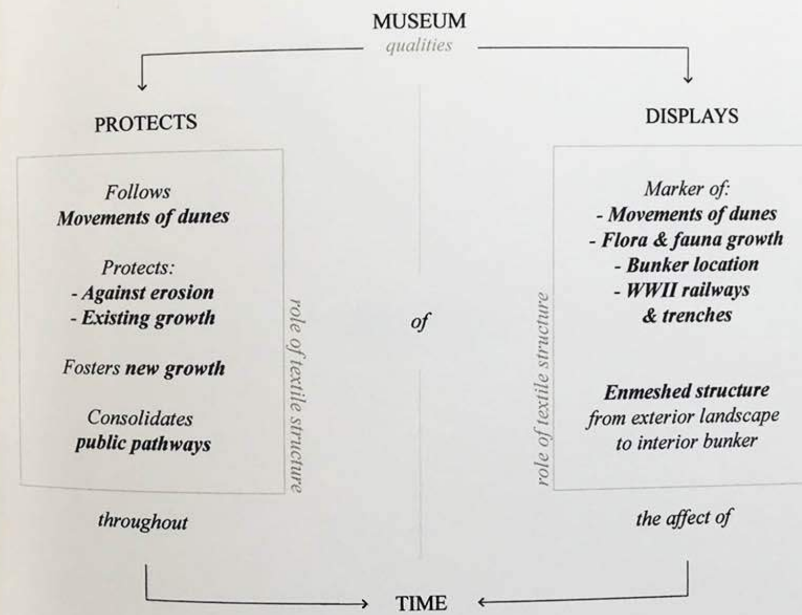
WHAT. ***Museum.*** In the sense that it will ***display*** and ***protect.*** Instead of exhibiting elements removed from their context inside a thick building skin, this museum will manifest itself as a ***component based geo-textile*** structural system ***highly integrated*** in its environment of dunes and bunkers.

It will display the ***historical past*** of the site, its ***geological changes*** and its ***flora and fauna*** by acting as a geological marker. It will protect the dunes and the bunkers against erosion, consolidate public pathways, protect existing growth and foster new growth.

The museum structure, through its ***qualities of disassembly*** and ***dynamic form*** will ***change and adapt*** to the migration of flora and fauna, visitor needs, and erosion. These changes will be recorded as witnesses of flowing ***time***.

Proposal disection

Museum of time



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Key Words

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Museum

According to the ICOM (International Council of Museums):

A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment.

This definition is a reference in the international community.

Textile logic structural system

A structural system at the architectural scale using the structural logic qualities of textiles: resilient, highly interconnected, interdependant, and flexible.

Component

A part or element of a larger whole.

Design for disassembly / Circular economy

Architecture which is designed for disassembly for the sake of sustainability in a "circular economy" model. Refers to the book *Building for a Circular Future by* Guldager Jensen, K. (GXN) and Sommer, J.

Resilience

The capacity to recover quickly from difficulties.

Geotextile

Any of various strong textiles or other materials used, in the form of sheets, for the protection or retention of soil, rubble, water, etc., in fields such as civil engineering and landscaping.

Holistic

Characterized by the belief that the parts of something are intimately interconnected and explicable only by reference to the whole.

Data-driven

Determined by or dependent on the collection or analysis of data.

Marker

An object used to indicate a position, place, or route.

Definitions are from Oxford dictionary, except "textile logic structural system" and "design for disassembly/Circular economy" which I defined by myself based on my research, see "references" for related books.

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Scales

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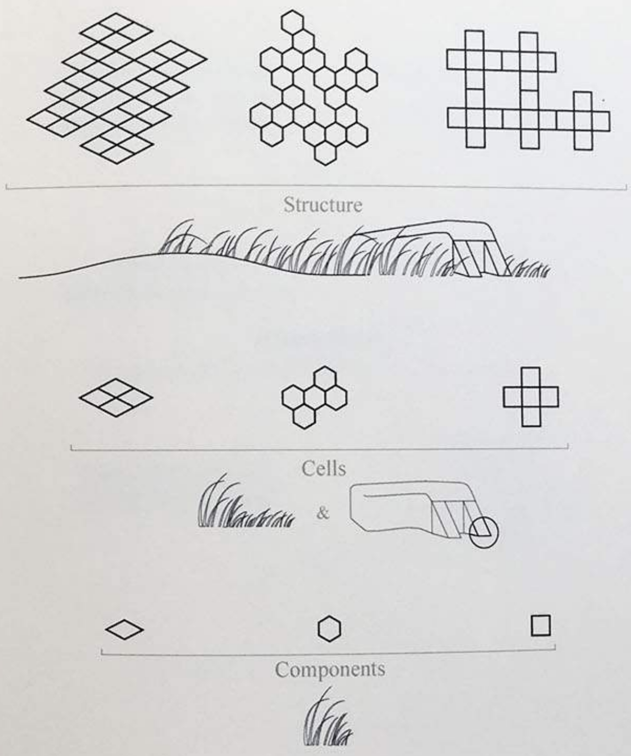
Scale break down

Textile-logic structure made out of cells,
themselves formed by components,
all addressing different contextual scales



Scale matrix

Variations in time scale versus site and structure scales

	site scales	structure scales [role of textile structure]
geological time	*Movement of the dunes* *Movement of the bunkers* *Wind and water erosion*	*Overall flexible structure* *[Following / Recording Protecting]*
	relates to	
historical facts	*WWII bunkers* *WWII railways & trenches*	*Overall stiff structure* *Cells* *[Showing / Protecting]*
	relates to	
ephemeral life	*Dunes flora & fauna* *Bunker flora & fauna*	*Components* *Cells* *[Following / Recording Fostering]*
	relates to	

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Method of investigation

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At the ***structure scale*** addressing ***geological time***, the focus will be on the ***structure as a whole*** acting as a ***guide*** through the landscape and the bunkers. At this scale it will be seen as a ***textile*** acting differently according to its context and its own materiality. This investigation will be lead as a ***mapping excercise***. It will be informed by historical maps, analysis of the movements of the dunes, the season's rhythm and touristic activity, and by performance of flexibility of assembled components. This will be represented as a time based succession of orthographic projections of the overall structure.

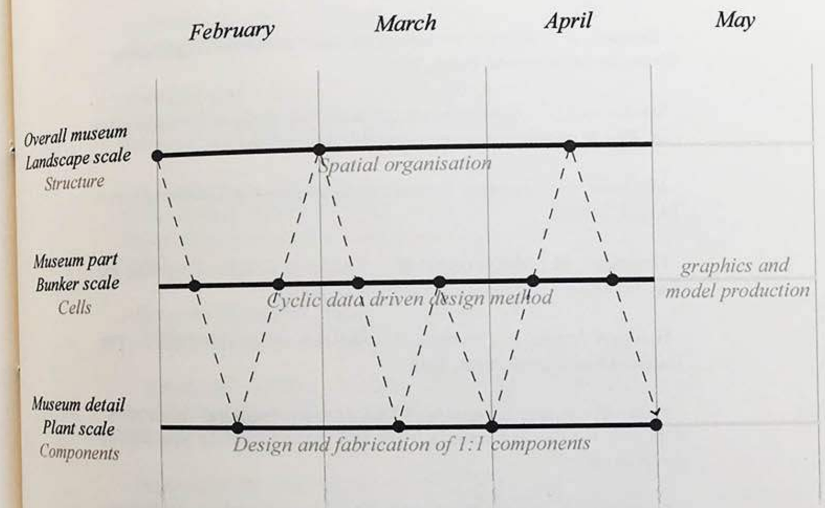
At the ***component scale*** addressing ***ephemeral life***, the focus will be on the design of the ***individual components***. This investigation will be lead by ***physical experiments*** of the material and formal qualities of the components. These will be developed for particular contexts for instance designing components with variable shading qualities for specific plant growth requirements. This will be represented as orthographic projections and 1:1 models.

At the ***cell scale*** addressing both, ***historical facts and ephemeral life*** the focus will be on a group of ***bunkers and their surroundings***—which will be chosen later in the process.
- The first investigation will target the ***organisation of the cells*** according to their ***surroundings*** and will be studied through a ***parametrical model*** informed by the analysis of the distribution of plants, sand and concrete via the latest satellite view available as well as physical experiment on the physical quality of the cells/components developed for a certain kind of context. It will be represented as orthographic projections.
- The second investigation at this scale will be directly linked to the first one but focussing on the ***reconfiguration of the cells*** through time as its surroundings evolve (mainly growing plants and evolution of the erosion). The method is called ***cyclic data driven design method***. It will be studied through ***time based simulations*** that will point out cells/components to be ***added, withdrawn or permuted throughout time***. The output is expected to be a video or a succession of stills as well as a parametric tool for the architect to use through time.

Process

Pursuing the idea of a ***holistic architecture*** since the beginning of my studies, I perceive the process of the project engaging with all scales at all time, from the landscape to the individual plant, from the overall structure to the individual component in continuous back and forth design iterations constantly informing each other ***between scales***.

The various modes of representation used to explore different length and temporal scales in the project will be developed in parallel. The aim is to promote a productive friction between resources for driving the design project forward in a critical manner.



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2016	Research stay - Philip Beesley Architect INC - Toronto, Canada

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Bego, France

The "Bego" is located in the southern part of Brittany's largest coastal
dunes and beaches area: 26 km long by less than 1 km width, from
Gâvre ... served and non-
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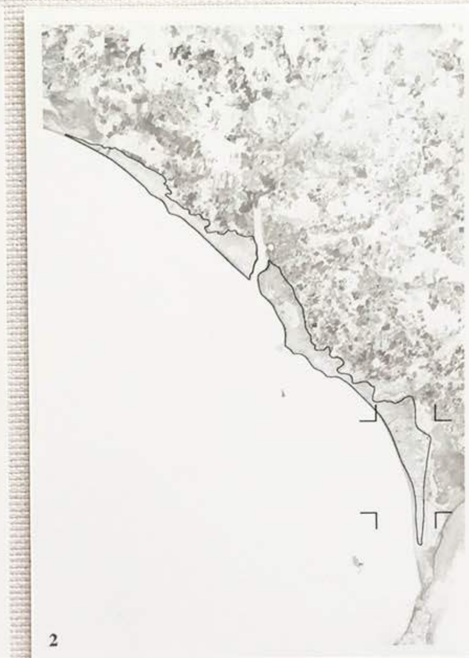
us from it. The ... natural
movements, and their harsh climatic conditions, are an ideal site to test
and bring forward the qualities of such an architecture.

Bego, France

The "Bego" is located in the southern part of Brittany's largest coastal dunes and beaches area: 26 km long by less than 1 km width, from Gâvres to Plouharnel. This site represents 2600 ha of preserved and non-urbanised land: in contrast with other areas, there isn't any built up sea-front. The only buildings and infrastructure in the dunes are linked with touristic or military activity such as parking, small roads, and bunkers. Since 2000, the Gâvres-Plouharnel site is preserved and controlled by a large protection plan called "Opération Grand Site". During the summer months the population of the area drastically increases. This plan works to reduce the amount of cars on the site and localize people on walking paths to avoid trampling and destruction of the vegetation. Hence, the landscape is marked by wooden fences (ganivelles) and geo-textiles leading to the beaches. The goal is to preserve the valuable natural resources of the site without excluding the touristic activity.

The project is fully aware of these problematics and will try to bring a solution while questioning the current construction rules. These rules are stated due to the current ways of building which are highly destructive, completely erasing the nature from the site. I believe in a more respectful way of building where an architecture will work with nature and not against it. Lightweight, flexible, porous and symbiotic this architecture could foster growth and protect from undesired erosion while bringing forward the qualities of the site without isolating us from it. The dunes, because of their protected status, their natural movements, and their harsh climatic conditions, are an ideal site to test and bring forward the qualities of such an architecture.



1. Situation - Southern Brittany, France
Drawing

2. Situation - Bego, part of Gâvres-Plouharnel dunes
Drawing

3. Situation - Bego, at the scale of the entire battery from the WWII
Satelite view from Maps

4. Situation - Bego, at the scale of a group of bunkers and their surronding flora
Satelite view from Maps

5. Monthly repartition of overnight stays in Brittany, France between 2007 and 2015
Data from "Observatoire regional du tourisme en Bretagne"

Dunes

Brittany's dunes slowly appeared during the Bronze Age. From the
XVII century, the largest dunes area stopped their progression even
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This for the
structure n with
them. Taking design
consideration a an just
morphology, the plants and animal also adapt their behaviour through
the different seasons, phenomenon that will also inform the project.

Dunes

Brittany's dunes slowly appeared during the Bronze Age. From the XVII century, the largest dunes area stopped their progression even though some of them are still highly sensitive to erosion. The dunes are dynamic and constantly changing their form. Three different areas can be identified: the foredune, the white dune and the grey dune. They evolve with one another. Three major factors impact the general dynamic of the dunes: the swell and the currents model the beaches; the wind builds the foredune and transports the sand above and beyond the sea line; plants contribute to fix the sand.

The living conditions in the dunes are especially hostile; sea spray and sand can offer at its best a poor, dry, salty soil that is constantly moving. By adapting their physiology and morphology to a life in the dunes, certain plants succeeded to conquer this unwelcoming environment and go on to become a crucial part of its existence. For instance, to resist from blowing sand impact some plants have developed thick leaves often enveloped to protect their vital parts. Most of the inhabitants of the dunes are insects, spiders, and other invertebrates. They appreciate heat and dryness. As an example of their adaptation most of them have a clear colour to hide in the sand or escape overheating from the sun.

This adaptation from the flora and fauna is an inspiration for the structure of the project that will be develop in close collaboration with them. Taking the climatic and morphologic conditions as a first design consideration at the scale of the components and cells. Further than just morphology, the plants and animal also adapt their behaviour through the different seasons, phenomenon that will also inform the project.


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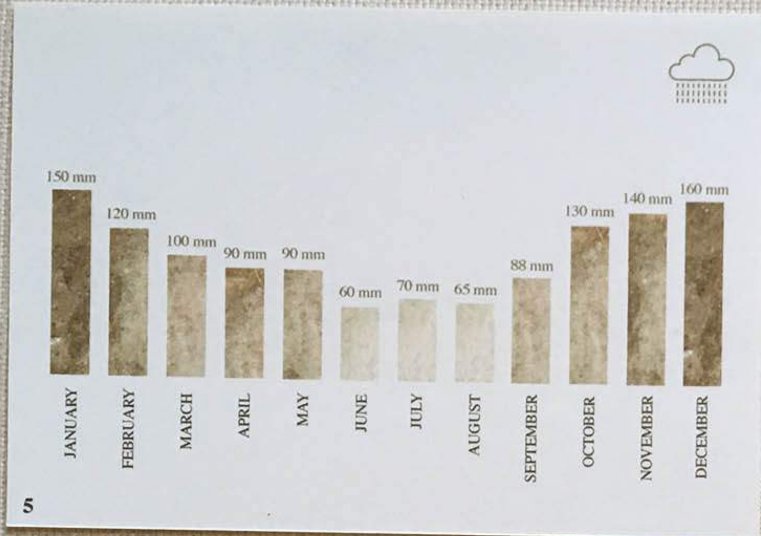
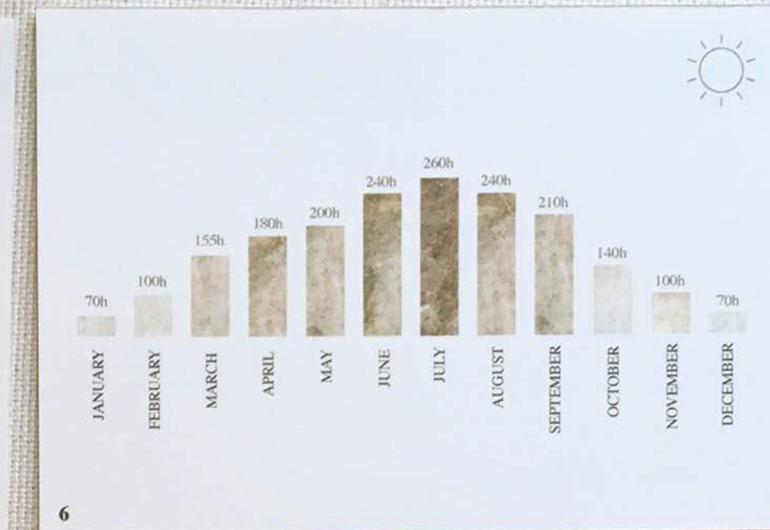
Cultivated land
Trees
Trees
Foredune
Grey dune
White dune
Beach
Trees
4





1. Picture of the Bego dunes
Picture from site

2. Drawing of *ganivelles* in the dunes
Hand drawing from Loïc Tréhin

3. Plants and animals found in the dunes
Hand drawing from Loïc Tréhin

4. Differenciation of the type of dunes
Satelite view from Maps

5. Monthly repartition of the amount of precipitation in Bretany, France between 1981 and 2010
Data from Meteo France

6. Monthly repartition of the amount of sunlight (hours) in Bretany, France between 1981 and 2010
Data from Meteo France

7. Inspiration relation structure/dunes
Art instalation by Christo and Jeanne-Claude

Bunkers

After the Second World War, the dunes were left with new embedded grey concrete blocks: the bunkers which formed part of an extensive system of
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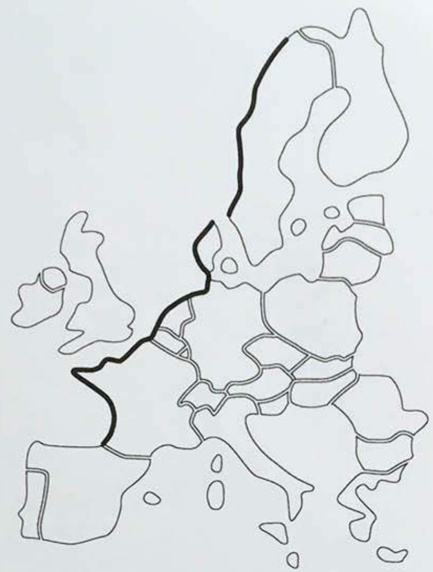
modular enough to be removed during the summer for the bunker to be reopened to the public.

Bunkers

After the Second World War, the dunes were left with new embedded grey concrete blocks: the bunkers which formed part of an extensive system of coastal defence fortifications built by Nazi Germany between 1942 and 1944 called the Atlantic Wall. On the coast from Northern Scandinavia to Southern France, the defence line was built against an anticipated Allied invasion of Nazi-occupied Europe. Ruins of this wall still exist in all the nations where it was built, although some of the fortifications have fallen in the Ocean or have been demolished over the years.
The "Bego" was a battery with four canons aiming to defend Lorient and to protect from a possible invasion coming from the South.
Since 1945, most of the bunkers are abandoned and left to nature. They became cave-like environments, with very little sunlight and and high humidity. In Brittany, where caves are very rare, the bunkers became homes for a number of species who live in caverns and appreciate the littoral climate—like bats, spiders or butterflies—that weren't part of the dune's fauna before. Today metal gates at the entrances of some bunker aim to protect them from visitors undesired disturbance.

Throughout the years and after abandonment, the bunkers became home to a new and sensitive fauna. However this fauna inhabits them mostly during the winter for hibernation, a time period when the surrounding areas (including the dunes) are not so frequented. We could imagine that instead of building permanent barriers—such as the metal gates—we instead cover the access only during the winter with a structure that is modular enough to be removed during the summer for the bunker to be reopened to the public.



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1945

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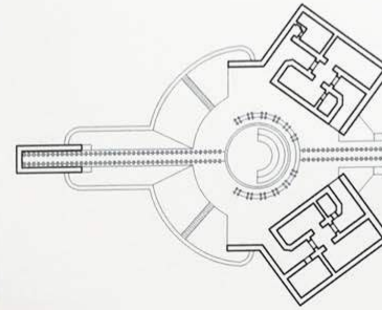

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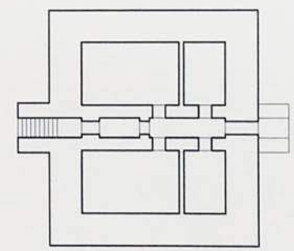

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1. Location of the Atlantic Wall built by Hitler during the WWII
Drawing

2. Diagram of the distribution of the bunkers in the Bego battery
Drawing (not to scale)

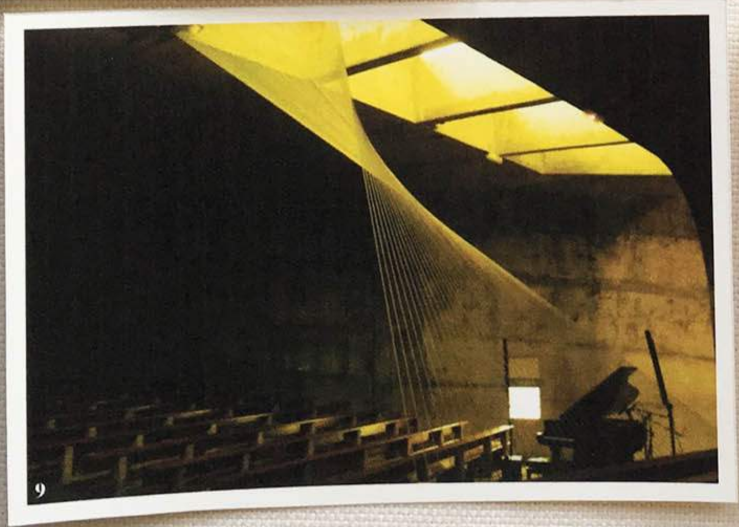
3. Satelite pictures of the Bego battery 1945-2016
1945 from coll. D. Cariou & 2016 from Maps

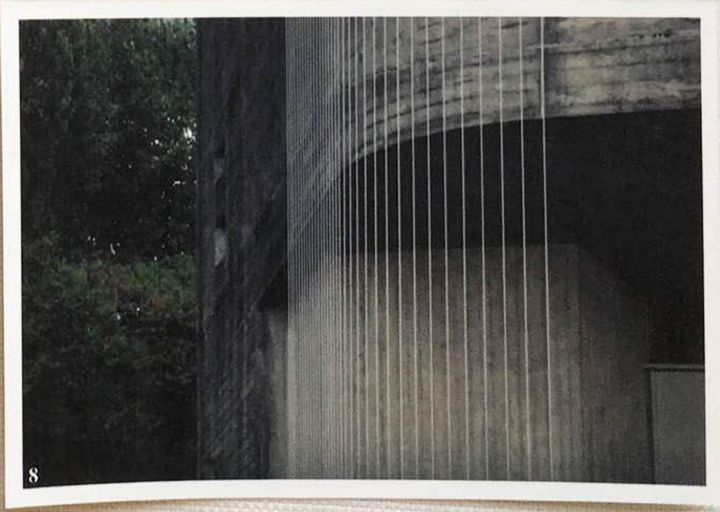
4. Picture and plan of one of the 4 canons on the Bego site
Picture from site & plan redrawn from Tomine, J.

5. Picture and plan of one of the shelters SK
Same

6/7. Material assembly - Sand and concrete
Picture from site

8/9. Inspiration relation structure/bunker
Screen shots from Architectones video by Veilhan, X.





Evolving visions

The bunkers, hated following the war, slowly gained acceptance
and became objects of history. In the meantime, some have been
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How can you develop a light and delicate holistic architecture closely
intertwined with its environment that can adapting to it?

Evolving visions

The bunkers, hated following the war, slowly gained acceptance and became objects of history. In the meantime, some have been destroyed, some renovated, but mostly they have been left untouched and abandoned. Immediately after the war the bunkers were used to explode left-over mines and bombs. This practice has since been altered so as to preserve the bunkers. Bunkers are also destroyed for safety reasons for instance in some cases they have produced strong currents and unwanted erosion around them. Some bunkers, but still a minority, have been renovated. They became museums or private homes. For example, the bunker-infirmary of the Bego battery is now hosting a museum about the "Chouannerie". Even though the Atlantic wall bunkers remain nowadays under-documented and under-protected, younger generations are developing a strong curiosity about them.

The project will continue this curiosity, while understanding the security concerns that in the worse cases led to the destruction of the bunkers. One of the first ideas that one could have in mind to achieve this goal is to create a museum protecting and stabilising the bunkers. However, the bunkers are on the protected land of the dunes where it is first of all very complicated to build because of the nature of the soil (moving sand) and also forbidden to destroy the extraordinary nature of such a landscape. It raises the questions: how can you reconcile this while providing information and safety to the visitors, while preserving and bringing forward the qualities of the landscape and architecture? How can you develop a light and delicate holistic architecture closely intertwined with its environment that can adapting to it?


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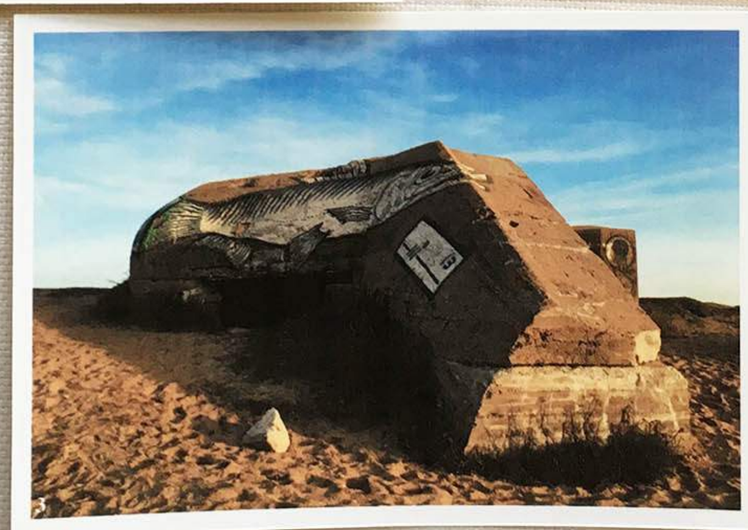
3

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1. Top: Canon II, spring 1943
Bottom: Canon I, 13th of April 1944
From the book, Le mur de l'Atlantique dans la presqu'île de Quiberon

2. Demolotion of a bunker on Ondres beach
Metropol-tp.com

3. Graffiti on one of the bunker
of Gâvres-Plouharnel area
Picture from site

4. Diagram of the evolution of visions towards the bunkers according to groups of people during and after the war
Diagram based on my own research

Textile logic

A textile is a material consisting of a network of fibres. It is formed
by weaving, knitting, crocheting, knotting, or felting. Depending on
the ty ... d, textiles have a
large ... ir flexibility,
perm ... based on
tensi ... ed joints
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A tex ... olecular
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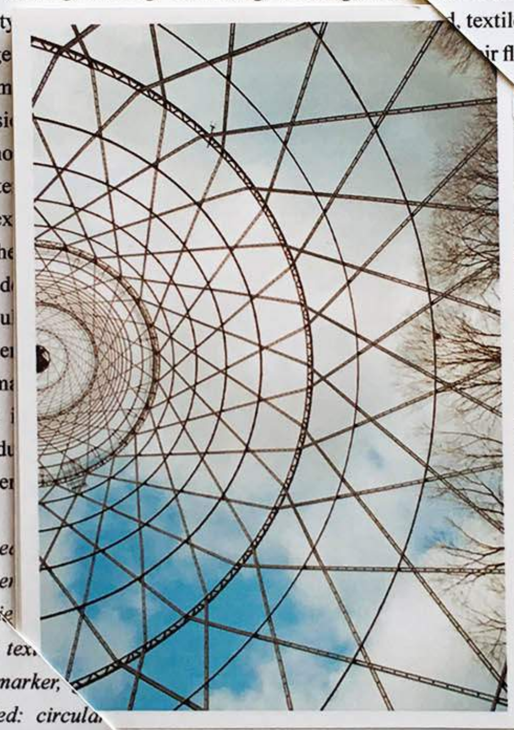

*Base ... ructural
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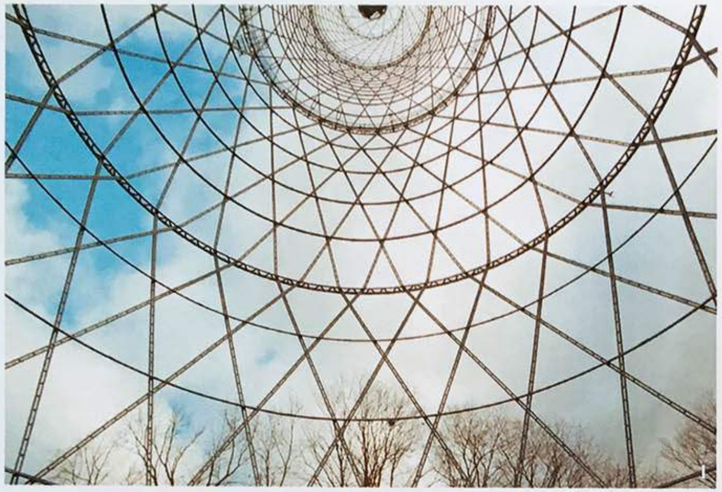
a new generation of component-based textile logic structure will be
developed.*

Textile logic

A textile is a material consisting of a network of fibres. It is formed by weaving, knitting, crocheting, knotting, or felting. Depending on the type of fibre and the network-forming method used, textiles have a large range of performances, their main qualities being their flexibility, permeability and the synergy of their structural performances based on tension. Textiles are highly interconnected using friction based joints to hold the fibre network together forming an interdependent circular system. These qualities define a type of structure using a "textile logic". A textile-logic structure could be at any given scale, from the molecular to the human to the architectural scale, as long as its performance can be defined as a resilient, flexible, interconnected, interdependent, circular system. Textile-logic structures have the ability to allow a better connection to its environment via its flexibility—implying its formal adaptability—via its potential for high specificity, its porosity, and its potential for synergy with its surroundings. Geosynthetic products such as geomembrane, geotextiles, geonets, are textiles-like materials that directly address these aspects.

Based on previous studies and experiments with textile-logic structural system, the choice for such a structure revealed itself as a solution to achieve the goal of an architecture intertwined with its surroundings. The textile structure in this project will be given several roles as geomarker, guide, protector to name a few. Also, a new notion is added: circular architecture, design for disassembly. From there, a new generation of component-based textile logic structure will be developed.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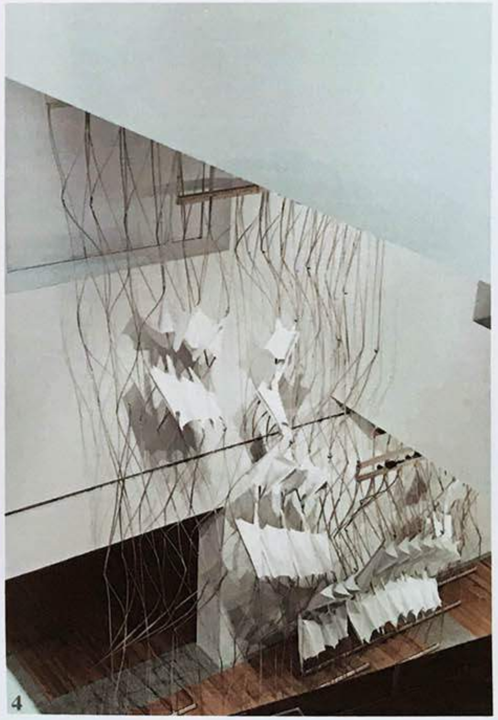
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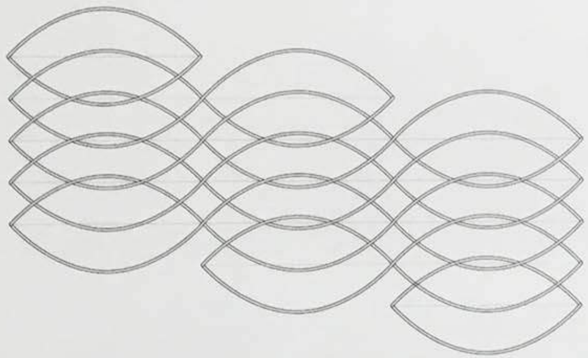

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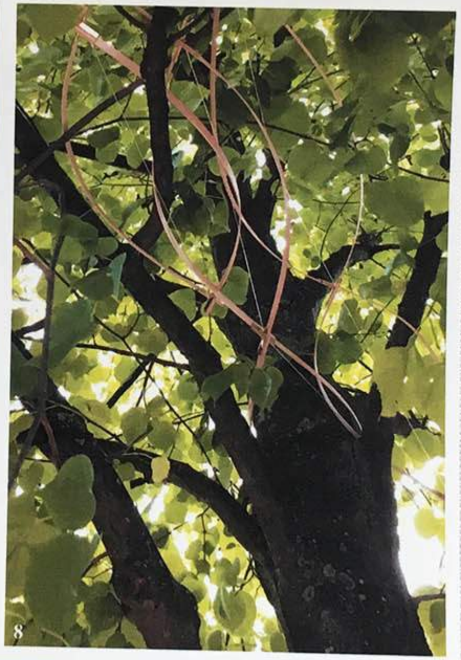

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1. Shukhov tower, Moscow
Wikimedia Commons

2. Differenciation in knitting density by Sollihøgda
Thefolio.org - Åsmund Sollihøgda, KADK

3. Palatine Burial by Beesley
Drawing from Kinetic architecture & geotextile installations - *Philip Beesley - Riverside, 2010*

4. Thaw, textile logic structure by Thomsen
Ramsgaard Thomsen, M., Bech, K. - Textile Logic for a soft space, 2011

5. Erratics Net, geotextile by Beesley
Picture by Philip Beesley

6. Comercial geotextile by Titan
Titanenviro.ca

7. Drawing of symbiotic structure, site specific wooden textile logic structure
From my own investigation

8. Picture of 1 to 1 mockup of symbiotic structure, site specific wooden textile logic structure
From my own investigation

Components *Design for disassembly*

The notion of “design for disassembly” used for this project comes from
the book *Building a Circular Future* which is a theory for a sustainable
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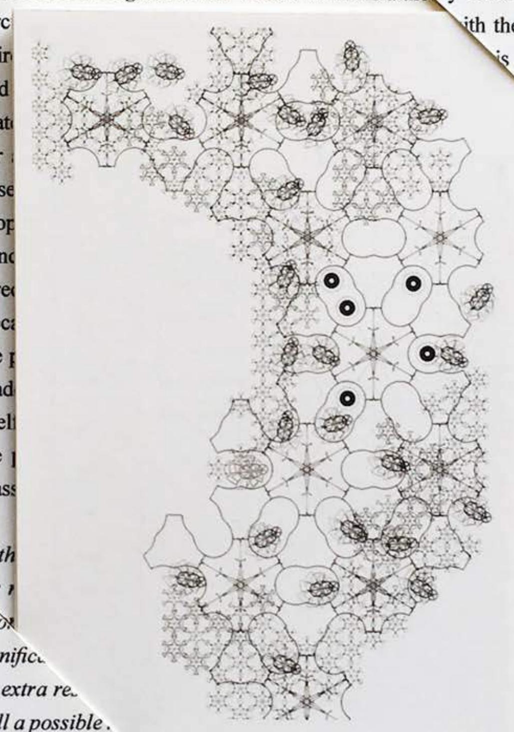

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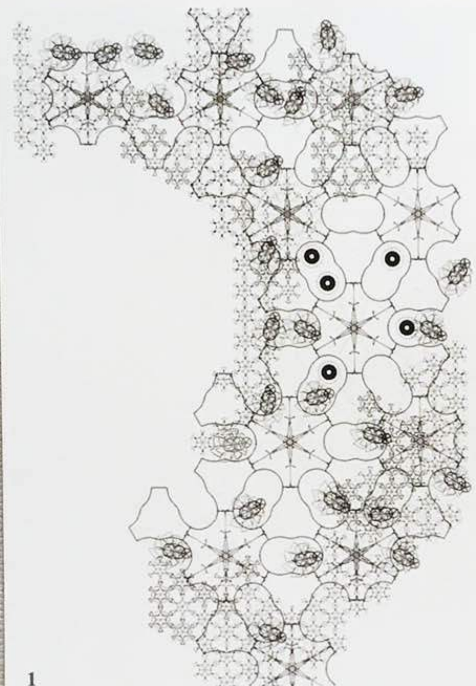
given qualities with another component with a different set of qualities,
this way following changes in the structure’s environment.

Components *Design for disassembly*

The notion of "design for disassembly" used for this project comes from the book *Building a Circular Future* which is a theory for a sustainable circular model for architecture. It connects directly with the notion of "circular economy". The "circular economy" is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times. The guidelines for a "design for disassembly" align with the idea of the component based textile structure of this project, enriching the vision with a larger scope concerning any kind of structure and with essential environmental concerns that dialogue directly with the worry of the structure to be directly connected to its environment, respecting it and working with it. Because of components that can be assembled and disassembled easily, the process of production, maintenance, recycling, and adaptability are made easier and as good for the environment than it is for the design itself. Philip Beesley's work for example, coming closer to the scale of the project, uses this construction method. Different components are mass-produced and then assembled in a way that allows disassembly.

With a component based textile-logic structure, elements can be reused for new parts, also in the assembly process or later for maintenance if one component breaks, it can be replaced very easily. This is a significant quality for a structure exposed to natural forces, allowing an extra resilience—added to its topology and material resilience—as well a possible metamorphosis by replacing one type of component with given qualities with another component with a different set of qualities, this way following changes in the structure's environment.



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1. Hylozoic Ground plan diagram, Beesley
Diagram from Hylozoic Ground *- Philip Beesley - Riverside, 2010*

2. Components from Breathing Column, Beesley
Drawings from Hylozoic Ground *- Philip Beesley - Riverside, 2010*

3. Lace Wall by Thomsen
Picture by Anders Ingvartsen

4. Component investigations for Lace Wall
Picture by Anders Ingvartsen

5. Components metal structure by McDonough+Prn
Picture from Bertram Radelow

6. Detail of the above
Picture from Bertram Radelow

7. 3XN offices, timber structure designed for disassembly
Picture by Adam Mork

8. Detail of the above
Picture by Adam Mork


Computation
The development of computational tools will help the design and
fabrication of the component based textile structure informed by site
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Computation

The development of computational tools will help the design and fabrication of the component based textile structure informed by site specific data and physical experimentation. This aspect of the project is experimental. The method used and the tools created will shift and change throughout the design process to better fit its goals.

Based on primary experimentations and investigations, an agent based mesh segmentation seems to be a valid method to pursue.
Suggested methods at the time of writing for the design: a first color analysis of satellite pictures will be made to identify different types of flora; then, within the model the different membranes and layers of the textile-like structure will be represented by meshes refined and specified via agent behaviour according to specific aspects of the context (plants, animals, climatic conditions, geometry, programmatic locations). One mesh subdivision would represent one component of the structure. For fabrication, algorithms will help unfolding the structure to draw and understand their composition and position within the overall structure.

Seeing these methods as a loop to repeat every season, the overall algorithm will be able to adjust the design of the component-based structure to changes that happen on site (migration of a plant, extra erosion for instance), pointing out components to be removed, replaced, or produced. This method highlights a new concept of a "dynamic" architecture that allows architecture to be continually updated. The role of the architect then becomes continuous, requiring them to follow their projects throughout their life.


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1. Height map differentiating the type of vegetation
From my own early investigation, with Grasshopper

2. Satelite view of a part of the site
Satelite view from Maps

3. Selecting a range of point with the same height corresponding at the same kind of plant
From my own early investigation, with Grasshopper

4. Populating the mesh at the selected areas with components
From my own early investigation, with Grasshopper

5. Close up of the organisation of the components
From my own early investigation, with Grasshopper

UN goals

The project addresses the UN goals in two ways. First with its will to create a resilient architecture working with nature and not against it. Ins ... ngage with its surrou ... is aiming to lead a ... ification, help re ... goal to strive ... oject is also ac ... -based structu ... Talking directly ... *ircular future,* ... mption and pr...

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UN goals

The project addresses the UN goals in two ways. First with its will to create a resilient architecture working with nature and not against it. Instead of erasing nature, architecture could engage with its surroundings and use natural phenomena. This investigation is aiming to lead a way to develop an architecture that would combat desertification, help restore degraded land and soil, referring to the 15th UN goal to strive and achieve a land degradation-neutral world. This project is also addressing the 12th UN goal, by suggesting a component-based structure able to be disassembled, hence reused and recycled. Talking directly to the circular model developed in the book *Building a circular future*, this construction method would ensure sustainable consumption and production patterns.

One of my main inspirations following these principles are the nomadic tribes in the coastal regions of Southeast Asia, the Badjao, stateless people with no nationality and no consistent infrastructure. They live on the ocean—with the ocean—and sometimes kilometres away from the shore. Living in such a naturally tumultuous place, they learned to adapt to its every whim, leading them to design and build homes that can be disassembled, redesigned and reassembled while maintaining the same resources. When a storm hits a community, a common effort is developed and a gathering of material coming from their own homes is achieved in order to reinforce damaged homes. With such a behaviour they teach us that fragility can be a strength for adaptation and harmony with our environment, in contradiction with the global tendency of privileging strong and permanent building fighting with their elements.

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1. UN goals adressed in the project
un.org

2. Homes of the Badjao, nomade sea tribe
Picture via Shutterstock.com

3. Homes of the Badjao, nomade sea tribe
Picture via Shutterstock.com

4. Design for disassembly principles
From the book Building a Circular Future

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